



DESIGN GUIDELINES FOR FACILITIES CONSTRUCTION

2011 Edition

Revisions made to the 2009 Edition are shown in red

FACILITIES MANAGEMENT & PLANNING
UNIVERSITY OF NEBRASKA-LINCOLN

Ted Weidner, Assistant Vice Chancellor

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INTRODUCTION AND SUGGESTIONS FOR USE

1. INTRODUCTION:

a. The Design Guidelines and Standard Details included in this manual identify the standards and preferences of the University of Nebraska-Lincoln Facilities Management & Planning Division in many areas of construction design. These preferences have evolved from the division's experience in overseeing the construction, operation and maintenance of UNL buildings over many years. Revisions to previous editions of the Design Guidelines are indicated by blue text. It is intended that these Guidelines serve as a uniform reference for consultants providing architectural and engineering design for UNL construction projects, in addition to being used by the Facilities Planning staff. The value of being able to transmit the large body of specific information and preferences contained in these Guidelines is obvious. It will result in the use of construction systems and materials which have been proven to be cost-efficient and effective. The use of these Guidelines will also improve the efficiency of the design process itself by insuring that relevant information is communicated to project designers in a timely manner.

b. The Design Guidelines and Standard Details are organized by subject matter into divisions identified by the numbering system suggested by the Construction Specifications Institute and familiar to most builders and designers.

2. UPDATING FOR REGULATORY COMPLIANCE:

This manual has been updated as noted on particular pages. Revisions from the previous edition are indicated by blue text and sidebars. Since the requirements of applicable ordinances, codes, statutes, and regulations are subject to change, it is the responsibility of the design professional to determine independently that the project fully complies with all applicable ordinances, codes, statutes, and regulations in effect at the time of the design. If, in the opinion of a design professional working on a specific matter, a requirement of these guidelines is so inconsistent with a requirement of an applicable ordinance, code, statute, or regulation that compliance with this manual would violate the applicable provision, the design professional should comply with the applicable ordinance, code, or regulation and should also advise the UNL project representative in writing of the apparent inconsistency and the reasons that the guideline may not be followed

3. STATUS OF DESIGN GUIDELINES:

a. The Guidelines do not include "standard" or "master" specifications for any construction material or system. The translation of the standards and preferences given herein into contract document requirements is left to the individual consultant. In no instance shall a direct referral to these Design Guidelines be included in contract documents prepared by Design Consultants, nor shall any portion of these Design Guidelines be reproduced in project specifications. It is expected, however, that all of the applicable preferences in the Guidelines will be reflected in the drawings or specifications prepared for the project. The application of these Guidelines to a

specific project should be reviewed with the UNL Project Representative by the Prime Design Consultant(s) at the outset of the design process.

b. Every effort has been made to insure that these Guidelines reflect sound design and engineering principals. However, if any Design Consultant finds that the application of any of these Guidelines would result in a design which is inappropriate or compromised in any way, the Design Consultant should notify the UNL Project Representative in writing. The existence of these Guidelines in no way relieves the Design Consultant from the professional responsibilities defined in its agreement with the University.

c. The Design Guidelines are the property of the University of Nebraska-Lincoln and are intended solely for projects on the University of Nebraska-Lincoln campuses. They are not to be copied for use by others nor used on projects outside of the University of Nebraska-Lincoln campuses.

4. MODIFICATION PROCEDURE:

a. Users of this manual, including UNL Facilities Management and Planning staff and UNL Building Systems Maintenance staff, who have suggestions for modifying or expanding the subject matter covered in the Guidelines are encouraged to submit their suggestions in writing to the Facilities Management office. A form for providing such input is provided in the appendix to the manual, although any form of written communication or e-mail is welcome. All suggestions for modifications should be directed to the UNL Department of Facilities Planning and Construction.

5. SUGGESTIONS FOR USE:

a. This version of the Design Guidelines requires the use of Adobe Acrobat viewer software. If your computer does not have the latest version of this software installed, it can be downloaded, without cost, from the <http://www.adobe.com/> web site.

b. Navigation: The Design Guidelines have been bookmarked to provide efficient navigation within the document. To access these bookmarks, click on the Bookmarks tab on the left edge of the page. Click on the Division titles to access list of individual guidelines or standard details. Click on the Guideline or Standard Detail title to access the individual guideline or detail. Links have also been established between the listings on the Table of Contents and the respective guidelines and standard details. Clicking the number or title on the Table of Contents listing will navigate the document to that item.

c. Subject Matter Search: In the drop-down menu under EDIT, select FIND (or type Control+F); type in subject word or phrase. The command will display successive instances of the word or phrase if they appear in the document.

6. WAIVERS:

Applications for waivers to any section of these Design Guidelines **shall** be made, in writing, by the Architect/Engineer of record to the UNL **Department of Facilities Planning and Construction**.

CAMPUS PLANNING

1. CONFORMANCE TO CAMPUS PLANS:

Proposed new facilities, additions to existing facilities, or major facility renovations shall conform to the most current UNL Comprehensive Facilities Plan and Campus Master Site Plans. It shall be the responsibility of the Manager of Facilities Planning in the UNL Facilities Planning Department to assure project compliance.

2. CONFORMANCE TO UNL SPACE AND LAND GUIDELINES:

Proposed new facilities, additions to existing facilities, or major facility renovations shall conform as nearly as possible to the most current University of Nebraska Space Guidelines and Land Guidelines issued by the University of Nebraska Office of Facilities. Questions about interpretations of the guidelines should be submitted to the Manager of Facilities Planning in the UNL Facilities Management Department.

3. PROJECT DESIGN REVIEWS:

a. Aesthetic Review Committee: Projects which by their nature will have a visual impact or produce a change on the exterior of any building or structure on the UNL campus shall have an appropriate project documentation submitted for review to the Aesthetics Review Committee. The committee will recommend to the Director of Facilities Management and/or the Director of Landscape Services, whether such project be approved, approved with modifications, or disapproved. Submissions to the Aesthetic Review Committee should be initiated by the UNL project manager through the Manager of Facilities Planning.

b. NU Project Review Board: Projects which by their size and nature require review by the University of Nebraska Project Review Board, appointed by the Board of Regents, are required to submit appropriate documentation to the NU Project Review Board for review and approval. Submissions to the NU Project Review Board should be initiated by the UNL project manager through the University of Nebraska Director of Facilities.

GENERAL REQUIREMENTS FOR FACILITY DESIGN

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1. APPLICATION:

New structures, additions to existing structures, and major facility renovations shall conform to the requirements of this guideline.

2. SUSTAINABLE DESIGN:

New construction and major remodel projects shall implement the goals and requirements defined in the Leadership in Energy and Environmental Design program for New Construction (LEED-NC), sponsored by the United States Green Building Council (USBGC). The degree or level of implementation of this program shall be established by the University of Nebraska-Lincoln at the outset of the design process. An explanation of the LEED-NC program is attached to these Design Guidelines as the Sustainable Design Appendix.

3. EXTERIOR MATERIALS PALETTE / ARCHITECTURAL STYLE:

- a. General: Materials selected for the exterior facades of new buildings and additions to new buildings should be harmonious with and reflective of the materials used on existing buildings in the environs of the project in their character, type and color.
- b. City Campus: Buildings in the central core area bounded by R Street, W Street, Stadium Drive (10th Street) and 17th Street, should conform wherever possible to the Collegiate Georgian style. Brick and limestone should be used similar to the City Union addition completed in 1999. Sloping slate roofs should be used wherever possible.
- c. East Campus: Buildings in the central core area bounded by the internal loop road should conform wherever possible to the existing Beaux-Arts style. Brick and limestone should be used similar to the Food Industries Complex addition completed in 1990. Sloping tile roofs should be used wherever possible.
- d. Other: New buildings outside the central core areas referenced above may be designed in a more contemporary expression of the above-referenced architectural styles, but still use the same palette of materials and colors.

4. DESIGN CONTINUITY IN ADDITIONS AND REMODELING:

In building additions and partial remodeling, basic interior finishes and materials and other visible elements, such as finish hardware, door frames, and doors should match the style and finish of those items in the original building unless otherwise approved.

5. ON-GRADE ENTRANCES:

The floor level(s) of new structures and major additions to existing structures should be established at an elevation, and integrated with the final topography of the site, whereby steps or switchback ramps are not required in the exterior approach path to any significant point of egress to the building. This requirement should be implemented in a way which still provides for positive drainage away from the building of paved areas, lawns, and planting areas.

6. ACCESS REQUIREMENTS FOR CONCEALED MECHANICAL AND ELECTRICAL COMPONENTS:

- a. Construction documents should be correlated and cross-referenced to insure that concealed mechanical and electrical system components which require inspection, adjustment, service or maintenance, including, but not limited to VAV boxes, control valves, balancing valves, reheat coils, control devices, fire dampers and balancing dampers, are provided with an appropriate means of access, either through readily removable ceiling panels or properly sized and located access panels or doors. Where access panels or doors are used, their size and dimensioned location should be indicated on the construction documents.
- b. Access to mechanical rooms shall be by means of stairs or an elevator. Access solely by means of a ladder is prohibited.

7. SEISMIC AND STRUCTURAL DESIGN REQUIREMENTS:

See Section 1613 of the 2006 International Building Code.

UNL has identified FEMA 361 as a reference for shelters but will be open to reasonable alternatives proposed by the AE of record for a project, on a project by project basis. The AE's proposal should include identifying the safest place(s) in the building that occupants can go to in the event of a tornado.

8. SOUND TRANSMISSION STANDARDS:

a. Building Envelope and Room Enclosures: Design and select building systems to provide the following sound transmission resistance:

Building Envelope:	STC 35
Office Enclosures:	STC 30

b. Mechanical Systems: See paragraph 5c of DG 230000.10 for noise criteria (NC) standards applicable to HVAC systems.

c. Fume Hoods: See paragraph 7h of DG 230000.10 for noise criteria (NC) standards applicable to fume hood systems.

9. WINDOW CLEANING:

A workable method for cleaning windows and glass should be incorporated into the design of the building. Such provisions shall be reviewed and approved by the UNL project representative. For window cleaning access from the roof, OSHA-compliant tie-off points for both window cleaners and swing stages should be included.

10. WINDOW DESIGN TO REDUCE BIRD STRIKES:

For new buildings, additions, and window replacement projects, windows must be designed and specified to reduce bird strikes as much as possible. The AE firm must present options for consideration by the University. The Bird-Safe Building Guidelines by the New York City Audobon Society (www.nycaudobon.org) shall be the standard reference.

11. FIXED LADDER TO ROOF HATCHES:

A fixed ladder conforming to OSHA requirements shall be provided at every roof hatch location. Where roof hatches are located in areas accessible to the public, a security door limiting access to the roof hatch shall be provided. Roof hatches shall not be accessed from required exit enclosures and/or stair towers.

12. COORDINATION OF MODULAR FURNITURE LAYOUTS

Designers laying out modular furniture arrangements and selecting modular furniture system components shall coordinate layouts so as to avoid conflicts with building components such as

electrical switches and outlets, fire alarm stations, thermostats, radiators, and air supply and return grilles. Designers should consider eliminating modular furniture wall panels where such panels are immediately adjacent and parallel to exterior walls or interior partitions, and using standards attached directly to the building walls to support intersecting panels and/or wall hung components.

13. COORDINATION OF MECHANICAL AND ELECTRICAL ITEMS LOCATION

- a. Require that light switches be grouped together with other items such as alarm stations and thermostats located in the same vicinity and arranged in an orderly fashion (i.e. with devices aligned and evenly spaced).
- b. Require that location of receptacles, switches, and similar items be coordinated with architectural drawings so as not to interfere with casework, marker boards, tack boards, and similar items.

14. ELIMINATE SHELF STOCK ITEMS REQUIREMENT

Shelf stock of items such as carpet, paint, etc. must not be specified. Only unique mechanical, electrical and plumbing items should be shelf stocked.

