Idaho State UNIVERSITY

Design Standards

Developed by

Facilities Services

2010/2011

TABLE OF CONTENTS

INTRODUCTION

Thank you for your interest in providing design services at Idaho State University (ISU). It is through this important partnership with Facilities Services that we can maintain and improve our built environment to support the University's mission and goals. Please consider incorporating this document into all of our collective projects. Use it as a springboard for dialogue with our department before beginning each new endeavor.

INTENT

The Idaho State University Design Standards are set forth as a guideline for design professionals working on campus. One of our intents is to avoid recurring problems or issues during design, construction, and implementation of projects. Our hope is that these standards will provide important information that design professionals need to make better facilities, and to outline the unique features of working on the ISU campus. With these standards, we hope to answer many frequently asked questions that will help consultants avoid redesigns and extended construction administration work.

Though this document refers mostly to new construction, in areas of extensive remodel, the building and spaces should be brought into alignment with these standards.

DISCLAIMER

These guidelines are not intended to be a substitute for specifications prepared by design professionals, and do not relieve the consultants from their responsibility to exercise due care in design and administration of ISU projects in a manner consistent with accepted standards of professional practice.

FUTURE MODIFICATIONS

This is a living document and ISU encourages comments, suggestions, proposed corrections or modifications from consultants, staff, faculty, and students. Please email your comments to ISU Facilities Services at hanscher@isu.edu. Suggestions will be considered and guidelines updated yearly.

PROJECT INITIATION AND CLOSEOUT REQUIREMENTS

The design professionals must submit review sets of documents to the ISU Project Manager (PM). Affix the sticker from Appendix A on the first sheet in the set.

Record Documents shall consist of electronic files in PDF and AutoCAD format and printed record sets of drawings and specifications. These shall be due upon project closeout.

OTHER RELATED DOCUMENTS

This guideline should be consulted in conjunction with the Construction Standards Manual.

DESIGN STANDARDS

SITE DESIGN

Building Floor Elevation
Building entryways shall be at sidewalk grade level so that stairs or ramps are not required. All exterior ramped sidewalks and stairs shall meet the requirements of the Americans with Disabilities Act (ADA).

After-Hours Entrance
One entrance in each building will be designated by the University as the after-hours entrance. The after-hours entrance should be well lit, located on an accessible route, and will typically be equipped with an automatic door operator. The after-hours entrance shall be provided with a card reader and key override and be connected to the campus door access control system. A recess-mounted Knox-Box shall be provided in an exterior wall at this location. Knox-Box placement must be approved by the Idaho State University Project Manager (ISU PM), the state fire marshal and the local fire chief.

Service and Emergency Access
Access shall be provided for service and delivery vehicles. The width and capacity of roadways and walks shall be designed to accommodate anticipated vehicle sizes and weights. Access shall be provided to buildings for emergency vehicles per the requirements of the authorities having jurisdiction.

Concrete Sidewalks
Concrete sidewalks should be wide enough to accommodate pedestrians and bicycle traffic at 6'-0" wide minimum. Concrete sidewalks should support the weight of any vehicles that can be expected to drive on the walks. Concrete sidewalks should slope away from buildings at two percent (2%) minimum slope (preferred), and five percent (5%) maximum slope. A medium broom-finish should be provided on concrete walks. Single steps should be avoided.

Exterior Stairs
Exterior concrete stairs shall have twelve inch (12") treads (minimum) and six inch (6") risers (maximum). Stair treads shall be sloped two percent (2%) toward the nosings for drainage. Stair landings shall have ¼-inch-per-foot slope for drainage. A medium broom-finish should be provided on stairs and landings. Dense, air-entrained concrete shall be provided for proper coverage of steel reinforcing. Metal pan stairs or pre-cast concrete stairs should only be used in exterior applications where the stairs are protected from the weather.

Concrete and Steel Site Elements
At low walls, benches, etc., one inch (1") chamfered edges shall be provided to discourage property damage by skateboarding and similar activities. Devices such as "Skatestoppers" (see www.skatestoppers.com) should be provided at walls and stair handrails, which may be subject to property damage.

Parking Layout
The standard parking stall size shall be 9'-0" wide x 18'-0" deep. The standard width of a two-way parking aisle shall be 24'-0". The standard color for painted striping is white. Accessible parking spaces shall be provided per the requirements of the ADA and International Building Code (IBC).

Parking Lot Lighting
Campus lights must match in character and color with the surrounding lighting design. The type of fixture and standard must be approved before the documents go to bid. A minimum of 0.5 foot-candles of illumination shall be provided in all areas. Metal halide lamps should be specified for parking lot lighting. The ground-to-lamp height shall not exceed thirty two feet (32') to allow University equipment to change lamps.

Site Limits
The site limits shall extend to logical termination or transition points. Contractual site and landscape repair shall include areas where utility connections and trenching work are to be performed. Site limits shall not divide an existing planting area. The new landscape treatment shall extend into the remainder of the planting area.

Site Furnishings
The following site furnishings should be included in major construction projects:

- Benches
- Tables
- Bike racks
- Trash receptacles
- Ash receptacles
- Emergency telephones
- Way finding signage

Site Lighting
A minimum of two (2) foot-candles of illumination shall be provided on all exterior walkways. Exterior ambient light levels in non-pedestrian areas shall be one (1) foot-candle (maximum). Site lighting shall be circuited to allow for a fifty percent (50%) reduction in light levels by switching off every other fixture via time clock or other approved means.

LANDSCAPE DESIGN

Landscape Design Principles
The design of campus landscapes should adhere to the following principles:

- Campus landscapes should require low maintenance.
- Campus landscapes should conserve irrigation water.
- Drought-tolerant plant materials should be used wherever possible.
- Visible drip irrigation should be used wherever practical.
- For new planting areas, weed barrier fabric should be provided beneath the landscape bark, and in shrub beds.
- Grass should only be used in areas that are large enough to easily maintain.
- Concrete mow strips should be provided where lawn abuts planted areas.

Trees
New trees shall be a minimum two inches (2") measured by caliper. Trees that bear excessive fruit or seedpods should be avoided. Trees should be placed a sufficient distance from buildings, sidewalks and other structures to permit proper growth when mature and to avoid damage to walks and foundations. Trees placed in public rights-of-way shall comply with the Pocatello "Tree Selection Guidebook" published by the Pocatello Tree Commission and be pre-approved by ISU Facilities Services to insure compliance with our tree maintenance program.

Retaining Walls
Concrete retaining walls with appropriate drainage shall have surface finishes which match adjacent structures. Modular pre-cast block retaining walls shall match campus standard color and brand, including cap units.

EXTERIOR BUILDING FINISHES

Brick
The use of brick is strongly encouraged. Colors should be selected based on the campus standard brick, or match the brick on existing buildings in the vicinity of the project site.

Pre-finished Metal
The use of pre-finished metal with concealed fasteners is preferred for exterior trim, soffits and copings. The Architect shall avoid creating spaces where birds will roost or nest. The use of wood exterior trim is discouraged.

Cement and Synthetic Materials
The use of Exterior Insulation and Finish Systems (EIFS) is prohibited. The use of concrete masonry units (CMU) as an exterior finish material is generally discouraged. The use of cement stucco with synthetic finish color coat is allowed.

Joints
Sealant and caulk joints should be no wider than necessary. Details shall be provided for control and sealant joints. Details shall be provided for the intersection of different building materials.

EXTERIOR FENESTRATION

Daylighting
The utilization of daylighting techniques in building design is encouraged. Clerestory windows are preferred over skylights.

Sun Control
Sun control and shading devices (such as overhangs and light shelves) should be utilized to control excessive solar gain. Sun control and shading devices should be provided at east- and west-facing windows to control solar gain in the early morning and late afternoon hours during the summer months. Horizontal shading devices should be provided at south-facing windows to control solar gain in the summer (when sun angles are high), but permit passive heating in the winter (when sun angles are lower). High performance glazing should be utilized where heat gain is an issue. Pay particular attention to detailing sun control systems so that glazing and shading devices can be cleaned and maintained.

Computer Modeling
For new buildings and major additions provide computer modeling of daylighting, sun control, and solar gain. Mechanical systems shall not be relied upon to make up for uncontrolled solar gain.

Operable Windows
Operable windows are acceptable on upper levels of multi-story buildings, but consideration should be given to the integration of operable windows with HVAC control systems for energy conservation. Operable windows should be avoided on the ground floor of buildings for security reasons.

INTERIOR SPACE PLANNING

General
Classrooms and other high traffic areas should be located on the ground floor and near main entrances, wherever possible. Faculty offices and other spaces with relatively low traffic should be located on the upper floors of multi-story buildings.

Main Stairways
The main stairway between the first and second floors of multi-story buildings shall be open, inviting, visible from the main entry and lobby, and ample in width to encourage use of the stair.

Interior Stairways
Exposed surfaces shall be painted or finished in appearance (including the underside of stairs). Interior stairways shall be well lit. Windows providing natural light are desirable in stairways. Exposed concrete landings and steps shall be sealed, at a minimum.

Elevators
Every multi-story building shall be served by a minimum of one elevator to provide accessibility. In larger multi-story buildings, it may be desirable to provide a second elevator hoistway and larger machine room to accommodate a future elevator. One elevator in each multi-story building shall be sized to accommodate the anticipated furniture and equipment, as well as standard building materials, and custodial equipment. One elevator shall provide access to the roof if there is a mechanical penthouse or roof-top mechanical equipment.

Room Numbers and Door Numbers
The assignment of numbers to rooms and doors shall follow the University's numbering system, which is designed to aid in way finding. Room and door numbering shall be coordinated with the ISU PM and the ISU Space Planner during the design phase. Final room and door numbering shall be reviewed and approved by the ISU PM. Follow ADA door signage requirements.

DESIGN OF SPACE ABOVE CEILINGS

Coordination of Above-Ceiling Work
The Architect shall provide adequate space above the ceilings to accommodate the various building systems. During the Design Development phase, the Architect shall consider the three-dimensional layout of the above-ceiling work and coordinate between the various sub-consultants to minimize conflicts between ductwork, piping, conduits, lighting fixtures, etc.

Choke Points
For coordination purposes, the Architect/Engineer shall prepare section drawings at "choke points" to ensure that adequate above-ceiling space is being provided in the design.

Service Access
Reasonable access shall be provided for the servicing of equipment installed above ceilings.

ROOFTOP ACCESS AND DESIGN

Interior Stair
An elevator to a mechanical penthouse is the preferred means of roof access. Where an elevator to a mechanical penthouse cannot be provided, an interior stair to a roof penthouse is the next preferred means of roof access.

Roof Hatch
If an elevator or stair cannot be provided for roof access, a roof hatch with a stair or ladder is the third preferred means of roof access. Where a ladder is provided for roof access, a handrail or ladder extension shall be provided as required by the applicable codes or regulations (including OSHA). Ship's ladders shall not be used for roof access.

Parapets
For buildings with flat or low slope roofs, parapets should be provided to guardrail height (42 inches above roof level) wherever possible. Where it is not possible for parapets to be provided, fall protection measures shall be provided.

Fall Protection
Fall protection anchorages shall be provided on all roofs per OSHA requirements, to remain a permanent fixture of the building.

Window Washing
Where windows cannot be accessed with a man-lift around the building to be cleaned, a window washing system shall be provided with safety tie-off anchors.

Roof Penetrations
The number of roof penetrations should be minimized.

Roof-top HVAC Units
Roof-top HVAC units shall be located away from the edges of roofs to minimize visibility of the units from below, and to avoid the need for fall protection while performing maintenance. The Mechanical Engineer shall provide access to roof-top HVAC units per OSHA and Idaho Administrative Procedures Act (IDAPA) regulations. Special consideration shall be given to the height of HVAC equipment above the roof deck and clearances for maintenance and operation.

INTERIOR FINISHES

Corridor Flooring
Corridor flooring shall be vinyl composition tile, porcelain or ceramic tile, or other durable low-maintenance flooring approved by the ISU PM.

Chair Rails
Chair rails should be considered in the design of meeting and conference rooms.

Corner Guards
Corner guards should be provided in high traffic areas such as corridors.

Wall Coverings
The use of wall coverings is discouraged. Vinyl wall covering may be used on accent walls in prominent conference rooms, with the approval of the ISU PM.

CLASSROOM DESIGN STANDARDS

General
The information in this guideline describes preferences and minimum standards that should be incorporated into the design of seminar rooms, small classrooms, large classrooms, and lecture halls in new or renovated facilities. In renovation projects, some variation from these standards may be

necessary because of the location of existing building elements. When this occurs, the resulting design should be carefully evaluated to ensure that a fully useable and effective space for learning activities is provided. The matrices that follow provide general requirements for the various types of classrooms. More specific requirements for classroom design follow the matrices.

Seminar Rooms
Seminar rooms are for small classes, usually of less than 20 students, where teaching is generally conducted in a discussion format (see charts on following pages). Seminars are usually held for upper division undergraduate and graduate classes. Seminar rooms should be equipped with movable tables and chairs that may be reconfigured by the instructor. Seminar rooms seldom have a formal instructor's station, although one wall should contain a marker/chalkboard, projection screen, and telephone/data connections. Whiteboards and whiteboard paint are encouraged. Paint should be contained by a frame so that occupants cannot write on areas that are difficult to clean. Seminar rooms often double as conference or meeting rooms.

Small Classrooms
Small classrooms vary in size from about 20 to 39 student stations (see charts on following pages). These classrooms are small enough to permit flexibility in seating arrangement and can accommodate various teaching formats — discussion, small group interaction, demonstration and lecture. Small classrooms are usually equipped with movable student seating, tables and chairs. Small classrooms should have an identifiable teaching wall with marker/chalkboard, one or more projection screens, and telephone/data connections. Whiteboards and whiteboard paint are encouraged. Paint should be contained by a frame so that occupants cannot write on areas that are difficult to clean. An instructor's station with desk or table, chair, and table or floor lectern should be located near the teaching wall.

Large Classrooms
Large classrooms vary in size from about 40 to 79 student stations (see charts on following pages). Classrooms of this size are usually equipped and configured for instruction in the lecture format. At the upper end of the size range, sloped or tiered floors should be considered to improve sight lines. Moveable seating with fixed tables is generally required to maintain aisle widths established by fire and life-safety codes. Large classrooms have one identifiable teaching wall with a main marker/chalkboard, one or more projection screens, and telephone/data connections, and controls. An instructor's station with desk or table, chair, and lectern (possibly equipped with lighting, sound, and audio-visual equipment controls) should be located near the teaching wall. Please check with the user groups of the space on the placement of boards. Whiteboards and whiteboard paint are encouraged. Paint should be contained by a frame so that occupants cannot write on areas that are difficult to clean.

Lecture Halls
Lecture halls have a student seating capacity of 80 or more, fixed seating, sloped or tiered floors, and are often specially shaped for acoustical and line-of-sight considerations. The size of lecture halls usually necessitates the use of visual and audio reinforcement to adequately communicate the educational message. For this reason, specialists in acoustics and audio-visual equipment should be included on the design team for lecture hall facilities. Very large lecture halls, sometimes referred to as "teaching auditoriums", may have a stage or platform presentation area and can serve as a performance venue.

SEMINAR ROOMS

General Guidelines	Parameters
Student Station Capacity	12-19
Square Feet/Student Station	20-30 (at tables)
Square Footage	240-570
Aspect Ratio (Length/Width)	.6 to 1.5
Min. Angle of Incidence	20°
Max. Horizontal Viewing Angle	120°

Instructional Guidelines	
Clear/Teaching Area	6' minimum
Preferred Seating	Movable tables and chairs.
Marker/Chalkboards	Maximize at teaching walls within angular parameters.
Projection Screen	8' maximum width at teaching wall.

Room Configuration Guidelines	
Wall Planes	Parallel
Floor Plane	Flat
Ceiling Plane	Flat
Ceiling Height	9' minimum
Entrances	Avoid teaching wall.
Windows	Operable, if used. Provide draw drapes or black-out shades for light control.

Finishes	
Walls	Gypsum board with smooth Level 5 finish and semi-gloss enamel paint. Chair rail on side and rear walls.
Floor	Vinyl composition tile, carpet or carpet tiles.
Ceiling	Acoustical panel ceiling system or gypsum board with light-colored, non-reflective paint.
Acoustics	Ambient noise not to exceed 35NC. Wall sound transmission coefficient (STC) 50 min.

Utilities & Systems	
Lighting	Fluorescent. 50 fc minimum at work surfaces; switch-able or dimmable to 5 fc for projector or video use.
Electrical	Provide one or more dedicated circuits. Provide minimum outlets as indicated.
Telecommunications	One telephone/data outlet (minimum).
Environmental	Temperature and ventilation as per ASHRAE.

SMALL CLASSROOMS

General Guidelines	Parameters
Student Station Capacity	20-39
Square Feet/Student Station	18-30 (varies with seating capacity)
Square Footage	975 maximum
Aspect Ratio (Length/Width)	.75 to 1.2
Min. Angle of Incidence	30° desirable
Max. Horizontal Viewing Angle	90° desirable

Instructional Guidelines	
Clear/Teaching Area	8' minimum
Preferred Seating	Movable tables and chairs.
Marker/Chalkboards	Maximize at teaching walls within angular parameters; additional walls if required.
Projection Screen	8' maximum width at teaching wall.

Room Configuration Guidelines

Wall Planes	Parallel
Floor Plane	Flat
Ceiling Plane	Flat
Ceiling Height	9' minimum
Entrances	One in rear 2/3 of room. Avoid teaching wall.
Windows	Operable, if provided. Provide draw drapes or black-out shades for light control.

Finishes

Walls	Gypsum board with smooth Level 5 finish and semi-gloss enamel paint. Chair rail on side and rear walls.
Floor	Vinyl composition tile, carpet or carpet tiles.
Ceiling	Acoustical panel ceiling system or gypsum board with light-colored, non-reflective paint.
Acoustics	Ambient noise not to exceed 35 NC. Wall sound transmission coefficient (STC) 50 min.

Utilities & Systems

Lighting	Fluorescent. 50 fc minimum at work surfaces; switchable or dimmable to 5 fc for projector or video use.
Electrical	Provide one or more dedicated circuits. Provide minimum outlets as indicated.
Telecommunications	One telephone/data outlet (minimum).
Environmental	Temperature and ventilation as per ASHRAE.

LARGE CLASSROOMS

General Guidelines	**Parameters**
Student Station Capacity	40-79
Square Feet/Student Station	16-22
Square Footage	640 to 1,740
Aspect Ratio (Length/Width)	.75 to 1.3
Min. Angle of Incidence	30° desirable
Max. Horizontal Viewing Angle	90° desirable

Instructional Guidelines

Clear/Teaching Area	12' minimum
Preferred Seating	Option 1: Fixed tables and chairs. Option 2: Fixed tablet-arm chairs (10% LH).
Marker/Chalkboards	Maximize at teaching walls within angular parameters; additional walls if required.
Projection Screen	12' maximum width at teaching wall.

Room Configuration Guidelines

Wall Planes	Parallel
Floor Plane	Flat, sloped or tiered, depending on capacity, size and configuration.
Ceiling Plane	Generally flat, but may be shaped for acoustical purposes in upper size range.
Ceiling Height	9' minimum
Entrances	Two required for 50+ student stations. Preferred location in rear 2/3 of room. Avoid teaching wall.
Windows	Operable, if provided. Provide draw drapes or black-out shades for light control.

Finishes

Walls	Gypsum board with smooth Level 5 finish and semi-gloss enamel paint. Chair rail on side and rear walls if movable seating is used.
Floor	Vinyl composition tile, carpet or carpet tiles.
Ceiling	Acoustical panel ceiling system and/or gypsum board with light-colored, non-reflective paint.
Acoustics	Ambient noise not to exceed 35 NC. Wall sound transmission coefficient (STC) 50 min.

Utilities & Systems

Lighting	Fluorescent. 50 fc minimum at work surfaces; switch-able or dimmable to 5 fc for projector or video use.
Electrical	Provide one or more dedicated circuits. Provide minimum outlets as indicated.
Telecommunications	One telephone/data outlet (minimum).
Environmental	Temperature and ventilation as per ASHRAE.