CODE COMPLIANCE & DESIGN FOR DISABLED

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1. APPLICATION
2. BUILDING CODES
3. ACCESSIBILITY STANDARDS
4. DESIGN REVIEWS

1. APPLICATION:

a. **Requirement:** All facilities designed, constructed or altered by, on behalf of, or for the use of the University of Nebraska-Lincoln shall comply with the building codes mentioned in this guideline and with the accessibility standards set forth in the Americans with Disabilities Act (ADA) and in Title 156 - Nebraska Accessibility Requirements of the Nebraska Administrative Code.

2. BUILDING CODES:

a. **Applicable Codes:** Construction projects should be designed to comply with the requirements of the following codes and standards:

- (1) International Building Code, 2009 Edition.
- (2) International Energy Conservation Code, current adopted edition (2003).
- (3) NFPA 101, Life Safety Code, National Fire Protection Association, as currently adopted by the Nebraska State Fire Marshal (2000).
- (4) ANSI Standard A17.1 for Elevators and State of Nebraska Elevator Inspector requirements.
- (5) International Plumbing Code, 2009 Edition.
- (6) International Mechanical Code, 2009 Edition
- (7) International Fuel Gas Code, 2009 Edition
- (8) International Existing Building Code, 2009 Edition
- (9) National Electrical Code (NFPA 70) 2005 Edition
- (10) Heating, Ventilating and Air Conditioning Standards, Including:

- Applicable NFPA Pamphlets
- SMACNA – Duct Construction Standards
- ASHRAE – Manuals as applicable for design and construction methods
- American Conference of Governmental Industrial Hygienists – Industrial Ventilation

(11) Plumbing Standards, Including:

- Applicable NFPA Pamphlets
- AGA Plumbing Standards

3. ACCESSIBILITY STANDARDS:

a. New buildings, additions to buildings and alterations should conform to the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) and Title 156 – Nebraska Accessibility Requirements of the Nebraska Administrative Code (NAC).

b. Exception to ADAAG For Ramp Slopes: Although the ADAAG permits a maximum slope of 1:12 for interior and exterior ramps, this should be viewed as the maximum allowable slope and only used where circumstances do not permit a more gentle slope. Wherever possible, the slope of interior and exterior ramps should not exceed 1:16. Exceptions to this standard must be approved by the UNL project representative.

4. DESIGN REVIEWS:

a. UNL Review. Projects with a construction cost of more than \$50,000 shall be submitted for review by the UNL ADA Compliance Officer.

b. UNL Building Official Review. All projects shall be submitted to the UNL Building Official for approval and Permit. To ensure that Code-required elements are not overlooked during the early design stages, projects should be submitted to the UNL Building Official as early as possible during the design process.

c. Fire Marshal Review. All projects shall be submitted for review by the Nebraska State Fire Marshal as required by Title 156 of the Nebraska Administrative Code. Project consultants shall be responsible for submitting material and receiving comments for all reviews up to the final review. The UNL project manager shall be responsible for submitting documents for the final review.

CUSTODIAL FACILITIES

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1. GENERAL REQUIREMENTS
2. CUSTODIAL WORK ROOMS
3. CUSTODIAL EQUIPMENT/SUPPLY STORAGE ROOMS
4. WASTE MANAGEMENT ROOMS

1. GENERAL REQUIREMENTS:

a. Application. Every new building, addition, and/or remodeling of an existing building should include custodial facilities of the size and type described in this Guideline. Such facilities must be specifically considered in the Program Statement phase or other planning processes which define the scope of the project

b. Space Allocations. Space for custodial work rooms, custodial equipment and storage rooms and trash storage rooms should be allocated in accordance with the following table:

BUILDING AREA>	UP TO 20,000 SQ. FT.	20,000 - 30,000 SQ. FT.	30,000 - 150,000 SQ. FT.	OVER 150,000 SQ. FT.
CUSTODIAL WORK RMS	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 EQUIP & STOR RMS	Included in Custodial Work Room	1 @ 100 sq. ft.	1 @ 100 sq. ft.	2 @ 150 sq. ft.
WASTE MANAGEMENT RMS	1 @ 80 sq. ft.	1 @ 100 sq.ft.	1 @ 120 sq. ft.	1 @ 170 sq.

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

Note 2: Distribute area in 60 sq. ft. increments on each floor level.

c. Existing Custodial Facilities: The requirements given above may be waived in the case of additions to existing buildings and for interior alterations to the extent that the existing custodial facilities of the type described which are in reasonable proximity to such construction meet the area requirements of these guidelines and are otherwise in reasonable conformance with these guidelines.

d. Use Restrictions: Custodial work rooms, custodial storage rooms, and waste management rooms should not be used as a passageway to other rooms nor should they share

space with fire reporting equipment, plumbing systems/equipment, alarm systems, electrical panel boards, telephone or data transmission equipment, or any other systems not directly related to custodial services. Custodial work rooms should not be locations for ladders or access doors to mechanical spaces, attics or roof areas.

2. CUSTODIAL WORK ROOMS:

a. Area: Generally, custodial work rooms should have a floor area of not less than 60 sq. ft. The minimum interior dimension for any custodial work room should be 5'-6". In multi-floor buildings with small (less than 10,000 sq. ft.) floors, the area of the custodial work rooms can be reduced to 48 sq. ft. each.

b. Ceiling Height: The minimum ceiling height should be 8'-0".

c. Doors: 3'-0" wide by 7'-0" high, swinging outward, equipped with storeroom function lock, closer, and 36" high armor plate on inside face. Storeroom function lock should be keyed to custodial day key and custodial grand master.

d. Service Sink: Floor level service sink, 24" square, comparable to Fiat* MSB 2424, with hot and cold water mixing faucet with vacuum breaker, American Standard* 8344.111, and hose and bracket, Fiat* Model No. 832-AA.

e. Mop Hanger: Model Geerpres* #5047, mounted above service sink. not on same wall as faucet..

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

g. Room Finishes:

(1) Walls: Walls within custodial work rooms may be concrete masonry or gypsum drywall construction, finished with semi-gloss enamel paint. Walls adjacent to and extending one foot beyond the edge of the service sink should be finished with an impervious waterproof material such as glazed ceramic tile, to a height of 4 ft.

(2) Floor: Sealed concrete.

(3) Ceiling: Painted gypsum drywall or suspended acoustic panels.

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

i. Electrical Requirements: Custodial work rooms and storage rooms should have a light level of 50 fc. Lighting fixtures should be recessed flush with the ceiling or surface-mounted supplied with a safety shield. Work rooms should have a minimum of two electrical outlet receptacles. Room shape and size may require more than two outlets. Outlets combined with light switches are not practical and are not permitted.

3. CUSTODIAL EQUIPMENT/SUPPLY STORAGE ROOMS:

- a. General: Custodial equipment/supply storage 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 shampoo machine, and carpet extractor. They are also used for the storage of bulk custodial supplies.
- b. Location: Storage rooms should be located in reasonable proximity to the building delivery entrance.
- c. Room Finishes: Same as described above for custodial work rooms.
- d. Electrical Requirements: Lighting and receptacles for custodial equipment/supply storage rooms should be the same as that described in paragraph 2i above, except that three electrical outlet receptacles should be provided.

4. WASTE MANAGEMENT ROOMS:

- a. General: Waste management rooms are intended for the inside accumulation of generally dry trash, generated by custodial activities, prior to its removal to exterior dumpster units. Recycling bins, for the collection of recyclable waste, will be located in these rooms. Waste management rooms are not intended for waste resulting from food service operations.
- b. Location: Waste management rooms should be located adjacent to the building loading dock and/or the receiving room and dumpster location.
- c. Room Finishes:
 - (1) Walls: Concrete masonry or comparable abuse-resistant system to withstand the impact of cart traffic and providing two-hour fire separation from remainder of building.
 - (2) Floor: Sealed concrete.
 - (3) Ceiling: Two-hour fire rated; exposed structure acceptable in building with reinforced concrete structural system.
- d. Code: One hour construction required for Waste Collection Rooms unless connected to a trash chute more than three stories high.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

TELECOMMUNICATIONS WIRING CLOSETS

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1. GENERAL
2. ENVIRONMENTAL REQUIREMENTS
3. ROOM CONSTRUCTION

1. GENERAL:

a. Application: Each new building or addition to an existing building should include spaces designated for the location of telecommunications equipment. Such spaces must be specifically considered in the Program Statement phase or other planning or planning processes used to define the scope of the project. These spaces should be designated exclusively for the location of terminal points and equipment associated with the following telecommunications systems:

- (1) Telephone/data.
- (2) Community antenna television (CATV) and closed circuit television (CCTV).
- (3) Computer networks.

b. Requirements: Allocate space within the primary telecommunications wiring closet for each of the following functions:

- (1) Telephone Entrance Area: The location at which the telephone entrance cable is terminated, protective devices are installed, and the initial allocation of the cable pairs is done.
- (2) Data Cable Entrance and Distribution Area: The location at which the fiber optics data transmission cable is terminated and the fiber equipment routers and network concentrators are installed, along with the racks containing patch blocks.
- (3) Closet Circuit TV (and CATV) Entrance Area: The location at which the CCTV (and CATV, if appropriate) building amplifier, splitter and patch panel are installed.

c. Use Restriction: Telecommunication equipment rooms or telecommunications riser closets should not be used as a passageway to other equipment rooms, nor should they share space with fire reporting equipment, alarm systems, electrical panel boards, power transformers,

custodial equipment or any other function which would require access for reasons other than telecommunications maintenance.

d. Location:

(1) Telecommunications wiring closets should be centrally located (both vertically and horizontally) within the building area served. Although some standards recommend a separate wiring closet for each floor level, every attempt should be made to maximize the area served from the primary wiring closet in order to minimize the cost of telecommunications wiring infrastructure equipment and space.

(2) Telecommunications wiring closets should be accessible from a common hallway.

(3) The maximum wiring run from the telecommunications wiring closets to the most distant telephone/data outlet served from the closet should not exceed 295 feet. The preferred maximum distance is 275 feet. The wiring closet will be the origination point for wiring to all communications outlets within the area served. These could number as many as one outlet for each 50 to 60 sq. ft. of net office or laboratory area served.

(4) Where wiring closets serve areas on more than one floor, the design process should recognize the need to incorporate appropriate paths of travel for the raceway systems which will be required to carry the telecommunications wiring between the floors.

(5) Wiring closets and telecommunications cabling should be separated from sources of electro-magnetic interference (EMI), such as induction devices, transformers, ballasts, power supplies, elevator equipment, generators, motors, X-rays and similar equipment as much as possible. Wiring closets should be separated from locations containing equipment such as photo copiers, microwave ovens and personal computers by 10 to 15 feet.

2. ENVIRONMENTAL REQUIREMENTS:

a. HVAC: The ambient temperature in wiring closets should be maintained in the range of 68^o to 75^o F., 24 hours per day, 7 days per week. Humidity should be maintained at 30% to 50%. Wiring closets should be ventilated at the rate of one air change per hour. The heat rejection of equipment installed in the room should be designed for when sizing cooling provisions for the rooms. Separate thermostatic control shall be provided for each telecommunications wiring closet.

b. Lighting: Lighting in the telecommunications riser closets should provide a minimum light level of 50 fc at desktop level.

3. ROOM CONSTRUCTION:

a. Enclosing Walls: Walls surrounding telecommunications wiring closets should extend to the structural floor above on all sides, both for reasons of physical security and environmental control. Minimum height to structural ceiling should be 8'-6". Provide adequate conduit or other

raceways through walls to adjoining accessible ceilings and/or accessible locations on other floors, where appropriate.

- b. **Ceiling:** A suspended ceiling should not be installed.
- c. **Floor:** Floor finish should be smooth, dust-free and not susceptible to static electricity build-up. Acceptable finishes would be composition tile or sealed concrete.
- d. **Door:** Provide 3'-0" wide by 7'-0" high door, opening outward, with storeroom function lock.
- e. **Windows:** Exposure of wiring closet interiors to direct sunlight should be avoided. Wiring closets should not be placed in locations containing exterior windows.
- f. **Size:** Minimum size of telecommunications wiring closets should conform to the table below. A clear space of 36" should be provided in front of all terminal boards, panels, or equipment racks.

SERVED AREA, NET SQ. FT.	CLOSET DIMENSIONS
Up to 5,000 sq. ft.	7' x 10'
Up to 8,000 sq. ft.	9' x 10'
Up to 10,000 sq. ft.	12' x 10'

- g. **Water Infiltration:** Wiring closets should never be located below ground level unless measures are taken to prevent water intrusion. Water or drain piping should not be permitted within the telecommunications wiring closet. Where the possibility of water intrusion exists, a floor drain should be located within the room.
- h. **Sprinkler Systems:** Where the location of automatic sprinkler head within the wiring closet is required, it should be the high heat type, and be protected with a wire cage to prevent its accidental discharge.
- i. **Plywood Terminal Boards:** Provide 3/4" thick Grade A-C plywood terminal boards, securely attached to walls and painted with two coats of light-colored fire-retardant paint. Plywood should cover the equivalent of one short wall and one long wall of the room. The designation of the walls to be covered should be coordinated with the location of the phone, data and TV entrance equipment and racks.
- j. **Electrical Systems:** See Article 6 of Design Guidelines DG 260000.10 for electrical requirements for Telecommunications Closets.

NON-PROGRAM BUILDING AREAS

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1. GENERAL
2. PUBLIC CORRIDORS
3. TOILET ROOMS
4. DOCKS
5. CUSTODIAL AREAS
6. TELECOMMUNICATIONS WIRING CLOSETS
7. MAIL FACILITIES
8. MECHANICAL EQUIPMENT ROOMS
9. ELECTRICAL CLOSETS
10. STORAGE ROOMS
11. UTILITY SERVICES FOR SITEWORK IMPROVEMENTS

1. GENERAL:

a. Application: "Non-program" building areas are those spaces within a building which facilitate the use and operation of the programmed areas, but which are often not mentioned in the program statement or other planning directive defining the requirements for the project. Unless specifically excluded in writing by the UNL Project Representative, every building project shall incorporate the non-program areas named below and these areas shall conform to the requirements of this Guideline.

b. Access to Non-Program Spaces: Entrance doors to mechanical equipment rooms, electrical closets, telecommunications rooms, and elevator equipment rooms shall be located to open off of corridors, lobbies, or other public spaces. Accessing these spaces through offices, meeting, teaching, or research spaces must be avoided.

2. PUBLIC CORRIDORS:

a. Floor Finish: Use hard-surfaced flooring. Quarry tile, terrazzo or comparable materials suitable for heavy traffic are preferred where the budget allows. Vinyl composition tile is acceptable where the budget does not permit the use of more expensive systems or where the installation of the preferred systems is not practical.

b. Wall Finish in High Traffic Locations: Provide glazed ceramic tile or comparable finish to protect walls at drinking fountains, elevator entrances, seating areas and similar locations.

- c. Corner Guards: If corridor wall finish is gypsum wallboard, the need for corner protectors should be recognized and appropriate measures incorporated into the construction documents.
3. TOILET ROOMS:
- a. Floor Finish: Require the use of ceramic mosaic tile for toilet room floors. Black or other dark colors shall not be permitted.
- b. Ceiling Finish: Use hard-surface material for ceilings, such as suspended gypsum dry-wall or lath/plaster systems. Do not use acoustical panel ceiling systems.
- c. Wall Finishes:
- (1) Toilet Rooms with Gypsum Wallboard Walls: Provide ceramic tile wall finish behind lavatories, urinals, and water closets to not less than wainscot height (48"). If budget permits, extend ceramic tile to door head or ceiling height.
- (2) Toilet Rooms with Exposed Masonry Walls: Provide glazed masonry units (glazed structural tile or faced concrete masonry units) or glazed epoxy paint systems or ceramic tile applied to masonry, behind laboratories, urinals and water closets to not less than wainscot height (48"). If budget permits, extend glazed surface to door head or ceiling height.
- (3) Paint Systems: Paint areas not covered with glazed surfaces with alkyd-based semi-gloss enamel paint system.
- d. Plumbing Fixtures: All plumbing fixtures, including lavatories, shall be wall-hung. (See Article 1 of DG 220000.10). In no circumstance shall toilet room lavatories be installed in a vanity counter. Such installations have been found to be unsatisfactory in an institutional setting.
- e. Floor Drains: Every toilet room shall have one or more floor drains.
- f. Ventilation: Toilet rooms and shower areas shall be served with exhaust systems providing the ventilation rates prescribed in the codes mentioned in DG 230000.10.
4. DOCKS:
- a. Application: Each new building project shall incorporate a concrete loading/receiving dock in a location accessible to delivery vehicles. The project design process shall include a determination as to whether the dock area will need to allow for semi-trailer vehicles. Dock surfaces and stairs serving docks shall be covered by roof or canopy structures.
- b. Walking Surface: The walking surface of the dock shall be concrete, broom finished to provide a non-slip surface.
- c. Dock Levelers/Bumpers: Determine requirements for dock leveler. As a minimum, provide laminated dock bumpers.
- d. Dock Height: Dock height shall be 46" to 48" unless dictated by special conditions.

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- e. Dumpster Area: Dock area shall include a visually-screened space for an adequate number of garbage and recycling dumpsters. Dumpster pad shall be constructed to drain with a 1/8" per foot slope.
5. CUSTODIAL AREAS: See DG 01 00 00.14.
6. TELECOMMUNICATIONS WIRING CLOSETS: See DG 01 00 00.15.
7. MAIL FACILITIES:
- a. Requirement: Each new building project shall incorporate, at an appropriate location, facilities for the receipt of incoming U.S. mail and campus mail and for the deposit of outgoing mail. As a general rule, separate mail facilities shall be provided for each academic department or other academic or administrative entity housed in the building. Depending upon the size of entity served, the mail facility may consist of a drop box or may be a separate room or may be an area within a room devoted to other administrative support services. The exact requirements shall be determined in consultation with the UNL Manager of Mail and Distribution Services and be based on upon the current and projected mailing needs of the unit served.
- b. Security: Mail facilities shall be designed and arranged so that access to incoming or outgoing mail placed in such facilities is available only to the receiving entity and to UNL Mail & Distribution Services.
- c. Equipment: Mail rooms shall be furnished with mail equipment appropriate to the department served and the needs of UNL Mail & Distribution Services. In most cases, this will consist of sorting cases or shelving, but other equipment may be required in some instances. Equipment needs shall be established during the pre-design consultation with UNL Mail & Distribution.
- d. Location: Mail facilities (drop boxes or mail rooms) shall be located in proximity to the building's main entrance, freight entrance or loading dock.
8. MECHANICAL EQUIPMENT ROOMS:
- a. Floor Finish: Exposed sealed concrete. Where equipment room is located above an occupied building area, provide measures to confine and control leaking liquids at pump and valve locations by sloping floor slabs to drains and applying waterproof membranes to floor slabs in vicinity of such equipment.
- b. Walls: Unpainted concrete masonry or cast-in-place concrete (where building foundation serves as room wall).
- c. Ceiling: Exposed structure where such structure meets code requirements for fire-resistance rating. Headroom to structure or under suspended equipment or ductwork shall be not less than 6'-0".
- d. Floor Drains: Locate in vicinity of possible liquid sources, such as pumps, valves and condensate drains.

- e. Equipment Installation: Provide clearances and housekeeping pads for mechanical equipment in accordance with Article 6 of DG 230000.10 PROCEDURES, DESIGN STANDARDS & DESIGN CRITERIA for mechanical systems.
- f. Space for Storage of Attic Stock: When allocating space for mechanical equipment rooms, include a vacant area within the room, kept free of mechanical equipment initially installed during the construction of the building, such area to be used for the storage of attic stock materials. The only materials that can be stored in mechanical rooms are those used to support mechanical systems (e.g. filters and belts).
9. ELECTRICAL CLOSETS:
- a. General: Provide electrical closets for branch circuit panels and other electrical equipment on each floor and/or area of the building. Electrical closets shall not be used as passageways to other equipment rooms.
- b. Floor Finish: Exposed sealed concrete.
- c. Walls: Concrete masonry or metal stud/gypsum drywall, extending to underside of structure above.
- d. Ceilings: Exposed structure where such structure meets code requirements for fire-resistance rating.
10. STORAGE ROOMS
- a. General: The requirement for storage rooms for building occupants generally will be included in the program statement or planning directive describing the scope of the project. The design of these rooms shall take into account the type of material and items likely to be stored in these rooms and insure that proper provisions are made for maintaining proper room temperatures, ventilation of the room, and fire protection.
- b. Shelving: If shelving is included within the scope of the project, the special requirements for the stored items or material shall be recognized in the design and/or selection of the shelving. Shelving for chemicals shall not be placed above eye level and shall have lipped edges to contain chemical spills.
11. UTILITY SERVICES FOR SITEWORK IMPROVEMENTS:
- a. Requirement: Provide electricity and water for irrigation systems and electrical service for outdoor lighting. Provide sill cocks on all sides of new buildings, spaced not greater than 200' apart.

PROJECT IDENTIFICATION AND CONSTRUCTION SIGNS

1. The sign should be installed at projects which affect the exterior campus environment by either construction or staging areas, for projects over \$250,000 in project cost.
2. The layout, content and other aspects of the project sign should conform to the requirements given in UNL Standard Detail SD1-01.
3. The project sign should be required to be erected in a prominent location on the project site, as directed by the University project manager.
4. Board of Regents Policy RP-6.2.7, Naming of Facilities, establishes the authority for naming buildings and other facilities at the University of Nebraska. The Board of Regents (BOR) policy stipulates “The naming of a room or a small cluster of rooms or other campus features such as a garden or landscaped area in honor of an individual, a family, a group, or an organization shall be approved by the Chancellor responsible for the facility and the President. These actions shall be reported to the Board of Regents.” BOR policy also stipulates that “The naming of a campus building or wing of a building, or fountain, monument, plaza, or street in honor of an individual, a family, a group, or organization shall be approved by the Board of Regents upon recommendation of the Chancellor responsible for the facility and the President”. See BOR policy statement for specific requirements and criteria in naming rooms, buildings, and other facilities.
5. Other signage on the project site will not be permitted - unless such signage is first approved by the University project manager. No promotional signage for consultants, contractors, subcontractors, or similar entities will be allowed on the construction fence, or as free-standing signs.

DOOR AND ROOM NUMBERING GUIDELINES

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1. APPLICATION
2. NUMBERING SCHEME

1. APPLICATION:

a. **Requirement:** Room and door numbering on floor plans of all UNL projects shall conform to the criteria given in this guideline. The numbering scheme will be established by the UNL **Signage Coordinator** after the floor plan layout has been finalized, immediately prior to the start of the Construction Documents phase, and shall be developed in coordination with and approved by the UNL Building System Maintenance Division (UNL BSM) of UNL Facilities Management. If plan changes occur after the numbering scheme has been established, the numbering scheme will be adjusted accordingly. All rooms and doors should be numbered in accordance with the requirements in this guideline. Room and door numbers should not be changed without the approval of the UNL project manager/**signage coordinator**, who will coordinate such changes within the Facilities Management Department and the UNL Records and Registration office.

2. NUMBERING SCHEME:

a. Room Numbering

1. Room numbers will be similar to city street numbers with even numbers on one side of the corridor and odd numbers on the opposite side.
2. Numbers may not be consecutive but shall be based on room/door location along the corridor and coordinated with the building structure.
3. **Room numbers shall follow the general format:**

XXXAB



- Indicates the floor
- Two digit room number 00-99. Even/odd numbers shall be on opposite sides of the corridor.
- A-Z Sub-room designation.
- AA-AZ Sub-room designation.

b. Door Numbering:

1. Door numbering begins with the main entrance off a corridor, and continues in a counter-clockwise motion for each additional entrance (door) accessing that space.