LARGE LECTURE HALLS

General Guidelines	**Parameters**
Student Station Capacity	80 and over
Square Feet/Student Station	8-22 (varies with seating capacity and style)
Square Footage	1,200 minimum
Aspect Ratio (Length/Width)	Established by acoustical and audio-visual requirements.
Min. Angle of Incidence	30° desirable
Max. Horizontal Viewing Angle	90° desirable

Instructional Guidelines

Clear/Teaching Area	Determined by audio-visual requirements.
Preferred Seating	Option 1: Fixed tablet-arm chairs (10% LH). Option 2: Fixed tables and swing-away seats. Option 3: Theatre seats w/folding tablet arms (10% LH).
Marker/Chalkboards	Consider double- or triple-hung motorized, lighted boards.
Projection Screen	Type, size and placement as determined by audio-visual requirements.
Projection Room	Separate room accessible from lecture hall and corridor. Layout determined by audio-visual and acoustical requirements.
Preparation Room	Consider room adjacent to teaching area for demonstration set-ups and equipment storage.

Room Configuration Guidelines

Wall Planes	Determined by audio-visual and acoustical requirements.
Floor Plane	Sloped or tiered, as determined by audio-visual, acoustical and sight-line requirements.
Ceiling Plane	As determined by audio-visual and acoustical requirements.
Ceiling Height	9' minimum
Entrances	Multiple entrances as required by code.
Windows	May not be desirable. Determined by audio- visual and acoustical requirements.

Finishes

Walls	Gypsum board with smooth Level 5 finish and semi-gloss enamel paint. Finishes should be selected in coordination with acoustical designer.

Floor	Vinyl composition tile, carpet or carpet selected in coordination with acoustical designer.
Ceiling	Tiles selected in coordination with acoustical designer. Ambient noise not to exceed 35NC. Wall STC - 50 min.
Acoustics	Acoustician to be member of design team.

Utilities & Systems

Lighting	Fluorescent. 50 fc minimum at work surfaces; switchable or dimmable to 5 fc for projector or video use.
Electrical	Should have dedicated circuits. Electrical service should be planned with A/V designer.
Telecommunications	Planned in coordination with A/V and acoustical.
Environmental	Temperature and ventilation acoustical designer. Ambient noise not to exceed 35 NC. Wall STC - 50 min.
Acoustics	Acoustician to be member of design team.

White/Chalkboards

The use of whiteboards is preferred over chalkboards. Chalkboards should be provided only where specifically requested by the academic department. Consideration should be given to locating a whiteboard on a side wall, in addition to the teaching wall. Projection screens should not cover or overlap whiteboards. The length of whiteboard units that are specified should be limited to the length of unit that could be transported to the room if replacement is necessary. Whiteboards shall be installed at the proper height for ADA accessibility and not so high that they have to be cleaned with a ladder. The wall under a whiteboard should be painted with high-gloss finish paint so that it can be easily cleaned. Consider using whiteboard paint inside of a frame. There needs to be a distinct separation between a conventional whiteboard and a smartboard so people will not write on the smartboard.

Audio/Visual

Audio/visual (A/V) capability should be provided in every classroom, in consultation with Academic Technologies Services staff. Either an A/V closet or rack should be provided in every classroom. The requirements shall be confirmed with Academic Technologies staff. Provisions should be made for a ceiling-mounted projector in every classroom and provide structural support for a projector suspension mechanism. Recessed, ceiling-mounted projection screens shall be provided in all classrooms. Remote, key-controlled screen actuators are preferred. Connections should be provided for the following:

- Laptop computer
- Digital projector
- Document camera
- Smartboards (confirm with Academic Technologies Services staff)

Classroom Doors

All classroom doors shall have either a sidelight or vision panel in the door.

LABORATORY DESIGN STANDARDS

General

The information in this guideline provides requirements for the design of teaching laboratories and research laboratories. The matrices that follow provide general requirements for teaching and research laboratories. More specific requirements for laboratory design follow the matrices.

TEACHING LABORATORIES

General Guidelines	Parameters	Ref. to ISU Design Standards
Student Station Capacity	Confirm requirements with academic department.	
Square Feet/Student Station	25-54 (depending on academic department).	
Room Configuration Guidelines		
Access	Easily accessible from main circulation corridor.	
Entrances	Minimum door size is 3'-0" x 7'-0".	
Space between lab benches	6' to provide ease of access.	
Windows	Desirable with light control and black-out shades.	
Finishes		
Walls	Water-resistant gypsum board with smooth Level 5 finish and semi-gloss enamel paint with low volatile organic compounds (VOC).	
Floor	Seamless sheet vinyl flooring that is impervious to chemicals. Vinyl composition tile is not acceptable.	
Base	Continuous sheet vinyl coved base with metal top edge trim.	
Ceiling	Suspended ceiling grid with vinyl-coated, water-resistant, laboratory-grade acoustical panels.	
Ceiling Height	9' minimum; 10' desirable.	
Utilities & Systems		
HVAC	Provide required exhaust test/laboratory procedures. Any modifications to hoods are to be approved in advance and hoods re-certified afterward.	
Plumbing	Confirm sink requirements with academic department. Deionized water supply shall have self-closing faucets and vacuum breakers on all lab faucets to eliminate the possibility of cross-connections. Provide emergency shower and eyewash equipment per applicable code and the requirements of the academic department.	
Lab Utilities (gas, air, vacuum, etc.)	Confirm requirements with academic department. There should be different sized pipe for medical gasses in the same area. Ex: Oxygen versus nitrous.	
Electrical	110/120 power at workbenches, at front demonstration bench, and at floor (if required). GFI protection at each outlet is required.	
Lighting	100 fc minimum at work surfaces — direct/indirect lighting preferred.	
Data	Data outlets at each workbench and at front demonstration bench.	
Telephone	One wall-mounted telephone outlet.	
Access Control	Keyed.	
Acoustics	Acoustic isolation required.	
Equipment		
Fixed	Lab benches/tables, demonstration bench, perimeter counters, recessed projection screen, overhead video projection, white/chalkboards, and tack boards.	
Fume Hood(s)	Confirm requirements with academic department.	
Movable	Chairs/lab stools.	

RESEARCH LABORATORIES

General Guidelines	Parameters	Ref. to ISU Design Standards
Room Configuration Guidelines		
Entrances	Minimum door size is 3'-0" x 7'-0". Consider use of 40"-42" wide door, or a pair of doors with a keyed, removable mullion and an inactive leaf.	
Space between lab benches	5' or greater to provide ease of access.	
Windows	Should not be operable.	
Finishes		
Walls	Water-resistant gypsum board with smooth Level 5 finish and semi-gloss enamel paint with low volatile organic compounds (VOC).	
Floor	Seamless sheet vinyl flooring that is impervious to chemicals. Vinyl composition impervious to chemicals. Vinyl composition tile is not acceptable.	
Base	Continuous sheet vinyl coved base with metal top edge trim.	
Ceiling	Suspended ceiling grid with vinyl-coated, water-resistant, laboratory-grade acoustical panels.	
Utilities & Systems		
HVAC	Provide required exhaust test/laboratory procedures. Any modifications to hoods are to be approved in advance and hoods re-certified afterward.	
Plumbing	Confirm sink and drain requirements with researcher. Deionized water supply shall have self-closing faucets and vacuum breakers on all lab faucets to eliminate the possibility of cross-connections. Provide emergency shower and eyewash equipment as per applicable code.	
Lab Utilities (gas, air, vacuum, etc.)	Confirm requirements with researcher. There should be different sized pipe for medical gasses in the same area. Ex: Oxygen versus nitrous.	
Electrical	Provide electrical outlets to meet electrical current requirements, including GFI protection at each outlet. 20-40% capacity.	
Lighting	Fluorescent with 100 fc minimum at work surfaces. Provide lamps with high color rendition index (CRI).	
Data	Provide data outlets at each workbench.	
Telephone	Confirm number and location of telephone outlets.	
Access Control	Card access.	
Acoustics	Acoustic isolation required.	

RESEARCH LABORATORY DESIGN REQUIREMENTS

General

1. New research laboratories should be designed to meet the requirements for a Biosafety Level 2 laboratory.
2. The design of new research laboratories should be based on a standard laboratory planning module of 10'-6" center-to-center.
3. Research labs should not be designed around the requirements of a particular researcher, unless required by the building program.
4. Laboratory utilities should be provided to each lab for future flexibility.

Architectural Design Requirements

1. The design of a laboratory building shall incorporate adequate facilities (separate from laboratories) for food storage and consumption.
2. Separate office spaces for laboratory employees should be provided off of public corridors.
3. Each laboratory where hazardous, biohazardous or radioactive materials are used shall contain a sink for hand washing.
4. Laboratory sinks shall have lips that protect sink drains from spills.
5. Chemical storage shelves shall not be placed above laboratory sinks.
6. Sufficient space or facilities (e.g., storage cabinets with partitions) shall be provided so that incompatible chemicals/gases (waste and non-waste) can be physically separated and stored. Secondary containment shall be provided, wherever applicable.
7. The lab shall have a minimum aisle clearance of at least 24 inches. Main aisles for emergency egress shall have a clearance width of at least 36 inches.
8. A pathway of at least 36 inches shall be maintained at the face of the access/exit door.
9. The space between adjacent workstations and laboratory benches should be 5 feet or greater to provide ease of access.
10. Laboratory doors shall be automatically self-closing.
11. Doors in "H"-occupancy laboratories shall have doors which swing in the direction of egress. Doors serving "B"-occupancy shall swing in the direction of egress if the occupant load is 50 or more. Where possible, all "B"-occupancy lab doors should swing out.
12. The laboratory shall be designed so that it can be easily cleaned.
13. Laboratory bench tops must be a seamless, one-piece design to prevent contamination. Laminate bench tops are not suitable. Lab countertops shall incorporate a lip to help prevent run-off onto the floor. Penetrations for electrical, plumbing and other considerations must be completely and permanently sealed. If the bench abuts a wall, it must be coved or have a backsplash against the wall. Walls should be painted with washable, hard, non-porous paints.
14. Laboratory casework shall be Premium grade. Factory-finished, modular plywood cabinets with hardwood face veneer should be used. Chemical-resistant, solid surface material shall be provided at lab countertops. The following materials may be used in laboratory casework, if approved by the ISU PM:
    - Plastic laminate over MDF
    - Melamine interiors
    - 3mm PVC edge banding
15. Special laboratory and safety programming will be necessary for the following:
    - Laboratories for Biosafety Level 3
    - Radioactive Material Laboratories
    - Laboratories with Irradiators and/or Radiation Producing Machines
    - Laboratories using Non-Ionizing Radiation Sources, including Lasers

Laboratory Structural Design

For floor design, the live load shall be 100 lbs. PSF minimum and 2,000 lbs. point loading for portable equipment. Loads imposed by specific fixed equipment shall be considered.