2. Door numbers are represented as follows:

XXX.1, XXX.2, XXX.3, etc. (XXX represents the ROOM number)

**UNL PROJECT RECORD DRAWINGS,
OPERATIONS AND MAINTENANCE MANUALS &
CAD DRAFTING STANDARDS**

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1. APPLICATION
 2. DRAFTING STANDARDS
1. APPLICATION:
- a. Requirements:
 - (1) As-Built Documentation: Upon project completion, the design firm shall provide UNL with complete project as-built record documentation including but not limited to construction drawings, construction specifications, addenda, change order attachments, change directives, supplemental information, clarification drawings or written text or similar documents. As-built drawings shall be submitted as both Mylar drawings and CAD files on diskettes in conformance with the requirements of this guideline. Written documents such as construction specifications, addenda, change directives, clarifications, supplemental information, and similar text documents shall be submitted to UNL on diskettes in MicroSoft Word or Excel formats or other compatible formats as approved by the Owner. Add specification requirements for Contractor(s) to record documents to include dimensioned drawings of all underground utilities and services provided. Dimensions of underground utilities and services shall be from fixed structural elements or landmarks and shall be accurate to within +/- 6" in all directions, including depth below grade.
 - (2) Operations and Maintenance (O&M) Manuals: Require that three (3) sets of operations and maintenance manuals be submitted by the Contractor(s), including special warranties, as appropriate. The design consultant shall review the submitted O&M manuals for completeness and conformity with specified requirements. The O&M manuals shall be forwarded to the Owner when they are found to be satisfactory condition by the design firm.
 - b. Required Submittal Timing: Include specification requirements for Contractor(s) to submit accurate field sets of as-built record documents, operations and maintenance manuals, and other like documents to the design firm prior to the Contractor's final payment application or thirty (30) days from the project substantial completion date, whichever is sooner. Unless otherwise stipulated by the Owner, the design consultants shall submit complete as-built record documents to the Owner not less than thirty (30) days from the date the Contractor's field records and other record documents are received by the design consultant. The design

consultant's shall review and forward operations and maintenance manuals to the Owner not less than thirty (30) days from the date the O&M manuals are received from the Contractor(s).

c. Record Drawings, Minimum Requirements: Design consultants shall revise construction plans and drawings for as-built record documentation, in accordance with the design services agreement. Record drawings are to include revisions contained in bid addenda, change orders, change directives, and minor field revision drawings documented by the contractor. Identify all Bidding Alternates that were accepted. Small format clarification drawings, change order or change directive drawings, not issued on the construction drawing standard sheet size, shall be added to the sheet(s) of the same size as the original construction documents in an organized and sequential manner. Update cover sheet(s) to add or delete sheets as required. Identify the primary construction firm name, address, and primary contract on the cover sheet. Clearly label each sheet with the note "AS-BUILT RECORD DOCUMENT" in a prominent location. Include "AS-BUILT REVISION DATE: DAY/MONTH/YEAR" on each sheet. To each record drawing sheet, affix, sign, and date the professional registration seal of each responsible design professional. Design professionals may add disclaimers on the record documents regarding accuracy of information provided by Contractor(s). Architectural, Mechanical, and Electrical schedules shall be updated to identify manufacturers, makes, and model numbers of the actual items or equipment provided in the construction. Add dimensions to located underground utilities and services, based on information provided by the Contractor(s).

d. Record Specification and Text Documents, Minimum Requirements: Design consultants shall provide a binder with project bid documents, specifications, and all addenda, directives, clarifications and RFI's issued by the design consultants, all of which shall be labeled "AS-BUILT RECORD DOCUMENTS". Addenda, directives, clarifications, and RFI's, if not bound with the specifications, shall be bound together as one binder and labeled as such.

2. DRAFTING STANDARDS:

a. General:

(1) Drawing files must be provided in the current AutoCAD *.DWG format.

(2) Each file should contain only one drawing. The name of the file should readily identify the drawing which it represents.

(3) Each diskette should be labeled with the UNL project number and project name, the AutoCAD file names on the diskette, and the project manager's name.

b. Plotting Format: AutoCad "paperspace" is the preferred format for plotting drawings. If "paperspace" is not used, directions for plotting must be included in the drawing on the "Defpoints" layer.

c. Layering: All layering should conform to the AIA CAD Layer Guidelines.

d. Fonts: Any font that is standard to the current AutoCAD, or any previous version of AutoCAD, is acceptable. The "Roman Simplex" (ROMANS) font is preferred for drawing notes, schedules, and dimensions; the "Roman Triplex" (ROMANT) font is preferred for titles. No third-party fonts should be contained in the drawings.

e. Custom Objects: Owing to the wide use of drawings within UNL Facilities Management and Planning, custom objects, which require enabling software beyond the basic AutoCAD

installation for viewing and editing, shall not be inserted in drawings and neither shall proxy objects, as substitutes for custom objects.

f. Menus: No custom menus should be used on the drawings.

g. Drawing Criteria:

(1) On civil drawings, outlines of any objects, such as blocks, sidewalks, streets, and walls, should be drawn as a continuous polyline.

(2) Utility lines on site plan drawings should be drawn as a continuous polyline.

(3) Architectural Drawings:

(a) Representation of Walls and Columns:

- Exterior outlines of buildings should be drawn as a polyline. If the plan is drawn as a footprint, it should be drawn as a single polyline.
- Interior walls which consist of more than a single line should be drawn as a single polyline. Any set of lines that are drawn to represent an object shall be cleaned and trimmed and shall share common vertices so that they may be joined at any time.
- Columns should be drawn at their final finish size as a continuous polyline.
- Duplicate lines and extra lines should be removed.

(b) Representation of Doors and Windows:

- Doors should be simply represented with a rectangle and arc.
- Doors and door numbers should be shown on separate layers.
- Windows should be shown on a separate layer and represented with one or two lines and no jamb detail unless such a detail is required for construction purposes.

h. Purging of Extraneous Elements: All drawing files should be purged of extraneous elements before they are submitted to UNL.

DRAWING CONTENT AND SUBMITTAL REQUIREMENTS

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1. DRAWING CONTENT CHECKLIST
 2. SPECIFIC REQUIREMENTS FOR CONSTRUCTION DOCUMENTS
 3. PROJECT DATA TABULATION
1. DRAWING CONTENT CHECKLIST:
 - a. Requirement: Project design documents submitted by A/E consultants or design/build contractors shall include, as a minimum, the information required by the Drawing Content Checklist included as Attachment 1 to this Guideline, as appropriate for the design phase of the drawing submittal.
 2. SPECIFIC CONTENT REQUIREMENTS FOR CONSTRUCTION DOCUMENTS
 - a. General: The final construction documents should include the following information to facilitate the use of the drawings by the UNL Custodial Services Division to determine requirements for custodial services and to verify the selection and location of toilet accessories and compliance with ADA requirements.
 - (1) Room Finish Schedule: The room finish schedule shall contain a column indicating the area of each room in the building.
 - (2) Large Scale Drawings for Toilet Rooms: Toilet rooms shall be shown with plans and elevations at a scale of not less than $\frac{1}{4}'' = 1'-0''$. Both plan and elevation drawings shall be fully dimensioned to show the plan location and height of toilet fixtures, toilet accessories, and toilet partitions.
 3. PROJECT DATA TABULATION:
 - a. Requirement: Beginning with the Design Development Submittal, all drawing submittals shall include on the drawing set cover sheet a tabulation of project data containing, as a minimum, the information indicated on the form included as Attachment 2 to this guideline.

DRAWING CONTENT CHECKLIST			
Project Name:		UNL Project No.	Date:
UNL Project Mgr:		Project Design Phase: 1-SD <input type="checkbox"/> 2-DD <input type="checkbox"/> 3-CD <input type="checkbox"/> 4-Constr <input type="checkbox"/>	
SITE PLAN:		BUILDING SECTIONS AND WALL SECTIONS	
1. Proposed new structures 1,2,3		1. Show materials of construction 2,3	
2. Existing buildings or structures 1,2,3		2. Fire-rated assemblies and penetrations 2,3	
3. Property lines, with dimensions 1,2,3		3. Dimensions of all heights 1,2,3	
4. Streets, easements and setbacks 1,2,3			
5. Water, sewer, and electrical		HVAC SYSTEMS	
a. Points of connection 2,3		1. Show entire HVAC systems	
b. Proposed service routes 2,3		a. All units, with their capacities 2,3	
c. Existing utilities 2,3		b. Mounting details 3	
6. Required parking 1,2,3		c. Ductwork layout and sizing 2,3	
7. Drainage and grading		d. Location of fire dampers, where required 2,3	
a. Drainage inflow/outflow locations 2,3		e. Equipment schedules 3	
b. Areas to be maintained for drainage 2,3		2. Energy conservation calculations, where required	
8. Topographic survey, when appropriate 2,3			
9. North arrow 1,2,3			
10. Show all sidewalks and drives 1,2,3			
11. Show sidewalk control joint and expansion joints 2,3			
FOUNDATION PLAN		ELECTRICAL SYSTEMS	
1. All foundations and footings 2,3		1. Electrical fixtures; interior, exterior, site 2,3	
2. Size, locations, thicknesses, materials, strengths, and reinforcing 3		2. Wiring sizes, circuiting, grounding 3	
3. Imbedded anchoring 3		3. Panel schedules, single line diagrams 3	
4. Geotechnical (soils) report 2,3		4. Load calculations, fixture schedules 3	
		5. Show point of connection with utility line 2,3	
BUILDING PLANS		PLUMBING SYSTEMS	
1. Plans for all floors, including basement 1,2,3		1. Show all fixtures and piping 2,3	
2. All rooms, with use and overall dimensions 1,2,3		a. Slopes, materials and sizes 3	
3. Locations of structural elements and openings 2,3		b. Points of connection with utilities 2,3	
4. Doors & windows; door & window schedules 2,3		2. Septic tanks, pre-treatment systems 2,3	
5. Fire assemblies, separations and draft stops 2,3			
6. Room finish schedule 2,3		STRUCTURAL CALCULATIONS	
7. Reflected ceiling plan(s) 2,3		Where required, including seismic calculations 3	
8. Roof plan(s) 2,3		SPECIFICATIONS FOR CONSTRUCTION SYSTEMS	
FLOOR AND ROOF FRAMING PLANS		Identified in drawing notes or in separate manual. 3	
1. All floor and roof framing members		ADDENDA AND CHANGES	
a. Sizes 3		Bidding addenda and change orders 4	
b. Methods of attachment 3		REVISIONS	
c. Location and materials 2,3		Drawing revisions marked and identified 4	
EXTERIOR ELEVATIONS		REMARKS:	
1. All elevations shown 1,2,3			
2. Vertical dimensions and heights 1,2,3			
3. Identify all openings and materials 2,3			
4. Show lateral bracing, where applicable 2,3			

Attachment No. 1 to UNL Facilities Planning & Construction Design Guideline 010000.22

NOTE: This table is under review following new Board of Regents requirements for Schematic Design approval.

PROJECT DATA TABULATION

Project Title: _____ UNL Project No. _____



VICINITY MAP

PROJECT DESIGNERS

Discipline	Firm	Individual in Responsible Charge	NE Regis. #
Architecture			
Mechanical Systems			
Electrical Systems			
Structural Systems			
Sound Systems			
Fire Protection Systems			

DESIGN CRITERIA

Occupancy Group	UBC:	NPFA:	
Location on Property:	Seismic Zone:		
Building Height:	No. of Stories:		
UBC Construction Type:			
Square Footage	Actual	Allowable	Occupant Load
Basement			Basement
1st Floor			1st Floor
2nd Floor			2nd Floor
3rd Floor			3rd Floor
Nth Floor			Nth Floor
Totals			
FIRE SPRINKLERS	Hazard:	Coverage:	
LAND USE/ZONING			

Attachment No. 2 to UNL Facilities Planning & Construction Design Guideline 010000.22

University of Nebraska – Sustainability Design Policy

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1. INTRODUCTION AND GOALS
2. CATEGORIES AND POINTS

1. INTRODUCTION AND GOALS:

In the interest of being good stewards of the environment, the University of Nebraska is implementing sustainable building goals and requirements into their design guidelines.