HVAC REQUIREMENTS

Controls

1. Due to the critical nature of laboratory systems, building automation systems shall be provided with emergency power.
2. HVAC systems shall be designed for continuous operation to maintain space conditions of heating from 68 - 70° F and cooling from 74 - 78° F during occupied periods and heating to 55° F and cooling to 84° F during unoccupied periods. An appropriately labeled override

button shall be provided to switch the lab to "occupied" status. Some exceptions may include computer rooms, kitchens, and server rooms.

3. To maximize energy efficiency, controls shall be provided to switch the lab to "standby" status of 65°/80° F. during occupied periods. A sonic/thermal sensor located in the lab should be provided to reset the controls from "standby" to "occupied" status.
4. For labs in which research takes place, it may be important to maintain or monitor temperature conditions within smaller tolerances. Features for system overrides or increased control capability will need to be specially designed.
5. HVAC control equipment shall have the capability to resume operations following a power outage. When power service is resumed, the systems shall operate exactly as they did before the power outage. Alarms shall require manual reset, should they indicate a potentially hazardous condition.
6. Automatic fire dampers shall not be used in laboratory hood exhaust systems. Fire detection and alarm systems shall not be interlocked to automatically shut down laboratory fume hood exhaust fans.
7. Fume hood ventilating controls shall be arranged so that shutting off the ventilation of one hood will not reduce the exhaust capacity or create an imbalance between exhaust and supply for any other hood connected to the same system.
8. Air handling unit fans shall run continuously, without local control from the fume hood location and independent of any time clocks.

Exhaust Air System Design

1. The exhaust stacks for fume hood and lab exhaust shall be located to prevent ingestion of exhaust into the same building and adjacent buildings. Measures to accomplish this requirement shall include an effective separation of 30 feet from building openings and specialized systems to eject exhaust away from the building. If the building design does not allow effective separation, the Engineer shall complete engineering analyses such as exhaust plume dispersion rate analysis to verify the safety of the proposed design.
2. Exhaust ductwork shall be fire- and corrosion-resistant, and its selection shall be based on its resistance to the primary corrosive present. For most purposes, purge-welded Type 316L stainless steel is acceptable, but this material may be attacked by some corrosive materials (such as hot nitric acid).
3. Exhaust ductwork joints shall be sealed to protect against attack by chemicals.
4. All horizontal ducting shall be sloped (1/8 inch per foot) down toward the fume hood.

Supply Air System Design

1. Laboratory ventilation systems shall not be internally insulated. Sound baffles or external acoustical insulation at the source should be used for noise control.
2. An adequate supply of make-up air (90 to 100 percent of exhaust) shall be provided to the lab.
3. Corridors shall not be used as plenums.
4. Supply air shall meet the requirements of the laboratory work and the latest version of ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality.
5. Supply air shall be filtered to 85 percent (85%) —Minimum Efficiency Operating Value (MERV) of 11.
6. Air handling units for chemical fume hoods should be connected to an emergency power system so that fans will automatically restart upon restoration of power after an outage.

Laboratory HVAC System Design

1. Laboratories should have mechanically-generated supply and exhaust air. All labs with hazardous materials shall exhaust a minimum of 100 percent (100%) of room supply air to the outdoors.
2. Cabinetry or other structures or equipment must not block or reduce effectiveness of supply or exhaust air.
3. There shall be ten (10) air changes per hour of ventilation for laboratories. With approval of the ISU PM, airflow may be set back to six (6) air changes per hour after hours or when the space is unoccupied. Room light switches shall not be used to control either hood exhaust flow rates or room air change rates.
4. Laboratories must be maintained under negative pressure in relation to the circulation corridor or other less hazardous areas. Clean rooms requiring positive pressure should have entry vestibules provided with door-closing mechanisms so that both doors are not open at the same time.
5. The air velocity volume in each duct shall be sufficient to prevent condensation or liquid or condensable solids on the walls of the ducts.
6. General room exhaust outlets shall be provided where necessary to maintain minimum air change rates and temperature control.
7. Fume hoods should be labeled to indicate which fan or ventilation system they are connected to.
8. Air flow in laboratories shall be designed to move from low hazard to high hazard areas.
9. Room air currents at a fume hood should not exceed 20 percent (20%) of the average face velocity to ensure fume hood containment.
10. Make-up air shall be introduced at the opposite end of the laboratory room from the fume hood(s), and flow paths for room HVAC systems shall be kept away from hood locations to the extent practical.
11. Make-up air shall be introduced in such a way that negative pressurization is maintained in all laboratory spaces and does not create a disruptive air pattern.

Electrical Requirements

1. The laboratory shall be fitted with dual channel metal surface raceway (similar to Wiremold 4000) to provide power, data and telephone to the lab benches and equipment walls.
2. Circuit breakers shall be located outside the lab, but not in fire-rated corridors.
3. The power capacity supplied to each laboratory should exceed current requirements by 20 to 40 percent (20-40%).

Plumbing Requirements

1. Auxiliary shut-off valves for gas and vacuum lines shall be located outside the lab in a lockable cabinet.
2. Sink drain traps shall be transparent (e.g., made of glass) and easy to inspect or have drain plugs to facilitate mercury spill control.
3. Lab waste lines shall be separate from domestic sewage, and a sampling point(s) shall be installed in an easily accessible location outside the building, after the neutralization tank.
4. A plumbed eyewash and safety shower meeting the requirements of ANSI Z358.1-1998 shall be provided at all work areas where, during normal operations or foreseeable emergencies, areas of the body may come into contact with a substance that is corrosive, severely irritating to the skin, biohazardous or radiological, or which is toxic by skin absorption. Delivered water temperature should not be at extremes that might discourage the unit's effective use under emergency conditions. A comfortable range is 60-95 degrees F. In circumstances where chemical reaction is accelerated by water temperature, a medical advisor should be consulted for the optimum temperature for each application. Generally, if the water is near

room temperature, it should be acceptable. Eyewash stations shall be in accessible locations that require no more than ten (10) seconds to reach and should be within a travel distance no greater than one hundred (100) feet from the hazard. Each eye/face location shall be identified with a highly visible sign. The area around the eye/face wash shall be well-lighted and highly visible.

5. Water supplied to emergency showers shall be tepid. If tepid water is not readily available, the water should be tempered in accordance with ANSI Z358.1 – 2004.
6. Compressed air supply fittings shall be provided with medical grade, stainless steel ¼-inch NPT quick disconnects.

FUME HOOD REQUIREMENTS

Fume Hood Location

1. Fume hoods should be located away from activities or facilities which produce air currents or turbulence, such as high traffic areas, air supply diffusers, doors and operable windows.
2. Fume hoods should not be located adjacent to a single means of access to an exit. Fume hoods should be located more than ten (10) feet from any door opening.
3. Fume hoods should not be located opposite workstations where personnel will spend much of their working day, such as desks or microscope benches.
4. An emergency eyewash/shower station shall be within ten (10) seconds of walking time/distance from each fume hood.

Fume Hood Selection

1. All fume hoods shall meet the requirements of NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals.
2. All fume hoods shall be selected to operate with an exhaust system with a remote fan. Fume hoods shall not be selected to operate with local motors.
3. Fume hoods should be specified to be four (4) feet in length, unless directed otherwise by the ISU PM.
4. Variable air volume (VAV) fume hoods should be used, unless there are sound reasons to not use VAV hoods (e.g., if there are only a few hoods and energy savings would not realized, or for dedicated single-ducted hoods). In those cases where VAV hoods cannot be used, constant air volume hoods with by-pass air openings shall be used. All hoods shall be equipped with sash stops on vertical rising sashes allowing the sash height to be set at 16 inches (16”) during routine use, unless there are sound reasons to use another sash height.
5. VAV fume hoods shall be equipped with motion sensors to activate higher flow rates when the lab is occupied.
6. Consider the following factors when selecting a fume hood:
    a. Room size (length x width x height)
    b. Number of room air changes
    c. Lab heat load
    d. Types of materials used
    e. Linear feet of hood needed, based on:
        1. Number of users per hood
        2. Frequency of use
        3. Percent of time spent working at the hood
        4. Size of apparatus to be used in the hood
7. The hood surface should have all-welded construction and have accessible rounded corners for cleaning ease.
8. The hood baffle should be removable for inspection and cleaning.

9. Fume hood interior surfaces shall be constructed of corrosion-resistant, non-porous, non-combustible materials such as Type 316 stainless steel, and should be smooth and impermeable, with rounded corners. These materials shall have a flame spread index of 25 or less when tested in accordance with NFPA Method 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
10. Laboratory hoods shall be provided with a means of containing minor spills.
11. There must be a horizontal bottom airfoil inlet at the front of the fume hood.
12. Adjustable baffles with horizontal slats must be present in the fume hood interior at the bottom and top.
13. Before a new fume hood is put into operation, an adequate supply of make-up air must be provided to the lab.
14. Laboratory fume hoods shall provide a minimum average effective fact velocity of 100 feet per minute (fpm), with a minimum of 70 fpm at any point.
15. Where the required velocity can be obtained by partly closing the sash, the sash and/or jamb shall be marked to show the maximum opening at which the hood face velocity will meet the requirements.
16. An airflow indicator shall be provided and located so that it is visible from the front of the fume hood.
17. Baffles shall be constructed so that they may not be adjusted to restrict the volume of air exhausted through the laboratory hood.
18. For new installations or modifications of existing installations, controls for laboratory hood services (e.g., gas, air and water) should be located external to the hood and within easy reach.
19. Shut-off valves for services, including gas, air, vacuum and electricity, shall be located outside of the hood enclosure where they will be readily accessible in the event of a fire in the hood. The location of such a shut-off shall be legibly lettered in a related location on the exterior of the hood.
20. Laboratory hoods shall not have an on/off switch located in the laboratory. Exhaust fans shall run continuously without direct local control from laboratories.
21. Heated perchloric acid shall only be used in a laboratory hood specifically designed for its use and identified as “For Perchloric Acid Operations.”
22. Fume hoods shall have permanent signage to indicate what different chemicals or other substances are allowed in that hood. Gas, water, and air shall be plumbed in as part of the hood completion.