The goals and requirements being implemented are based on the Leadership in Energy and Environmental Design program for New Construction (LEED-NC 2009) which is sponsored by the United States Green Building Council (USGBC). This program encompasses a holistic approach to sustainable design. The intents of the program are to provide a quantifiable rating system universal to the building industry and to transform the marketplace to become more sustainable. The rating system is point based with four different levels of certification possible. There are a total of 110 points possible in the rating system. The different certification levels are as follows:

- Certified 40-49 points
- Silver 50-59 points
- Gold 60-79 points
- Platinum 80-110 points

Points towards achieving certification are obtained by meeting the requirements for various “credits.” Credits will identify specific goals and requirements that pertain to all aspects of the design and construction of a project, ranging from recycled materials to energy efficiency to construction waste management. Strategies that meet these goals and requirements (as defined by each “credit”) will benefit the university, occupant, community, and global environment in the following ways:

- Optimizing Energy Performance
 - Projects that meet these goals and requirements will decrease building energy usage and provide tangible results for the university and our community through lower utility costs

and reduced resource usage while meeting the environmental requirements of functions to be housed in the building.

- **Indoor Environmental Quality and Health**
 - Projects that achieve a high indoor environmental quality will provide benefits to the university and moreover to occupants. It is widely accepted that indoor environmental quality increases occupant productivity and mental health while reducing absenteeism. Occupant health is a high priority for learning institutions.

- **Local/Regional Community**
 - Projects that meet these goals and requirements will benefit the University of Nebraska campus environments, and will directly affect the local and regional community of which the university is a member. These projects will reduce the load on our local municipality infrastructure. They will stimulate the local economy through increased demand for local resources and materials and new sustainable market development. These projects will also reduce the negative impact on our local environment as compared to a standard building.

- **Global Environment**
 - Projects that meet these goals and requirements will use considerably less of our world's natural resources, create substantially less waste through construction and operation, and conserve our energy sources.

To obtain certification, the project must be registered with the USGBC and the proper documentation submitted per LEED requirements. The University of Nebraska may or may not pursue certifications per the LEED program depending upon the project. However, all new construction and major renovation projects will achieve a minimum of 26 points. Individual projects may require meeting a higher number of LEED credits.

2. CATEGORIES AND POINTS

The University of Nebraska's four categories, based on LEED credits, are as follows:

- Certified Level (40 points)
- Desirable (41-59 points)
- Optional (60-79 points)
- Advanced for High Level of Certification (80-110 points)

Certified Level (40 points)

This category pertains to credits (goals and requirements) that have been determined attainable based on good practices. These credits shall be considered mandatory on all projects unless the University of Nebraska requests otherwise. The costs to implement strategies that meet all of these credits are anticipated to add minimally to the total construction budget and will vary per project. These additional costs will apply to associated construction cost for sustainable design features, consultant fees for additional documentation and research, and Commissioning. All minimal credits may provide a return on investment ranging from energy cost savings to increased productivity. It is possible to reduce the additional cost by beginning the implementation of strategies that meet these credits during the early stages of the project.

Desirable Level (41-59 points)

This category pertains to credits (goals and requirements) that have been determined attainable with small additional effort beyond normal design and construction practices. These credits shall be achieved in the project at the request of the University of Nebraska or at the desire of the design team. In addition to the minimal credits, the costs to implement strategies that meet all of these credits are anticipated to add to the total construction budget and will vary per project. These additional costs would apply to associated construction cost for sustainable design features, consultant fees for additional documentation and research, and Commissioning. All minimal and desirable credits may provide a return on investment ranging from energy cost savings to increased productivity. It is possible to reduce the additional cost by beginning the implementation of strategies that meet these credits during the early stages of the project.

Optional Level (60-79 points)

This category pertains to credits (goals and requirements) that have been determined attainable but optional upon project specific aspects. The costs to implement strategies that meet these credits are also optional upon project specific aspects. Strategies that meet these credits shall be considered on all projects and implemented at the request of the University of Nebraska or at the desire of the design team.

Advanced Level (80-110 points)

This category pertains to credits (goals and requirements) that have been determined attainable for projects striving for a high level of LEED certification or exceptional sustainable design. Strategies that meet these credits shall be pursued only at the request of the University of Nebraska. In addition to the minimal, desirable, and optional credits, the costs to implement strategies that meet all of these credits are anticipated to add to the total construction budget and will vary per project. These additional costs would apply to associated construction cost for sustainable design features, consultant fees for additional documentation and research, and Commissioning. All recommended credits may provide a return on investment ranging from energy cost savings to increased productivity. It is possible to reduce the additional cost by beginning the implementation of strategies that meet these credits during the early stages of the project.

Implementation Process

At the end of the Design Guidelines is a standard LEED-NC 2009 project checklist as provided by the USGBC. This checklist is preferred as it is available online and remains updated as the LEED-NC program is revised. Each credit has been separated into three categories; Yes, Maybe, or No. The “Yes” category is equivalent to the aforementioned “Recommended” category. The “Maybe” category is equivalent to the aforementioned “Optional” category. The “No” category encompasses the aforementioned “Conditional” and “Advanced” categories. Refer to the LEED-NC reference guide for credit requirements and strategies. All credits categorized as “Yes” shall be implemented in design and construction unless the University of Nebraska-Lincoln deems otherwise. All credits categorized as “Maybe” shall be implemented in design and construction upon suggestion of the University of Nebraska-Lincoln or at the desire and ability of the design team. All credits categorized as “No” shall be implemented in design and construction only at the request of the University of Nebraska-Lincoln.

(See LEED-NC 2009 Registered Project Checklist UNL Design Guideline Appendix)

CONCRETE

PART 1 - GENERAL

1. GENERAL

PART 3 - EXECUTION

2. FORMWORK TOLERANCES
3. TOLERANCES FOR FORMED SURFACES CAST-IN-PLACE
4. PLACING REINFORCEMENT
5. CONCRETE PROTECTION FOR REINFORCEMENT

PART 1 - GENERAL

1. GENERAL: The construction specifications should prescribe the following tolerances for cast-in-place concrete work and include the requirement that work which does not comply with these tolerances must be removed and replaced at no additional cost to the Owner. The tolerances given herein are generally those prescribed by the American Concrete Institute (ACI). In cases where these tolerances are more restrictive than those listed in ACI publications, the tolerances listed herein may be waived in favor of the ACI tolerances, with the written approval of the UNL project representative.

PART 3 - EXECUTION

2. FORMWORK TOLERANCES: Require that concrete formwork be constructed such that the finished concrete construction conforms to the tolerances given below:
 - a. Variations from the Plumb:
 - (1) In lines and surfaces of columns, piers, walls and in arrises: 1/4" in any 10 ft. length; 1" maximum for entire length.
 - (2) Exposed corner columns, control joint grooves and other conspicuous lines: 1/4" in any 20 ft. length; 1/2" maximum for entire length.

- b. Variations From Level or From the Grades Indicated on the Drawings:
- (1) In slab soffits¹, ceilings, beam soffits, and in arrises: 1/4" in any 10 ft. length; 3/8" in any 20 ft. of length; 3/4" maximum for entire length.
 - (2) In exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines: 1/4" in any bay or in any 20 ft. of length; 1/2" maximum for entire length.
- c. Variations in Distance Between Walls, Columns, Partitions and Beams: 1/4" per 10 ft. of distance but not more than 1/2" in any one bay, and not more than 1" total variation.
- d. Variation in Linear Building Lines from Established Position in Plan: 1 inch.
- e. Variation in the Sizes and Locations of Sleeves, Floor Openings, and Wall Openings: minus 1/4 inch.
- f. Variations in Cross-Sectional Dimensions of Columns and Beams and in the Thickness of Slabs and Walls: Minus 1/4"; plus 1/2".
- g. Footings:
- (1) Variations in Dimensions in Plan: Minus 1/2" or plus 2" when formed, or plus 3" when placed against unformed excavation.
 - (2) Misplacement or Eccentricity: 2% of the footing width in the direction of misplacement but not more than 2"².

3. TOLERANCES FOR FORMED SURFACES CAST-IN-PLACE: This section provides a way of quantitatively indicating tolerances for surface variations due to forming quality, but is not intended to apply to surface defects attributable to placing and consolidation deficiencies. Allowable irregularities for the purpose of defining tolerances are designated either abrupt or gradual. Offsets and fins resulting from misplaced, mismatched, or misaligned forms, sheathing or liners, or from defects in forming materials are considered abrupt irregularities. Irregularities resulting from warping unplaneness, and similar uniform variations from planeness or true curvature are considered gradual irregularities.

¹ Variations in slab soffits are to be measured before removal of supporting shores; the Contractor is not held responsible for variations due to structural deflection, except where the latter are corroboratory evidence of inferior concrete quality or curing, in which case only the net *variation* due to structural deflection can be considered.

² Applied to concrete only, not to reinforcing bars or dowels.

**Table 3-01 - Permitted Irregularities in
Formed Surfaces Checked With 5 Ft. Template**

Type of Irregularity	Class of Surface (See Surface Definitions Below)			
	A	B	C	D
Gradual	1/8"	1/4"	1/2"	1"
Abrupt	1/8"	1/4"	1/4"	1"

Gradual irregularities should be checked with a 5 ft. template, consisting of a straightedge for plane surfaces or a shaped template for curved or warped surfaces. In measuring irregularities, the straightedge or template may be placed anywhere on the surface in any direction.

Surface Definitions for Table 3-01:

Class A is required for surfaces prominently exposed to public view, where appearance is of special importance.

Class B is required for coarse-textured concrete formed surfaces intended to receive plaster, stucco, or wainscoting.

Class C is a general standard for permanently exposed surfaces where roughness is not objectionable.

Class D is a minimum quality requirement for surfaces where roughness is not objectionable, usually applied where surfaces will be permanently concealed.

- a. Require that forms be fabricated for easy removal without hammering or prying against concrete surfaces. Require crush plates or wrecking plates where stripping may damage cast concrete surfaces. Require top forms for inclined surfaces where slope is too steep to place concrete with bottom and side forms only. Require that wood inserts for forming keyways, reglets, recesses and the like be kerfed, to prevent swelling and for easy removal.
- b. Require temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete is placed, and for placement of concrete. Require that temporary openings be securely braced and set tightly to forms to prevent loss of concrete mortar. Temporary openings on forms should be located at inconspicuous locations.
- c. Indicate in contract documents where exposed corners and edges of concrete are to be chamfered. Require the use of wood, metal, PVC or rubber chamfer strips to produce uniform, smooth lines and tight edge joints.
- d. Form Ties: Require the use of factory-fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 - (1) Generally, require that portion of snap-off metal ties remaining in concrete be a least 1-1/2" inside concrete. Define where any exceptions to this requirement would be acceptable, if any.
 - (2) Generally, require the use of form tie systems which will not leave holes larger than 1" diameter in concrete surfaces.
- e. Provisions for Other Trades: Require that openings be provided in formwork to accommodate the work of other trades, and that the size and location of such openings be determined from the trades requiring these openings. Items built into forms should be accurately placed and securely supported.

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- f. Cleaning and Tightening: Forms and adjacent surfaces to receive concrete should be thoroughly cleaned. Chips, wood, sawdust, dirt or other debris should be removed just before concrete is placed. Require that forms and bracing be retightened after concrete placement to eliminate leaks and maintain proper alignment of forms.
4. PLACING REINFORCEMENT: Shall be in accordance with the current American concrete Institute (ACI) (standards).
5. CONCRETE PROTECTION FOR REINFORCEMENT: Shall be in accordance with the current American Concrete Institute (ACI).
- a. Require placement of reinforcement to obtain at least minimum coverages for concrete protection. Require that bars and bar supports be arranged, spaced and secured to hold reinforcement in position during concrete placement operations. Wire tie ends should be directed into concrete, not toward exposed concrete surfaces.
- b. Welded wire fabric should be installed in lengths as long as practicable. Adjoining pieces should be lapped at least one full mesh and splices laced with wire. End laps in adjoining pieces should be offset to prevent continuous laps in either direction.
- c. Do not allow metal reinforcement to be straightened or rebent in a manner which will injure the material. Do not permit bars with kinks or bends not shown on plans to be used.
- d. Provide details for splices and laps on drawings and require reinforcing to be fabricated and installed in accordance with such details. Where necessary splices are not shown on the drawings, members should be lapped sufficiently to develop the strength of the bar by bond and securely wired. Locations of such laps should be approved by the Architect/Engineer. Splices should overlap at least 30 bar diameters in concrete and 40 diameters in masonry.
- e. Require the clear distance between reinforcing bars to be not less than 1-1/3 times the maximum size of coarse aggregate or 1" absolute minimum.
- f. Horizontal reinforcing in concrete and masonry should be continuous around corners, or corner bars should be provided. Where bars of different sizes intersect at corners, corner bars of the larger size should be provided.
- g. For slabs on grade, reinforcement shall be supported by chairs or may be omitted if fiber reinforcement is used.