ELECTRICAL REQUIREMENTS

General

1. Electrical panels should be designed with 30 to 40 percent (30-40%) excess capacity to facilitate future electrical modifications and growth.
2. In installations where services and controls are within the hood, additional electrical disconnects shall be located within fifty (50) feet of the hood and shall be accessible and clearly marked. (Exception: If electrical receptacles are located external to the hood, no additional electrical disconnect shall be required.)
3. All outlets are to be GFI protected.

Emergency Power

1. Emergency power shall be provided to HVAC controls, lab monitoring equipment, and door access controls.
2. Emergency power shall be available to selected equipment locations within the lab. These locations shall be confirmed by the researcher and the ISU PM.

3. Chemical fume hood exhaust fans shall be connected to an emergency power system in case of a power failure.
4. Emergency power circuits should be available for fan service so that fans will restart automatically upon restoration of power, following a power outage.
5. Alarms shall require manual restart, in the event that they indicate a potentially hazardous condition.

BIOLOGICAL SAFETY CABINET REQUIREMENTS

1. All biological safety (biosafety) cabinets shall be NSF-listed, UL-approved, and installed in accordance with the manufacturer's requirements.
2. Consider the following factors when selecting a biosafety cabinet:
    a. The type of protection required;
    b. Product protection;
    c. Personnel protection against Risk Group 1-4 microorganisms;
    d. Protection against exposure to radionuclides and volatile toxic chemicals; or
    e. A combination of the above.
3. Selection of a biosafety cabinet should be done in consultation with the Principle Investigator and Environmental Health & Safety.
4. Biosafety cabinets shall be located away from doors and high traffic areas.
5. External air currents degrade the effectiveness of the biosafety cabinet. All attempts shall be made to locate biosafety cabinets where supply air inlets will not interfere with performance.
6. Two biosafety cabinets should not be installed directly opposite each other if they are closer than six (6) feet apart.
7. A biosafety cabinet should not be installed within ten (10) feet of an autoclave.
8. Biosafety cabinets shall be certified to NSF Standard 49 by a qualified independent testing organization prior to building acceptance; or, for installations not involving significant building modifications, before use with biohazards.
9. Biosafety cabinets shall be vented from the building if toxic or malodorous chemicals are used.
10. When biosafety cabinets are connected to external ducts, a flow-monitoring system with audible and visual annunciations shall be used to alert the user of the biosafety cabinet of loss of external ventilation. Alternatively, thimble connections or canopy mini-enclosures in biosafety cabinets shall be fitted with a ribbon streamer or equivalent attached at an angle through which air enters the device to indicate the air-flow direction.

OFFICE DESIGN STANDARDS

Office Size and Location

Executive Order No. 2001-08 from the Office of the Governor requires each executive department director or other appointing authority to directly coordinate with the Department of Administration regarding any acquisition, lease or other occupancy of facilities or space. The Department of Administration has issued the "Facility Standard Sheet", which lists the following permissible square foot areas per full-time employee (FTE) for offices and open office areas:

Area/Room SF/FTE Hard Walls or Open Office
Director of Department 250 Hard Wall
Division Administrator 200 Hard Wall
Bureau Chief/Director of Board 144 Hard Wall
Regional/Division Manager 144 Open Office
Professional Staff 120 Open Office
Clerical Staff 100 Open Office

Clerical Pool 80 Open Office
Receptionist 100 Open Office
Adjunct Desk Area 70 Open Office
Waiting Area (per person) 10
Conference Room (per person) 15
Classroom (per person) 30

In general, private administrative offices should be located nearest to the core of the building and open office area with modular workstations placed around the perimeter to allow maximum daylight penetration.

Office Requirements
Each faculty office shall have the following:

- A four-plex electrical outlet on the two walls where the desk, return or credenza are most likely to be located.
- Telephone/data outlets at two locations that are best suited for office furniture layouts.
- A sidelight (with mini-blind) adjacent to the door.
- An electric hold-open device for the office door (if the project budget permits).

Private Offices
In general, full-time faculty members should be provided with private offices.

Shared Offices
A non-tenured faculty may share an office with one other non-tenured faculty member, if space is not available for individual offices. An adjunct faculty member will typically share office space with other adjunct faculty members.

RESTROOMS

Restroom Finishes
Ceramic tile should be provided on restroom floors. Ceramic tile should be provided on restroom walls (particularly at the plumbing walls) to 7'-0" A.F.F., when the project budget allows; otherwise, a ceramic tile wainscoting should be provided to 4'-0" A.F.F. Dark grout should be used at ceramic tile in restrooms.

Countertops should not be provided at lavatories because of difficulties in keeping countertops clean and presentable. Wall-hung porcelain lavatories should be provided instead. Shelves or hooks for backpacks and purses are preferable to countertops.

Number of Plumbing Fixtures
In addition to the requirements of the Plumbing Code, the types of space use in areas served by restrooms should be considered when determining the number of plumbing fixtures. Areas with classrooms and lecture halls will have high demand for restrooms between classes.

Floor drains shall be provided with automatic trap primers.

Automatic Operation Fixture Valves
Plumbing fixtures and faucets in multiple-occupant restrooms shall have automatic valves. These shall be equipped with override features for easy cleaning. If automatic flush valves cannot be used, then the handle on an accessible fixture should be on the side with greater space adjacent.

Sight Lines
Sight lines into restrooms should be considered when locating plumbing fixtures (such as urinals and water closets) and mirrors.

Dispensers and Receptacles
Paper towel dispensers should be located near the entrance to restrooms. Space should be provided for freestanding waste receptacles (provided by the Owner). Soap dispensers are provided by ISU. Coordinate backer material and mounting locations with ISU PM. Baby changing, fold-down tables shall be provided in restrooms.

CUSTODIAL FACILITIES

Space for custodial workrooms and custodial equipment and storage rooms shall be allocated in accordance with the following table:

BUILDING AREA	UP TO 20,000 SQ. FT.	20,000 TO 30,000 SQ. FT.	30,000 TO 150,000 SQ. FT.	OVER 150,000 SQ. FT.
CUSTODIAL WORKROOMS	1 @ 80 sq. ft. See Note 1.	60 sq. ft. per 15,000 sq. ft. of building area or portion thereof. See Note 2.	60 sq. ft. per 15,000 sq. ft. of building area or portion thereof. See Note 2.	60 sq. ft. per 15,000 sq. ft. of building area or portion thereof. See Note 2.
CUSTODIAL EQUIPMENT & STORAGE RMS.	Included in Custodial Work Room	1@ 100 sq. ft.	1@ 100 sq. ft.	2 @ 150 sq. ft.

Note 1: If the building has more than one story, provide an additional Custodial Work Room with floor sink and a floor area of not less than 48 sq. ft. on each of the other levels.
Note 2: Distribute in 60 sq. ft. increments on each floor level.

Use Restrictions: Custodial workrooms and custodial equipment and storage rooms should not be used as a passageway to other rooms or share space with fire reporting equipment, plumbing systems/equipment, alarm systems, electrical panelboards, telephone or data transmission equipment, or any other systems not directly related to custodial services. Custodial workrooms should not be locations for ladders or access doors to mechanical spaces, attics or roof areas.

Custodial Workrooms
Area: In multi-story buildings with small (less than 10,000 square feet) floors, the area of a custodial workroom can be reduced to 48 square feet each. The minimum interior dimension for any custodial workroom should be 5'-6".

Doors: 3'-0" wide x 7'-0", swinging outward, equipped with storeroom function lock, closer and 36 inches high armor plate on inside face.

Service Sink: Floor level service sink, 24-inch square, with hot and cold water mixing faucet with vacuum breaker, chemical dispensing station with separate water feed located away from the service sink, and eye wash all plumbed separately. Delivered water temperature for eye washes should not be at extremes that might discourage the unit's effective use under emergency conditions. A comfortable range is 60-95 degrees F. In circumstances where chemical reaction is accelerated by water temperature, a medical advisor should be consulted for the optimum temperature for each application. Generally, if the water is near room temperature, it should be acceptable. Eyewash stations shall be in accessible locations that require no more than ten (10) seconds to reach and should be within a travel distance no great than one hundred (100) feet from the hazard. Each

eye/face was location shall be identified with a highly visible sign. The area around the eye/face wash shall be well-lighted and highly visible.

Mop Hanger: Mounted above service sink, not on the same wall as the faucet.

Ventilation: Mechanical ventilation in room should provide not less than six (6) air changes per hour.

Room Finishes:

- Walls -- Walls within custodial workrooms may be concrete masonry or gypsum wallboard, finished with semi-gloss enamel paint. Walls adjacent to and extending 1'-0" beyond the edge of the service sink should be finished within an impervious material such as glazed ceramic tile, to a height of 4'-0".
- Floor -- Sealed concrete.

Location: Custodial workrooms should be centrally located so that no area in a building is more than 150 feet walking distance from such a room. Preferred locations are close to elevators, close to main pedestrian areas, and close to toilet rooms. Custodial workrooms should open to a public corridor or other primary circulation area.

Electrical Requirements: Custodial workrooms should have a light level of 50 foot-candles. Lighting fixtures should be recessed flush or surface-mounted, supplied with a safety shield. Workrooms should have two (2) GFCI protected electrical outlet receptacles.

Custodial Equipment and Storage Rooms

General: These rooms are used for the storage of major items of custodial equipment shared by several custodians — such as high-speed floor polisher, automatic floor scrubber, carpet shampooer, and carpet extractor. These rooms are also used for the storage of bulk custodial supplies.

Location: Custodial equipment and storage rooms should be located in reasonable proximity to the building delivery entrance. Ground floor locations are preferred.

Room Finishes: Same as described above for custodial workrooms.

Electrical Requirements: Lighting and receptacles for custodial equipment and storage rooms should be the same as described above for custodial workrooms, except that three (3) GFCI protected electrical outlet receptacles, each on a separate electrical circuit, should be provided.