MASONRY

PART 1 – GENERAL

1. MASONRY DESIGN

PART 3 - EXECUTION

2. CONSTRUCTION TOLERANCES

3. MASONRY INSTALLATION

PART 1 – GENERAL

1. MASONRY DESIGN: Masonry design and construction shall conform with all applicable code requirements, including the applicable standards adopted by the building codes. (Ref. ACI 530 Standards and Brick Institute of America technical notes.)

a. In addition, comply with the following applicable section of the “Minimum Requirements and Guidelines for the Exterior Building Envelope”, State of Wisconsin Department for Administrative Services, Facilities Department, March 1994 edition, as noted below:

Part XV – Guide Specification for Mortar. (*Colored mortar is not normally desired but will be permitted with the written consent of the UNL Manager of A&E Services.*)

b. Flashings Design: Flashing shall be designed and installed to assure that the flashing life is compatible with the masonry life. Flashings shall be designed and installed in accordance with the manufacturers’ recommendations and the applicable sections of *Sheet Metal and Air Conditioner Contractors National Association (SMACNA) Architectural Sheet Metal Manual*, *Brick Institute of America (BIA) Technical Notes*, *Portland Cement Association (PCA) Concrete Masonry Manual*, and *Indiana Limestone Handbook*.

c. Flashing Materials: Rigid metal flashings with ¾” exposed drip are preferred. Stainless steel is the preferred metal. Copper, galvanized steel, and pre-finished steel are acceptable if budget restraints preclude the use of stainless steel. Because of the potential staining associated with the use of copper, its use must be approved by the UNL Manager of A&E Services. All metal flashings shall be designed to preclude electrolytic deterioration resulting from the contact of dissimilar metals. Laminated copper equal to AFCCO* Copper Fabric (5 oz. per sq. ft. minimum) or H & B* C-Fab Flashing (5 oz. per sq. ft. minimum) may be used for concealed through-wall flashings that are not exposed. Concealed through-wall flashings, if used, must be specified to extend beyond the masonry face and shall not be cut flush with the masonry face until inspected and approved by UNL. EPDM flashing may be used under metal parapet caps, providing it has continuous structural support. PVC flashings are prohibited.

- d. Cleaning Masonry: Acid and other harsh chemical cleaners are prohibited.
- e. Cavity Wall Design: Cavity walls shall have CMU back-up walls, with 2" minimum clear cavity spaces. Specifications shall require the contractors to provide clean cavity spaces, back striking of mortar seepage and mortar net drainage system. An engineered galvanized metal stud wall with water resistant sheathing and building wrap system may be used instead of the CMU backup if specifically approved by the UNL Manager of A&E Services.

PART 3 - EXECUTION

2. **CONSTRUCTION TOLERANCES:** The construction specifications should contain the following tolerances for masonry work and include the provision that portions of the work which do not conform to these tolerances must be removed or repaired. The tolerances listed herein are generally those recommended by the Brick Institute of America (BIA).

a. Variations from the Plumb:

In lines or surfaces of columns, walls, and arrises: 1/4" in 10 feet; 3/8" in any story or 20 feet maximum; 1/2" in 40 feet or more.

For external corners, control joints and other conspicuous lines: 1/4" in any story or 20 feet maximum; 1/2" in 40 feet or more.

b. Variations from the Level or Grades Indicated on the Drawings:

For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines: 1/4" in any bay or 20 feet maximum; 1/2" in 40 feet or more.

c. Variation of the Linear Building Lines from Established Position in Plan or Related Portion of Columns, Walls and Partitions:

1/2" in any bay or 20 feet maximum; 3/4" in 40 feet or more.

d. Variation in Cross-Sectional Dimensions of Columns and in The Thickness of Walls:

Minus 1/4"; plus 1/2"

3. **MASONRY INSTALLATION:** The following requirements should be included in the construction specifications:

a. Stopping and Resuming Work: Rack back one-half masonry unit in each course; do not tooth. Clean exposed surfaces of set masonry, wet units slightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

b. Built-In Work: As the work progresses, build-in items specified under this and other sections of the specifications. Fill in solidly with masonry around built-in items.

(1) Fill space between hollow metal frames and masonry solidly with mortar or grout.

-
- (2) Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- (3) Fill CMU cores with grout no less than three courses (24") under bearing plates, beams, lintels, posts and similar members unless otherwise indicated.
- c. Non-Loadbearing Interior Partition Walls: Build full height of story to underside of solid structure above, unless otherwise indicated.
- d. Mortar Bedding and Jointing: Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting courses and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

MASONRY CAVITY DRAINAGE, WEEPHOLES AND VENTS

1. BRICK VENEER/SHELF ANGLE DETAIL

a. The installation of brick veneer facing over metal-stud backup, supported on shelf angles, should be detailed in accordance with UNL Standard Detail SD4-01. Important features of this detail include:

- (1) A stainless steel pan sitting between the first brick and the shelf angle in a dry joint.
- (2) Use screen weep vents to prevent insect penetration at the bottoms of walls and relief angles. Use rope weeps at lintels and other intermediate locations in the wall.

b. Lipped stretcher bricks resting on the shelf angle should not be permitted. The use of flexible thru-wall flashing material has also been found to be unsatisfactory and should not be permitted.

MEMBRANE ROOFING

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. APPROVED ROOFING SYSTEMS
3. ROOF INSULATION

PART 3 - EXECUTION

4. ROOFING SYSTEM DETAILS

PART 1 - GENERAL

1. GENERAL:

- a. Application: Roofing systems for nominally flat roof areas of new facilities shall conform to the requirements of this Guideline.
- b. Warranty Requirement: Require completed roofing installation to be warranted by roofing installer and primary roofing products manufacturer against defects in materials and application for the time period mentioned below.
- c. Pre-Award Approval of Roofing Installer and Guarantee: Observe requirements contained in UNL Standard Instructions to Bidders regarding submittal of written confirmation by roofing/membrane manufacturer that roofing installer identified by bidding contractor is an "approved applicator" for the roofing system specified and that the manufacturer will guarantee the roof as required by the Bid Documents for the period specified.

PART 2 - PRODUCTS

2. APPROVED ROOFING SYSTEMS:

- a. General: The selection of the roofing system to be utilized on any project is the responsibility of the project designer. The selected system shall respond to the unique requirements of the project. The project specifications shall require all components of the roofing system to be fully compatible with one another and fully approved by the manufacturer of the primary roofing system components.
- b. Approved Systems: The following systems are acceptable for use on UNL projects:
 - (1) EPDM Membrane Systems: Fully-adhered 45- or 60-mil thickness, unreinforced or reinforced. Selected system shall qualify for manufacturer's 15-year warranty and carry Factory Mutual (FM) approval.

(2) **Modified Bitumen Systems:** Multiple-ply systems employing reinforced modified bitumen base and/or ply sheets with mineral-surfaced modified bitumen membrane cap sheet, applied by mopping down with hot asphalt. Selected system shall qualify for manufacturer's 15- or 20-year warranty and carry Factory Mutual (FM) approval.

(3) **Built-Up Roofing System:** Not less than four-ply built-up aggregate-surfaced roofing system employing glass-fiber reinforced roofing felts mopped down with hot asphalt; flashing shall utilize modified bitumen products. Selected system shall qualify for manufacturer's 15- or 20-year warranty and carry Factory Mutual (FM) approval.

3. **ROOF INSULATION:**

a. **"U"-Factor:** Roof insulation shall provide an average "U"-factor of not more than 0.08 for the roof assembly.

b. **Installation:** All roof insulation shall be installed in two layers with the joints offset.

PART 3 - EXECUTION

4. **ROOFING SYSTEM DETAILS:**

a. **Slope:** All roofing systems for new construction shall be designed to slope not less than 1/4" per foot to insure rapid drainage of the roof membrane. Saddles and/or crickets shall be installed in valleys to prevent ponding. The arrangement of the roof slope and the location of drains shall recognize the effects of live and dead loads in causing deflections in the roof structure.

b. **Pitch Pockets:** Do not permit the use of pitch pockets. All equipment, pipes, walkways, and other rooftop appliances such as masts, antennas or satellite dishes, shall be mounted on flashed curbs or pipe pedestals.

c. **Layout:** Keep shape of roof areas as simple as possible. Use curbed roof relief and/or expansion joints to divide roof into rectangular shapes.

d. **Flashing/Counterflashing:** Require the use of two-piece counterflashing assemblies which allow the removal of the counterflashing flanges to facilitate removal and replacement of the base flashing.

e. **Overflow Drains and Scuppers:** On each roof areas containing roof drains, overflow drains or overflow scuppers shall be provided. Overflow drains shall have the same capacity as the roof drains and be located with the inlet flow line 2 inches above the low point of the roof area. Overflow scuppers, if used, shall have an area three times that of the roof drains serving the roof area and have an opening height of not less than 4 inches. The overflow scuppers shall be located with the inlet flow line 2 inches above the low point of the roof. Overflow drains and scuppers shall not be connected to the storm drain lines but discharge to an appropriate location on the exterior of the building.

METAL DOORS AND FRAMES

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. HOLLOW METAL FRAMES
3. HOLLOW METAL DOORS

PART 1 - GENERAL

1. GENERAL:
 - a. Application: Hollow metal work should be scheduled and specified in accordance with the requirements of this Guideline.
 - b. Design Coordination: Coordinate all door, frame, hardware and keying requirements with UNL Building Systems Maintenance prior to completion of bid documents to reduce possible hardware conflicts at later dates.
 - c. Shop Painting: Require all hollow metal items, including those fabricated of galvanized steel, to be pre-treated and shop primed.
 - d. All exterior doors must be prepared for card access and monitoring.

PART 2 - PRODUCTS

2. HOLLOW METAL FRAMES:
 - a. Usage: Generally, require the use of hollow metal frames for interior doors, sidelights, and borrowed lights throughout all building projects. Limited exceptions to this requirement may be granted by the UNL Project Representative where the use of alternative systems, such as aluminum framing systems, is deemed appropriate, or, in the case of renovation projects, where it is desirable to match existing construction.
 - b. Frame Requirements:
 - (1) Construction:
 - (a) Full-welded unit construction with corners mitered, reinforced, and welded full depth and width of frame.

(b) Full-welded or K.D. unit construction with corners mitered and reinforced frame at all interior locations. Welded full depth and width of frame where welded frames are used.

(2) Material:

(a) Require frames for exterior locations to be fabricated of 14 gauge galvanized steel sheets.

(b) Require frames for interior locations to be fabricated of 16 gauge hot- or cold-rolled steel sheets.

(c) Require frames for interior locations in animal facilities, shops and similar locations which may be subject to wash-down, to be fabricated of 16 gauge galvanized steel sheets.

(d) Require internal hardware reinforcement for all door hardware.

(e) Require mortar boxes to be installed by factory authorized representative.

(3) Frame Profile: All hollow metal door or vision panel frames should be required to have a 2" wide face dimension. The use of frames narrower than 2" has been shown to result in installation and maintenance problems over the long term.

(4) Frame Installation: Hollow metal frames should be detailed and specified to be attached to metal stud framing with not less than 3 anchor clips at each jamb and to masonry construction with not less than 3 anchors per jamb, or in accordance with manufacturer's installation instructions. Jamb members of metal stud-frame/drywall partitions at exterior doors are to be grouted with Portland cement/sand grout. Mullions dividing frame openings should not be grouted. Jamb members of metal stud-frame/drywall partitions at interior doors should be insulated with tight fitting fiberglass batt insulation.

3. HOLLOW METAL DOORS:

a. Usage: Use hollow metal doors complying with these requirements only where the use of solid core wood doors is not desirable because of exposure to moisture conditions or abuse. Appropriate locations for hollow metal doors may include garages, shops, certain types of athletic facilities, animal quarters and warehouses.

b. Door Construction:

(1) Exterior Locations: Require doors for exterior locations to be fabricated with galvanized steel sheets, not less than 16 gauge.