ACOUSTICAL DESIGN

Acoustical Consultant

An acoustical consultant should be utilized when designing important lecture halls, performance spaces, or other rooms with stringent acoustic requirements.

Mechanical Engineer's Responsibilities

The Mechanical Engineer shall provide an acoustical design to deal with air noise through ducts and unit noise through walls to minimize the impact of noise from mechanical units in occupied spaces.

Architect's Responsibilities
The Architect shall coordinate the acoustical design with the Mechanical Engineer by providing NRC ratings of wall, floor, and roof assemblies. Consideration shall be given to the need for door and window gaskets and the location and sealing of penetrations.

FIRE SUPPRESSION DESIGN STANDARDS

Fire Suppression Systems
In structures that are required to have automatic sprinklers, a fire sprinkler system meeting industry standards shall be provided. Each floor shall be provided with a dedicated zone control valve assembly. The zone riser and valve assembly for each floor shall be located in the first floor mechanical room. Each individual zone and floor assembly shall be monitored by the fire alarm system separately. Design documents shall be zoned to indicate the hazard of each space.

Fire Suppression Systems Design
The Engineer shall provide the following information on the contract documents:

- Hazard classification
- Location of supply riser and inlet lines
- Water supply characteristics including:
  - Pressure – static, residual
  - Flow
- Water density/area requirements for calculation

The Engineer shall show preliminary routing of fire protection main and the anticipated routing of any lines greater than two inches (2") in diameter. For distribution piping, the sprinkler head layout and hydraulic calculations shall be the responsibility of the Fire Protection Contractor. Fire Protection drawings and calculations shall be reviewed and approved by the authorities having jurisdiction (AHJ) and the insurance carrier. The Engineer responsible for fire protection systems shall review and approve fire protection drawings and calculations.

MECHANICAL DESIGN STANDARDS

General
The design shall abide by State of Idaho requirements for construction. The IDAPA and IGSHS standards at the following websites shall be the minimum standards for safety purposes:

http://www2.state.id.us/dbs/safety_code/igshshom.html
http://www2.state.id.us/adm/adminrules/rules/idapa07/07index.htm

Major pieces of equipment and equipment critical to the design shall be approved by the ISU PM. Such items shall be specified by manufacturer and product model number, or "Approved Substitution." Substitutions shall be submitted and reviewed prior to the bid. Approvals shall be communicated by written addendum only.

Unless a specific reason exists for specification of fewer manufacturers, the Engineer shall specify at least three approved manufacturers and products for each piece of equipment. Approval by the ISU

PM is required to specify fewer than three approved manufacturers and products. The following are not preferred by ISU:

- Reznor AHU's
- Gas Fired Heaters
- Open-Flamed Gas fired heaters without exhaust compromise indoor air quality

Please note: All HVAC must be tied into and interface with the existing on-campus control systems either JCI Metasys or Automated Logic. All mechanical systems are to be controlled and/or monitored. Existing internal duct insulation that cannot be cleaned shall be replaced.

HVAC DESIGN CRITERIA

System Design Temperatures

The design of heating systems shall be based upon an outdoor winter dry-bulb temperature frequency from ASHRAE 2001, dry-bulb temperature +9° F., 99 percent (99%). Cooling systems shall be designed in accordance with ASHRAE 2001 one percent (1%) levels, design temperatures 94° F. dry-bulb/63° F. wet-bulb.

For critical spaces, 100 percent (100 %) outside air systems shall be designed to maintain discharge temperatures at extreme temperature conditions (103° F., -4° F.).

Humidity Control

In areas of high humidity (i.e., gymnasiums, locker rooms, laboratories, etc.), the Mechanical Engineer shall provide calculations establishing the ability of mechanical systems to maintain humidity levels below 60 percent (60%), and to control condensation on all low temperature surfaces. For other applications, humidity control shall not be required, unless specifically required by the University.

Selected environments may require humidification provision and controls. Direct steam or steam-to-steam systems are preferred. These systems are dependent on the academic programs occupying the space, and shall be selected in conjunction with the ISU PM.

Indoor Design Temperatures

Typical indoor design temperatures shall be 70° F. for heating and 74° F. for cooling except in libraries, which shall be 72° F. for heating and cooling. Design conditions for specialty areas shall be designated by the ISU PM. A minimum temperature of 55° F. shall be maintained in mechanical rooms.

Ventilation shall be provided to electrical and mechanical rooms to maintain a room temperature of no more than 10° F. above outside air temperature. Cooling shall be provided to Tel-Data rooms to ensure that room temperatures never exceed 84° F nor drop below 68°F.Cooling shall be provided to hub rooms for Information Technology (IT) systems to ensure that room temperatures never exceed 84° F nor drop below 68°FAir temperature control shall be provided for elevator equipment rooms, as required to meet current Idaho code.

Indoor Air Quality Design Criteria

Minimum outside air-flow rates (CFM of outside air per person, unless air quality monitoring equipment is approved by ISU PM and installed to control OSA volumes) shall be established utilizing the following limits:

- Offices – 20 CFM
- Classrooms – 15 CFM

- Lecture halls – 15 CFM
- Computer laboratories – 15 CFM
- Library – 15 CFM
- Commons area – 15 CFM
- Laboratories – 20 CFM
- Corridors – 0.10 CFM per square foot

Minimum Total Supply Rates
The minimum total supply rates shall be as follows:

- Offices – 2 air changes/hour
- Classrooms – 4 air changes/hour
- Lecture halls – 4 air changes/hour
- Computer laboratories – 4 air changes/hour
- Library – 3 air changes/hour
- Teaching laboratories – 6 air changes/hour
- Research laboratories – 10 air changes/hour
- Commons – 2 air changes/hour

Miscellaneous
Where variable air volume systems are utilized, calculations shall be provided establishing that outside air flow rates and total supply air rates are met under all possible operating conditions.

Noise Level Calculations
The Mechanical Engineer shall provide the University with calculations that document noise levels of less than NC-35 in all spaces served by the systems. NC ratings generated from typical duct sizing programs are acceptable. Analysis shall be provided for both supply and return systems. This information should be contained in the start-up section of the maintenance and operations manuals that are required for job closeout. The Drawings shall indicate:

- Velocities
- Pressure drops
- Decibel attenuation through octave bands for sound attenuators

Sound pressure ratings around mechanical and electrical equipment (boilers, pumps, fans, motors, reducing valves, etc.) shall not exceed eighty (80) dBA at any point three feet (3') from the equipment.

Operation and Maintenance Considerations

- Access to all equipment shall comply with OSHA and IDAPA requirements.
- All equipment shall be located within seven (7) feet of the floor or a maintenance platform shall be provided to accommodate routine maintenance and repair.
- Space and access openings shall be provided for the servicing of mechanical equipment — including air handler unit coils, electrical panels, filters, etc.
- Space shall be provided for removal and replacement of the largest piece of equipment (fans, motors, coils, etc.) without requiring the removal of walls.
- The Drawings shall indicate the outline of space required for removal of coils, fans, etc. associated with each piece of equipment.
- Access panels shall be provided per industry standards.
- Clearances necessary for equipment maintenance shall be provided and designated on the drawings.

- Provide proper access — including stairs, ladders or elevators — to all mechanical equipment areas.
- Equipment shall be located where it can be easily accessed by a mobile crane.
- When specifying rooftop air-handling units, special consideration shall be given to equipment access; catwalks shall be provided where necessary to provide access for equipment maintenance.
- Access shall be provided to air-cooled condensers to accommodate the maintenance of condenser fans, without necessitating the use of fall protection equipment.
- Freeze-proof hose bibs shall be provided at rooftop-mounted equipment to accommodate routine and periodic cleaning of equipment.
- At least one standpipe drain (connected to the sanitary waste system) shall be provided on the roof to accommodate the disposal of fluids.

MOTORS

- Supply circuits shall be labeled to indicate the source panel and circuit.
- All motors shall be specified as "premium efficiency."
- All motors shall be provided with a Hand/Off/Auto (H/O/A) controller located adjacent to the motor.
- The location of motors shall be coordinated with the Electrical Engineer.
- All motors provided with HVAC equipment shall be rated for use with variable frequency control.

Variable Frequency Drives

Where variable frequency drives are to be used for control, the Mechanical Engineer shall specify, and the Mechanical Contractor shall supply, the variable frequency drives. Variable frequency drives shall be specified to introduce no more than a three percent (3%) harmonic distortion.

MECHANICAL IDENTIFICATION

Ductwork

Standard ASHRAE terminology shall be used in the contract documents. Ducts shall be marked with the direction of flow and duct type (supply, return, or exhaust) on both sides of each wall penetration and at no more than fifty-foot (50') intervals.

Piping

Piping identification systems shall comply with ASME standards regarding color, letter height and marker size. Marking systems shall identify the fluid conveyed and the direction of flow. Pipe shall be marked on both sides of wall or floor penetrations, at least once on every straight run of pipe, and at no more than twenty foot (20') intervals.

Equipment Information

Equipment information shall be provided for, and attached to, all mechanical equipment. This information shall be provided on engraved, color-coded laminated plastic labels with a permanent contact type adhesive, affixed to the piece of equipment. The identification labels shall provide the following information (at a minimum):

- Component identification designation (coordinated with construction drawings)
- Area served
- Power source
- Refrigerant charge (holding charge and full charge noted)

Mechanical Vibration and Seismic Controls
Isolation connectors shall be provided and installed at each connection to dynamic equipment. Isolation connectors shall be designed to minimize stresses imposed by piping systems, ductwork, etc. on mechanical equipment, as well as to minimize the transmission of vibration and noise from the equipment into the space. Mechanical equipment shall have seismic restraints as required by code.

Dynamic equipment shall be mounted to prevent vibrations from being transmitted to the building structure. Momentum slabs and/or vibration isolators shall be specified where necessary. Rooftop mechanical equipment shall be provided with a minimum six inch (6") thick concrete pad over steel framed building construction to minimize transmitted vibration and resulting transient sound.

MECHANICAL INSULATION

In general, external duct insulation shall be specified. Ducting systems shall not utilize duct liner or other internal duct insulation systems, unless approved by the ISU PM. Insulation on all cold surfaces shall be continuous through wall and ceiling openings, and shall have a continuous unbroken vapor seal. Insulation thicknesses shall comply with IEC requirements. Insulation systems shall include insulation of valves, fittings, etc., with removable covers where required for maintenance or operation. All steam pipe and associated devices shall be insulated to code.