(2) Interior Locations: Require doors for interior locations to be fabricated with 18 gauge cold-rolled steel sheets.

(3) Interior Locations Subject to Abuse or Wash Down: Where service conditions warrant, require 16 gauge face sheets and/or the use of galvanized steel face sheets on hollow metal doors in these categories.

FLUSH WOOD DOORS

PART 1 - GENERAL

1. GENERAL REQUIREMENTS

PART 2 - PRODUCTS

2. EXTERIOR DOORS
3. INTERIOR DOORS

PART 1 - GENERAL

1. GENERAL REQUIREMENTS:

a. Application: Flush slab wood doors used in building projects should be limited to solid core doors conforming to the requirements given in this Guideline. Hollow core wood doors are deemed to be inappropriate for use in the demanding environment of institutional usage and should not be used.

PART 2 - PRODUCTS

2. EXTERIOR WOOD DOORS:

a. General: Except for locations requiring monumental or especially ornamented door leaves or locations with aluminum and glass entrance doors, exterior doors should be flush slab solid core wood doors conforming to the requirements of this guideline. Exterior door installations should be located in a recess or protected by a permanent overhead canopy of sufficient width and depth to minimize the exposure of the door to precipitation.

b. Door Specifications: Exterior wood flush slab solid core doors should be Eggers Industries*, Algoma Hardwoods*, or Marshfield Door Systems SCLC* (structural composite lumber core) conforming to the requirements given in Table 1.

c. Exterior Door Finish Systems:

(1) Painted Finish: Generally, the exterior face and all edges of an exterior flush slab wood door should receive a painted finish consisting of a prime coat and not less than two finish coats of the highest quality alkyd-based semi-gloss enamel. The prime coat and at least one finish coat should be applied immediately after the door is hung. Particular attention should be given to the finish on the top and bottom edges to insure that these surfaces are thoroughly sealed.

(2) **Finish Behind Hardware Items:** The final door finish should be applied before the installation of any finish hardware item, except mortise butts, including locksets, closers, kickplates, flashing, drips and other items attached directly to the door.

d. **Exterior Door Hardware:** Except where specific requirements dictate otherwise, the following finish hardware items should be provided for exterior wood doors. Refer to Design Guideline DG 087100 for specific requirements for door hardware.

(1) **Butts:** Not less than 1-1/2 pair of heavy duty, bronze ball-bearing butts, with non-removable pin, such as Stanley FBB 191, sized in accordance with manufacturer's recommendations.

(2) **Lockset or Panic Device:** Use Schlage "L" Series mortise locksets with lever handles, in accordance with Design Guideline DG 087100; if panic device is required, use Von Duprin rim-type devices or approved equal. (Approved equal must enable future field installation of card access components and be of the same quality or better than Von Duprin; manufacturer must provide a letter of certification from an independent laboratory that devices can pass a 1 million cycle test in accordance with ANSI/BHMA A 156.3 test procedures.)

All exterior doors and vestibule doors shall be specified such that no chain or cable may be installed to lock the door from the inside.

(3) **Closer:** For outward opening doors, use LCN*, Norton* or Sargent* surface-mounted parallel arm type, sized in accordance with manufacturer's recommendations.

(4) **Door Control Device:** Door stop or combination stop/holder as dictated by conditions.

(5) **Kickplate:** 20 ga. Type 304 stainless steel with No. 4 finish with countersunk oval head screws, not less than 8" high by 1" less than door width.

(6) **Threshold:** 1/2" high by 5" wide, frost-barrier type, aluminum threshold, Reese* S282A or S282D, set in urethane caulk.

(7) **Drip Cap:** If door head is not protected in recess or under entrance canopy, provide aluminum drip cap, Reece R199.

(8) **Door Shoe:** Combination drip cap with polyurethane weather seal, Reese* DB595AU, set in urethane caulk.

(9) **Weatherstripping:** Compressible, adhesive-backed tubular polypropylene seal strips, Reece* 797B.

3. INTERIOR WOOD DOORS:

a. **General:** Interior wood doors in new construction should be flush slab solid core wood doors of the type described in this guideline, except where environmental conditions or usage of the facility may dictate the use of other types of doors, such as hollow metal doors. Examples of spaces which may not be appropriate for interior wood doors may include garages, shops, certain types of athletic facilities, animal quarters or warehouses.

b. Door Specifications:

(1) Interior non-fire-rated flush slab solid core doors should be Eggers Industries*, Algoma Hardwoods*, Graham 7-ply Premium Door (GPD)*, or Marshfield Door Systems SCLC* (structural composite lumber core) doors conforming to the requirements in Table 1. On projects with restricted budgets, Eggers Industries*, Algoma Hardwoods*, or Marshfield Door Systems PC* (bonded particle board core) doors conforming to the requirements of Table 1 may be used.

(2) 20/30 minute fire-rated flush slab solid core doors should be Eggers Industries*, Algoma Hardwoods*, Graham 7-ply Premium Door (GPD)*, or Marshfield Door Systems SCLC* (structural composite lumber core) doors conforming to the requirements in Table 1. On projects with restricted budgets, Eggers Industries*, Algoma Hardwoods*, or Marshfield Door Systems PC* (bonded particle board core) doors conforming to the requirements of Table 1 may be used.

(3) 90-, 60-, 45-minute fire-rated flush slab solid core doors should be Eggers Industries*, Algoma Hardwoods*, Graham 7-ply Premium Door (GPD)*, or Marshfield Door Systems* FD-90, FD-60, and FD-45 mineral core Positive Pressure Category A doors conforming to the requirements in Table 1.

c. Face Veneer: Unless otherwise approved by the UNL representative, interior flush slab wood doors should be faced with “A” Grade plain sliced red oak, book matched, with running veneer assembly.

d. Interior Door Finish Systems:

(1) Natural Finish: Generally, interior wood doors with hardwood face veneers and edges should be stained with a walnut-colored stain and given not less than two coats of polyurethane varnish, the final coat being a satin or semi-gloss finish. Specifications should require that this finish be applied to the top and bottom edges of the door.

(2) Finish Behind Hardware Items: The final door finish should be applied before the installation of any finished hardware item, except mortise butts, including locksets, closers, kickplates, and other items applied directly to the door.

e. Interior Door Hardware: Except where specific requirements dictate otherwise, the following finish hardware items should be provided for interior wood doors:

(1) Butts: Generally, use full-mortise ball bearing butts, such as Stanley* FBB-179, sized in accordance with manufacturer's recommendations. On low-frequency doors without closers, plain-bearing butts may be used. Half-surface ball-bearing butts, such as Stanley* FBB-173, with through bolts, should be used on mineral core fire doors.

(2) Lock Sets or Panic Devices: Use Schlage* “L” Series mortise locksets with lever handles, in accordance with Design Guideline DG 087100; if panic device is required, use Von Duprin* rim-type devices or approved equal. (Approved equal must enable future field installation of card access components and be of the same quality or better than Von Duprin; manufacturer must provide a letter of certification from an independent laboratory that devices can pass a 1 million cycle test in accordance with ANSI/BHMA A 156.3 test procedures.)

(3) Closers: Use LCN* or Sargent* surface-mounted closers, sized in accordance with manufacturer's recommendations. Closers on mineral core doors should be attached with through-bolts.

(4) Door Stops or Bumpers: Use wall-mounted door bumpers, such as Ives* BP 407½, wherever possible on interior doors. Where bumpers are installed on metal stud/gypsum drywall partitions, wood blocking to receive the bumper should be installed in the partition construction.

(5) Kick Plates: Doors with closers should have a 20 ga. Type 304 stainless steel kickplate with No. 4 finish, attached with countersunk oval head screws, not less than 8" high by 1" less than width of door..

(6) Special Hardware Items: Provide special hardware items for interior doors, such as door bottoms, stripping, seals, hold-open devices, and other such items as dictated by the door's usage.

f. Classroom doors shall be key-locked from both outside and inside following normal "classroom" function.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

TABLE 1: SPECIFICATIONS FOR FLUSH SLAB SOLID CORE WOOD DOORS				
	EXTERIOR WOOD DOORS	NON-FIRE-RATED INTERIOR WOOD DOORS	20/30-MINUTE RATED CATEGORY A POSITIVE PRESSURE INTERIOR WOOD DOORS	90/60/45-MINUTE RATED CATEGORY A POSITIVE PRESSURE INTERIOR WOOD DOORS
Quality Standard	WDMA IS 1-A, Custom Grade	WDMA IS 1-A, Custom Grade	WDMA IS 1-A, Custom Grade	WDMA IS 1-A, Custom Grade
Thickness	1-3/4"	1-3/4"	1-3/4"	1-3/4"
Construction	WDMA 5-ply	WDMA 5-ply	WDMA 5-ply	WDMA 5-ply
Maximum Size	4/0 x 8/0	4/0 x 10/0	4/0 x 10/0 single; 8/0 x 8/0 parallel swing & double egress	4/0 x 8/0 single; 8/0 x 8/0 parallel swing & double egress
Core	SCL (Structural Composite Lumber)	SCL (Structural Composite Lumber) or PC (Particle Board) See Note 1.	SCL (Structural Composite Lumber) or PC (Particle Board) See Note 1.	Mineral Core
Face	Medium density overlay. See Note 2.	"A" Grade plain sliced red oak.	"A" Grade plain sliced red oak.	"A" Grade plain sliced red oak.
Crossband	Nominal 1/16" thick.	Nominal 1/16" thick.	Nominal 1/16" thick.	Nominal 1/16" thick.
Stiles	Two-ply (min.) laminated. See Note 3.	Two-ply (min.) laminated, species to match face veneer.	Two-ply (min.) laminated, species to match face veneer.	Manufacturer's standard laminated construction to provide screw withdrawal resistance and split resistance.
Top & Bottom Rails	Top and bottom rails not required per WDMA standards.	Top and bottom rails not required for SCLC; provide 1-1/8" hardwood or softwood rails for PC.	Top and bottom rails not required for SCLC; provide 1-1/8" hardwood or softwood for PC.	1/2" top; 1-1/2" bottom.
Hardware Blocking	Not required.	Not required for SCLC; specify 5" top and/or bottom rail reinforcing and lock block reinforcing for all surface-mounted hardware on PC doors.	Not required for SCLC; specify 5" top and/or bottom rail reinforcing and lock block reinforcing for all surface-mounted hardware on PC doors.	Specify 5" top and/or bottom rail reinforcing and lock block reinforcing for all surface-mounted hardware on PC doors.
Face Assembly Adhesive	Type I (waterproof)	Type II (water-resistant)	Type II (water-resistant)	Type II (water-resistant)
Core Assembly Adhesive	Type II (water-resistant)	Type II (water-resistant)	Type II (water-resistant)	Type II (water-resistant)
Moisture Stripping	Specify aluminum stripping at top and bottom of door and at bottom of light openings.	None.	None.	None.
Warranty	Two years.	Full. Life of Installation.	Full. Life of Installation.	Full. Life of Installation.
Security Rating	Class 40. See Note 4.	Class 40. See Note 4.	Class 40. See Note 4.	Class 30. See Note 4.
<p>NOTES:</p> <ol style="list-style-type: none"> Particle board core doors only on projects with restricted budgets. A hardwood veneer face with a natural (clear) finish should only be used after it has been conclusively demonstrated that the veneer species selected and the finishing system have a proven record of durability in a weather exposure comparable to that of the proposed installation. Stile species at mill option unless hardwood veneer is used for both faces under the restrictions mentioned in Note 1 above, when stile species should match face veneer. In accordance with UBC Standard 41-1 and ASTM F-476. 				