Pipe Expansion Fittings and Loops
The Mechanical Engineer shall provide calculations to demonstrate that the steam and condensate lines have sufficient flexibility to relieve stress caused by expansion and contraction. If the steam and condensate lines are not inherently flexible enough to relieve these stresses, the Engineer shall modify the routing of the piping with loops, offsets or bends to create sufficient flexibility and/or add expansion compensating devices to the design. Anchors, loops, and expansion joints shall be provided as needed and detailed on the drawings.

Refrigeration and Air Conditioning Equipment
Refrigeration and air conditioning equipment installations shall include dryers, sight glass and thermostatically-controlled solenoid valves for pump-down operations. Provide the necessary protection devices, including but not limited to the following:

- Overload devices
- Low suction pressure cut-outs
- High head pressure cut-outs
- Low lubrication oil pressure cut-outs
- Crankcase heaters
- Anti-recycle controls
- Low ambient controls

Freeze-proof hose bibs shall be provided at all HVAC equipment. All antifreeze shall be propylene glycol. Condensate shall be piped to the nearest roof drain. All equipment shall be tagged with proper factory and /or fill charge of refrigerant. Logs for refrigerant equipment shall be maintained per requirements set forth by ISU. There is one specific procedure for equipment removal, new equipment installation, and refrigerant removal. A log for refrigerant addition will be required. All refrigerant charged equipment must have a final full charge stamped in at least two places with the type of refrigerant listed with it.

Please note:

Mechanical saddle/piercing valves can only be used to remove refrigerant but then they have to be removed and discarded and a new valve soldered/brazed in its place for permanent use.

Recovery DOT tanks used on campus for the purpose of recovering any and/or all refrigerant shall be iced down to facilitate a quicker recovery of said refrigerant in a timely and professional manner.

Air-Cooled Condensers
The design of air-cooled condensers shall take into consideration the proximity of the equipment to occupied buildings and background noise conditions. Maximum noise levels shall be eighty (80) dBA at any point three feet (3') from the condenser. Access platforms shall be provided to allow access to condenser fans without requiring the use of fall protection devices.

Boilers
Hot water boilers shall be non-condensing-type boilers, unless approved by the ISU PM.
For boilers rated above 80 percent (80%) efficiency, the Mechanical Engineer shall assess all operating conditions to ensure that the boiler will not be operating in the condensing range for stack gases.

Boilers shall be thoroughly cleaned, using boil-out procedures and chemicals recommended by the boiler manufacturer, prior to being placed in service. The following are preferred by ISU:

- Cleaver Brooks for boilers under 100hp
- Steam flanges shall use spiral wound gaskets
- Steam traps should be Spirax Sarco

Metal Ducts
The design of air handler systems shall utilize metal ducts on all air distribution systems. No duct liner shall be allowed on the project unless approved by the ISU PM. Ducts shall be designed for a minimum of two inches (2") H_2O positive pressure and one inch (1") H_2O negative pressure.
Ducts attached to fume hoods may reach 2.5" of positive pressure.

Duct Accessories
Smoke or smoke/fire dampers shall be provided where required by code. The Mechanical Engineer shall coordinate the location of smoke and smoke/fire barriers with the Architect. Access panels shall be provided for all smoke and smoke/fire dampers. The access panels shall not be blocked by piping, wiring or structural elements.

Silencers shall be provided when necessary to meet noise criteria. Where access to take-offs is available, balancing dampers shall be provided at the branch take-offs. Where this is not possible, and where otherwise requested by the University representative, opposed blade balancing dampers shall be located at the diffusers, and shall be screwdriver- operated.

Air Terminal Units
The Mechanical Engineer shall specify minimum and maximum air flows, air and water design pressure drops, design temperatures, and noise criteria (NC) ratings for variable air volume (VAV) mixing boxes and coils. The use of fan-assisted VAV boxes shall be avoided. The use of VAV boxes with filters shall also be avoided.

Diffusers, Registers and Grilles
In small office applications, modular core diffusers shall be specified.

Air Filters

Air filters shall be specified as the industry standard nominal size. Laboratories shall have 30 percent (30%) pre-filters and 95 percent (95%) intermediate filters. General classroom areas shall have 30 percent (30%) filters, and, where equipment configuration allows, 95 percent (95%) intermediate filters. Filter sections shall be provided with a filter differential pressure gauge.

HVAC Instrumentation and Controls
The approved suppliers for the campus wide direct digital control (DDC) systems are Johnson Controls and Automated Logic. Automatic temperature controls shall be provided by, or be fully compatible with, the products of one of these two suppliers.

ASHRAE standard terminology and abbreviations shall be utilized on all HVAC controls. Boxes and covers for HVAC controls shall be painted blue, and the circuits shall be labeled. Siphon tubes and shut-off valves shall be specified for steam pressure sensors. Pressure sensors with large fluctuations in pressure shall have "snubbers" installed in the sensing line.

HVAC System Control Logic
The design of all controlled systems shall include provisions for shut-down during unoccupied hours and be programmed in a low/high temperature limit for activation of HVAC systems as listed above. Override of night setback conditions shall only be included if authorized by the ISU PM. The use of web-based controls systems is encouraged.

A simplified control schematic — showing general control components, location, signal type and communication path — shall be provided on the Drawings. The intended location of gauges, sensors, actuators, etc., shall be clearly indicated on the construction documents.

Sequence of Operation
The Mechanical Engineer shall provide a detailed sequence of operation for all systems on the control drawings. The location of remote devices shall be clearly indicated on the drawings.

Special Fixtures
Eyewashes shall have a single actuator with tempering valve to provide the proper temperature. Emergency showers shall be provided as required by code. Floor drains are not required at emergency showers.

Water Heaters
Water heaters shall be designed to provide 140° F. water for institutional systems. Mixing valves are required.

Project Close-Out
Mechanical Engineer shall require notification by the contractor of the date when test and balance services are to be provided. The Mechanical Engineer shall work with the ISU PM to ensure that test and balance services are properly coordinated and observed where necessary. Test and balance reports should include test equipment calibration information.

The Specifications shall require the submission of Operation and Maintenance (O&M) manuals at least one week prior to the Date of Substantial Completion. O&M manuals shall be required to contain critical operating parameters of equipment (i.e., pressures, flows, amp readings, etc.) established by on-site measurements and not information provided by design manuals. Start-up logs are required for all refrigeration units (A/C's, refrigerators, freezers, etc.0, heaters (boilers, etc.), fan systems, humidifiers, pumping stations, pneumatics, etc.

Training shall be provided on all equipment at least seven days prior to substantial completion. Training shall be either on-site or off-site, depending on the equipment, at the discretion of the agency. Building commissioning is required.

ELECTRICAL DESIGN STANDARDS

General
Refer to Specification Section 01310 for the Coordination Matrix, which identifies divisional responsibilities.

POWER DISTRIBUTION SYSTEMS

Harmonics
The electrical distribution system shall be designed with neutrals sized to 200 percent (200%) to compensate for harmonics and non-linear loads. This shall include feeders to the main switchboard and branch circuit feeders. Each transformer shall be specified with the appropriate K-factor rating for the non-linear load it will feed. A typical K-factor rating to address harmonics is thirteen (13).

Coordination Studies
The Electrical Engineer shall perform all necessary coordination study calculations and indicate the required breaker size and trip settings, and fuse types on the Drawings. The coordination study shall include the 12,470V service over-current protection components. The existing primary-voltage distribution system and coordinate settings shall be surveyed where applicable.

Main Switchboard and Distribution Panelboards
The main switchboard and distribution panelboards shall be designed with circuit breaker construction, where practicable. All vertical and horizontal bussing shall be fully rated and full length.

Panelboards
Panelboard construction shall be specified for electrical panels rated at 1200 amps or less. Branch circuit panels shall have door-in-door construction. Fault current calculations shall be performed, and the results shall be recorded on the one-line diagram. The Electrical Engineer shall coordinate wall thickness requirements for flush-mounted panelboards with the Architect.

Panel Schedules
The panel schedules in the Drawings shall identify the distribution panel each panel is fed from. The circuit descriptions in the panel schedules shall include the following:

- Room numbers
- Type
- Light
- Receptacle
- N,S,E,W designators as appropriate (e.g., LTS – SOUTH)

Receptacles
A general note shall be included on the Drawings which requires the contractor to identify the panelboard and circuit number from which each receptacle is served. Identification with hot-stamped or engraved machine printing with filled lettering shall be provided on the face of each plate, and durable wire markers or tags shall be provided inside the receptacle boxes.

Medium Voltage Transformers
The Idaho Power Company provides the 12,470V pad-mounted transformers used by the University. The requirements for each transformer shall be coordinated with the appropriate Idaho Power Company representative.

Emergency/Standby Generators
For a new building or a significant renovation of an existing building, consideration should be given to providing an emergency or standby generator. In addition to a building code requirement, the Engineer shall insure that the telephone switch serving the building is provided with backup power. If an emergency or standby generator is provided, the following requirements shall be met:

- The generator shall be seamlessly compatible with the existing campus generator-monitoring Internet-based system, or shall provide a complete Internet-based system capable of stand-alone operation and being expanded for future growth.
- The respective generator manufacturer's sizing software shall be used to ensure compatibility with an uninterruptible power supply (UPS) and to meet load demands.

Emergency generator power shall be provided to the following:

- Fire alarm system
- Fire sprinkler system (for pumps and other equipment), if required by code
- Emergency lighting
- Door access system
- Closed-circuit television (CCTV)
- Telephone switches (where applicable)

Standby generator power shall be provided to the following:

- Computer panels
- An independent transfer-switch with control algorithm to switch to off if generator becomes overloaded
- Each generator shall communicate with the central monitoring system via a LAN connection. Compatibility with the central monitoring system shall be confirmed.

Telephone Switches: ISU operates its own telephone company. The telephone switches on campus require emergency backup power. In buildings that contain telephone switches, an emergency generator with a 24-hour fuel supply — in combination with two (2) hours of UPS battery backup — should be provided for the telephone switches. Where it is not possible to provide an emergency generator, telephone switches shall be provided with a minimum of eight (8) hours of emergency UPS battery backup.

Electrical Boxes and Conduit
Electrical boxes shall be 4-square, 2-1/8" deep boxes (minimum). Underground conduit shall be ¾-inch (minimum). Home run conduit shall be ¾ inch (minimum).

Disconnects/Starters
Disconnect switches shall be located on or near the equipment each switch feeds. Fused disconnects should be avoided if the switch or equipment has adequate upstream, over-current protection.
The size of the Hand/Off/Auto (HOA) switches shall be specified for mechanical gear. The location of the HOA switches shall be coordinated with the Mechanical Engineer. HOA switches should be located on or near the equipment being controlled, where practicable. HOA switches shall be located within the line of sight of the gear it feeds.

LIGHTING DESIGN

General
The lighting design shall yield minimum, maintained light levels per IESNA recommendations for indoor and outdoor applications.

Lighting Control
The Building Management System (BMS) shall control the lighting via contactor panels installed by the contractor, unless authorized by the ISU PM. The contactor panel shall have a screw-type cover and the appropriate NEMA rating. The contactors shall be controlled by the BMS via 24V pilot relays, which are also internal to the contactor panel. Provide ladder diagrams on the Drawings to demonstrate the lighting control. The BMS shall have a wet-contact card installed, or control a remote control unit having wet contacts, depending on the distance from the BMS control panel and the contactor panel. (Availability and compatibility shall be confirmed.) The BMS shall also monitor a photoelectric switch that is mounted (facing north on rigid galvanized steel conduit) 12 inches (12") above the roof.

EXTERIOR LIGHTING

General
See additional parking lot and site lighting Design Standards under Site Design.

Parking Lot Lighting
Fixtures similar to adjacent existing conditions shall be specified. The fixtures shall be mounted on 30-foot-high poles with 2 ½' high by 2' wide pole bases. The color of the fixtures and poles shall be dark bronze or to match existing adjacent conditions. The fixtures shall be controlled by the BMS via contactor panels. Light levels shall be designed per IESNA recommendations. A light loss factor of 0.6 for metal halide lighting shall be used to represent maintained lighting levels. The site lighting shall be circuited such that the following two lighting levels are obtained:

- Full Lighting – Follow IESNA recommended light levels.
- Night Lighting – The fixtures for night lighting shall provide a minimum of 0.2 foot-candles of illumination.

Exterior Building Lighting
Full-cutoff, shoebox style, metal halide fixtures (similar to Lithonia KAD and Lumark HR series) shall be specified — with pulse-start technology, when available. Lighting fixtures shall be provided over discharge exits with emergency circuit provisions per the International Building Code requirements. Exterior lighting shall be controlled by the BAS via contactor panels.

INTERIOR LIGHTING

Fluorescent lighting
Energy-efficient lighting fixtures with fluorescent lamps shall be specified for general illumination. Fluorescent lamps shall have a color temperature of 3500°K. The standard fluorescent lamps shall be 30 watt, T8 lamps with matching ballasts having a maximum THD of 10 percent (10%). Dimming ballasts may be incorporated into the design.

Night Lighting
Night lighting fixtures shall be provided in corridors such that one fixture is on continuously for low-level illumination.

Lighting Control Requirements by Room Type

Offices
- Control with occupancy sensors
- Set delay to 30 minutes
- Include a local switch

Restrooms
- Control with occupancy sensors
- Set delay to 30 minutes
- Provide one night-light fixture
- Provide keyed switch for night-light

Corridors
- Control via BMS
- Incorporate non-switched night-light fixtures
- Night fixtures shall have emergency ballasts or be powered by an emergency generator

Custodial Closets and Storage Rooms
- Switch control only
- No occupancy sensors

Mechanical and Electrical Rooms
- Switch control only
- No occupancy sensors

Computer Rooms
- Control with occupancy sensors
- Set delay to 30 minutes
- Include a local switch
- The lighting should be designed so that the lighting comes on in stages to help prevent voltage dips

Classrooms
- Control with occupancy sensors
- Set delay to 30 minutes
- Include a local switch

INFORMATION TECHNOLOGY

Introduction

Due to the ever-increasing complexity and need for coordination of low voltage systems, the University prefers that Division 17 and Division 18 construction be bid under one Integrated Building Systems Contractor that specializes in low voltage system installation. In addition to all

coordination for the low voltage system, low voltage cabling and system components, this contractor shall provide the conduit for the low voltage conductors where indicated in the drawings.

General
The consultant shall coordinate the design of the project with the current requirements and standards of the University's NETWORKING AND TELECOMMUNICATIONS (NeTEL) office. Their printed specifications are available from their website http://www.isu.edu/netel/.

NETEL – NETWORKING AND TELECOMMUNICATIONS

General Requirements
Telcom Rooms shall be exclusively dedicated to telephone and computer equipment. No other equipment will be allowed in these rooms.

IP Addresses
To obtain IP Addresses for addressable equipment that requires integration into the network, contractors shall coordinate with the NeTel office. The contractor shall be required to provide IP addresses along with descriptions in the submittal package.

Cabling and Raceways
The contractor shall home-run all data and communication cabling to the Telco Room and terminate accordingly. A manufacturer-certified contractor shall test the cabling after installation per Sections 17961 and 17967. The warranty shall be a minimum of ten (10) years and up to twenty five (25) years, depending on the application.

Raceways/Cable Trays

- Cable shall be concealed in EMT, IMC or RMC inside walls and in exposed areas, and shall be terminated with bushings on both ends.
- The minimum size conduit allowed is ¾" EMT (or rigid) w/2 ½" deep boxes.
- Bridal rings are permitted above ceilings from the cable tray to the conduit drops.
- The cable trays shall be sized to provide the currently required capacity, plus 100 percent (100%) for future capacity. A cabling contractor that is certified by the cable manufacturer shall install, terminate, test, secure, and label the cabling.
- Data conduit over three inches (3") in diameter shall be provided with one inch (1") innerduct to the full capacity of the conduit.

New Construction Integration with Campus System
The contractor shall provide two (2) four (4)-inch conduits with conductors and cable from the building telephone/communication room to the nearest manhole (which is usually located within 200 feet of new buildings) and then continue the un-spliced conductors and cable to the nearest IT hub facility. The Drawings shall indicate any existing conduits running between the manhole and the hub facility. In addition, the Drawings shall indicate the location of the hub facility rack on which the Contractor shall terminate the cabling. The Contractor shall terminate on the lightning protector jacks, and then onto a patch panel in the hub facility. The Contractor shall terminate fiber optic cabling on a fiber patch panel.

Grounding
Grounding tests shall be performed and the test results submitted for approval before any communications equipment is installed. The contractor shall adhere to NETEL's grounding

specification Section 17450 and testing procedure Section 17965, which are available on the website referenced at the beginning of this section. It should be noted that ground testing requirements are covered by both Division 16 and Division 17.

Data Cable Drops
Data drops shall be provided as indicated below:

Offices
- Conduit with bushing to accessible void above ceiling shall be provided on all walls
- Four (4) CAT 5E cable drops shall be provided at all workstations
- Two (2) CAT 5E cable drops shall be provided at countertops
- Two (2) CAT 5E cable drops shall be provided for printers

Classrooms
- Two (2) CAT 5E cable drops shall be provided at the front of the classroom

Computer Labs
- One (1) CAT 5E cable drop shall be provided at each computer station
- Raised flooring is permissible

Telephone/communication Rooms
- All equipment shall be rack-mounted
- All telephone and computer cables shall be run to the Telco Room. The University will make the final terminations.

BUILDING INTEGRATION

Introduction
Due to the ever-increasing complexity and need for coordination of low voltage systems, the University prefers that Division 17 and Division 18 construction be bid under one Integrated Building Systems Contractor that specializes in low voltage system installation. In addition to all coordination for the low voltage system, low voltage cabling and system components, this contractor shall provide the conduit for the low voltage conductors where indicated in the drawings.

Systems
Division 18 Building Integration shall include the following systems:
- HVAC Controls
- Fire Alarm
- Security System
- Utility Monitoring
- Lighting Control via the Energy Management System

Fire Alarms
The University's central monitoring station has a Bosch D6600 System that monitors the fire alarm system. The appropriate card shall be installed in the fire alarm control panel for communication via the Ethernet network to the D6600. To ensure compatibility with the central monitoring station, the Campus Standard for all new fire alarm control panels is Radionics/ Bosch. For more information on Bosch fire alarm equipment, see: http://www.boschsecurity.us/

Emergency AED's
AED's shall be provided as part of the project per the ISU PM. Evacuation plans, identification, and locations are also to be provided.

Automation Systems
The Campus Standard for automation systems are Automated Logic & Johnson Controls, Inc. (JCI).

CONTROLS

Lighting
The Building Management System (BMS) shall control the lighting via contactor panels installed by the contractor, unless authorized by the ISU PM. The contactor panel shall have a screw-type cover and the appropriate NEMA rating. The contactors shall be controlled by the BMS via 24V pilot relays, which are also internal to the contactor panel. Provide ladder diagrams on the Drawings to demonstrate the lighting control. The BMS shall have a wet-contact card installed, or control a remote control unit having wet contacts, depending on the distance from the BMS control panel and the contactor panel. (Availability and compatibility shall be confirmed.) The BMS shall also monitor a photoelectric switch that is mounted (facing north on rigid galvanized steel conduit) twelve inches (12") above the roof.

HVAC Control
The BMS shall control the heating, ventilating, and air conditioning systems. Division 16 of the Specifications shall require one (1) spare 120V circuit for Direct Digital Control (DDC) panels in each building area.

Metering
The requirements for meters are provided in Division 18 of the Construction Standards. Meters shall be compatible with the BMS. Meters shall be located in a readily accessible area. If meters are located outdoors, the meters shall be installed in a lockable, NEMA 3R enclosure with a hinged door. Electrical feeders entering buildings shall be monitored. Electrical panels that feed lease spaces shall be monitored. The ISU PM will confirm portions of a building that are or will be leased.

All sources of energy, including but not limited to electricity, steam, domestic water, and natural gas, shall be sub-metered within each building or major remodeled space. Sub-metering shall be tied into the BMS.

Door Access Control
All doors with electronic access control shall be connected to the University's existing access control system.