ALUMINUM REPLACEMENT WINDOWS

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. ALUMINUM REPLACEMENT WINDOW STANDARDS

PART 1 - GENERAL

1. GENERAL:

- a. Application: These Guidelines describe standards which should be considered in the selection, design, and specification of replacement window systems.
- b. Window Operation: The requirements given below are for thermally broken aluminum replacement windows. See individual requirements and criteria listed below for applicable types of operation, such as horizontal rolling, double or single hung; projected (awning or hopper type), casement, or fixed. The selection of the type of window operation should be based on the functional requirements of the window openings, along with the compatibility of the window installation with the architectural character of the building.
- c. Window Materials: The selection of replacement window system materials should be based upon the functional requirements of the window system, compatibility with adjacent materials and the architectural character of the building, the performance of the window system (air infiltration, water resistance, thermal transmission), and long-term maintenance factors. The standards included herein apply to aluminum windows, however, this does preclude the possibility that window systems fabricated of wood, wood clad with vinyl or metal, or steel would be appropriate in some instances.

PART 2 - PRODUCTS

2. ALUMINUM REPLACEMENT WINDOW STANDARDS:

- a. Material: Aluminum 6063-T6 prime billet, nominal extrusions to be minimum .090 thick.
- b. Construction: 2 separate frames with non-conductive, non-structural tongue and groove thermal barrier (1/4" minimum).
- (1) Sills: Tubular, with provisions for moisture weeping.
- (2) Sash: Hollow tubular, with stainless steel hardware, screws, and pins; removable and replaceable glazing. Glazing above 20'-0" to be replaceable from interior without compromising the sash integrity.
- (3) Screens: Fiberglass, 18 x 14 mesh; removable from inside.
- c. Weather-stripping: Double, woven, silicone-coated pile with polymeric fin.
- d. Glazing:
- (1) 1" tinted (solar bronze or gray), insulated, low-e. Glass to be polished plate or float glass; 1/4" preferred thickness, however, 1/8" thickness is acceptable in hung window applications where operable sash will not accommodate weight of 1/4" glass.
- (2) Dual glazing is also acceptable. Interior sash to have minimum 1/2" insulated glass and exterior sash to have single pane tinted (solar bronze or gray).
- (3) Insulated Glass: Insulated glass to have minimum 10 year warranty.
- e. Insulated Panels: Minimum R value of 10 with porcelain, textured aluminum skin on exterior.
- f. Guarantee: 10 years minimum.
- g. Framing Lumber: Pressure treated according to AWPB, LP-3; moisture content not to exceed 19%; fiber strength of 1200 psi.
- h. Nail, Screws, and Fasteners: Non-corrosive.
- i. Exterior Panning: Aluminum 6063-T6; nominal 0.062" minimum thickness.

3. PERFORMANCE REQUIREMENTS

- a. Horizontal Rolling (sliding)
- (1) Minimum HS-HC-60 rating.
- (2) CRF – minimum 47.

- (3) Water penetration – No leakage @10 psf.
- (4) Air infiltration – minimum .35 cfm/ft² @6.24 psf.
- (5) U value – no greater than .60.

b. Casement/Project-out

- (1) Minimum C-HC-80 rating.
- (2) CRF – minimum 57.
- (3) Water penetration – No leakage @12 psf.
- (4) Air infiltration – minimum .10 cfm/ft² @6.24 psf.
- (5) U value – no greater than .46.

c. Single/Double Hung

- (1) Minimum SH/DH-HC-60 rating.
- (2) CRF – minimum 50.
- (3) Water penetration – No leakage @ 8 psf.
- (4) Air infiltration – minimum .3 cfm/ft² @ 6.24 psf.
- (5) U value – no greater than .50.

d. Fixed

- (1) Minimum F-HC-80 rating.
- (2) CRF – minimum 57.
- (3) Water penetration – No leakage @ 12 psf.
- (4) Air infiltration – minimum .10 cfm/ft² @ 6.24 psf.
- (5) U value – no greater than .46.

4. ALUMINUM FINISH

- a. Anodized Finishes: Class I, .7 mil. minimum thickness for all exterior applications and interior applications with high abuse and/or moisture. Class II, .4 mil. thickness is acceptable for interior applications.
- b. Fluoropolymer Coatings: Minimum 70% PVDF for all exterior applications and interior applications with high abuse and/or moisture. Minimum 50% PVDF is acceptable for interior applications.

DOOR HARDWARE

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. APPROVED MANUFACTURERS
3. LOCKSETS
4. PANIC EXIT DEVICES
5. BUTTS
6. CLOSERS
7. STOPS

PART 1 - GENERAL

1. GENERAL:
 - a. Application: Finish hardware shall be selected and scheduled in accordance with this Guideline.
 - b. Design coordination: Coordinate all door, frame, hardware and keying requirements with UNL Building Systems Maintenance (UNL BSM) prior to completion of bid documents to reduce possible hardware conflicts at later dates.
 - c. Lockset Cylinders to be Delivered to UNL Key Services: Contract documents shall require all lockset cylinders to be delivered to UNL Key Services by the Contractor prior to their installation. Cylinders packages shall be marked with opening number, function or location, and project identification.
 - d. Use of Magnetic Locks: Magnetic locks shall not be used as a part of the locking arrangement on any exit doors or doors in the exit path. Where such doors require security measures which cannot be addressed by standard exit hardware, the use of a delayed egress locking arrangement, conforming to the requirements of NFPA 101 5-2.1.6 shall be used.
 - e. See DG 081416 for hardware requirements for flush wood doors.
 - f. NOTE: Door hardware on exterior doors must be designed and specified to prevent locking from the inside with a chain.

PART 2 – PRODUCTS

2. APPROVED HARDWARE MANUFACTURERS:

- a. Project specifications should limit the door hardware to the following manufacturers list:

Hinges:	Hager, McKinney, Stanley
Locksets	Schlage* or UNL approved equal
Panic Exit Devices	Von Duprin* or UNL approved equal
Mullions	Von Duprin* KR or UNL approved equal
Closers	LCN* or UNL approved equal
Handicap Door Operators	LCN*, Horton* or UNL approved equal
Stops	Quality* or Ives*

- b. Where the project involves an addition to an existing building or the renovation of an existing building, the project design process shall include the verification of the existing building hardware and keyway design with the UNL Facilities Access/Alarm Systems Manager.

3. LOCKSETS:

- a. Backset: 2-3/4"

- b. Keyway: 6 pin.

- c. Lock Types:

(1) For interior doors, use Schlage* "L" Series mortise locksets with 06A type lever handles.

(2) For interior doors to a controlled-access area requiring a changeable combination lock, use Unican* Series/Mas Hamilton* 3000 lockset, which conforms to ADA requirements. If this area is security sensitive during non-operational periods, a locking deadbolt should also be provided.

(3) For interior doors to custodial rooms, mechanical rooms, elevator service rooms, telecommunications wiring closets, and similar service rooms, use Schlage* L9080 locksets with storeroom function.

(4) For exterior doors where panic devices are not required, use locksets with interchangeable core with the appropriate Primus keyway. (Coordinate function of locksets with UNL Facilities Access/Alarm Systems Manager.

- d. Devices on Card/Prox Access-Controlled Openings: See Design Guideline DG 087400 to reference requirements pertaining to the use of electrified locksets on access-controlled openings. Coordinate the selection, specification, and installation requirements of such devices with UNL **BSM**.

- e. Keying Instructions:

- (1) General: Each building will have a unique fire/life safety Master Key System with as many sub-masters as necessary to accommodate the different departments housed within the building. The Master Key System and individual keying of locks will be determined by the UNL Facilities Access/Alarm Systems Manager.
- (2) Exterior Doors: Each building will have each exterior door keyed with a Schlage* maximum security (Primus) key utilizing an interchangeable core (IC core). All exterior doors on each building will be keyed alike, but will be unique for each building. City Campus buildings are to be keyed CP (City Primus). All East Campus buildings are to be keyed EP (East Campus Primus). All mechanical and roof access doors are to be keyed CEP (City East Primus). See Attachment No. 1.
- (3) Interior Doors: Each door shall have a separate day key. Where possible, doors within an area used by a specific individual shall all be keyed alike.
- (4) All mechanical rooms and electrical closets shall be keyed off the master system with the present mechanical room key. Telecommunications wiring closets and custodial closets shall be keyed separately to Sargent* LL keyway using the key designated by the UNL Facilities Management Key Shop. Mechanical rooms, elevator equipment rooms, and roof access are to be provided with Primus CE keyway.
- (5) The custodial rooms for all buildings will be keyed separately from the building master, on a separate grand-master key system, with each building sub-master keyed differently and all custodial rooms keyed alike within a building. This arrangement permits all custodial rooms on both campuses to be entered with a single grand-master key.
- (6) Project specifications shall require that all keys furnished for a project be supplied by the lockset supplier, and furnished with a biting list and comprehensive key schedule.
- (7) Any card access door shall utilize an appropriate Primus Keyway.

4. PANIC AND FIRE EXIT DEVICES:

- a. Device Type: Use Von Duprin* Series 99 touch bar rim-type exit devices keyed dogging features, equal by Sargent or UNL approved equal. Standard, non-electric devices must be able to be field-converted on-site, to electric operation by simply adding a new base assembly and appropriate retrofit assemblies. Vertical rod type devices, either concealed or surface mounted, may be used if approved by the UNL project representative.

** Use of vertical rod devices must have prior approval by UNL – Building Systems Maintenance.*

- b. Exterior Trim: Use lever handle trim option which most closely matches other hardware used on the project. On "egress-only" doors, do not use dummy trim. Require a vandal-resistant, break-away (non-freewheeling) trim which, if more than 35 pounds of torque is applied in the locked mode, the trim will go vertical position. A simple uplift motion will reset the lever to its original position. A shear pin will break to prevent any internal damage to the trim or the device if more torque is applied.

- c. Devices on Access-Controlled Openings: See Design Guideline DG 087400 for requirements pertaining to the use of panic exit devices with electric latch retraction on access-

controlled openings. Coordinate the selection, specification, and installation requirements of such devices with UNL **BSM**.

5. BUTTS:

a. Hinge Type: Generally, use full-mortise butts. Half-surface butts with through-bolts shall be used on mineral core fire doors. All out-swinging doors shall have butts with non-removable pins. Doors with closers shall have ball-bearing butts.

b. Electric Power Transfer Devices: See Design Guideline DG 087400 for requirements regarding the use of electric power transfer units (Von Duprin* EPT-10) in conjunction with access control panic devices. See Design Guidelines DG 087400 for requirements regarding the use of electric power transfer units (Murray* TEF 2+4) in conjunction with access control electrified mortise latch devices.

6. CLOSERS:

a. Powered Closer/Operator Systems: Building entrances, including vestibule doors, and high-traffic interior door locations where doors are not held in the "open" position during normal business hours, shall be equipped with a power closer/operator system enabling these doors to meet the ADA accessibility standards. Such a system shall have the following characteristics: 1) low-speed and low energy movement of the door leaf, making safety pads and/or guard rails unnecessary; 2) manual operation of the door without power assistance, permitting the continued use of the door in the event the operator mechanism fails; 3) have a demonstrated record of reliability and serviceability in institutional applications. Depending upon the specific application, one of the following systems shall be used and coordinated with the UNL Facilities Access/Alarm Systems Manager:

(1) Operator: Electric operating mechanism with maximum current draw not to exceed 3.15 amps. Operator shall be isolation mounted and concealed in an extruded aluminum case with side access wherever possible.

(a) Opening action shall be accomplished by 1/8 hp DC permanent magnet motor working through reduction gears to the output shaft. Gear train bearings shall be sealed ball bearing type.

(b) Closing action shall be accomplished by a maximum-duty spring (four independent coil springs separated by Teflon discs and enclosed in an external spring box) with a lifetime warranty. Close speed control shall be supplied by dynamic braking of the motor and shall be fully adjustable. Operator to act as manual closer when power is off or when the master control unit is removed.

(c) Off/On/Hold Open switch shall be supplied and remain inside the aluminum header in the On position unless noted otherwise. Where the switch is located outside the header, it shall be located on the top side wherever possible.

(d) Master Control shall incorporate the following features:

- Adjustable time delay of 2 to 13 seconds.
- Infinite adjustment to opening and open check speeds, including adjusting the opening force without affecting the opening speed.

- Immediate reversal of door motion with undue strain on the drive train. The door shall reverse when closing if an object stops the door.
- Motor Protection Circuit: Provide a locked door motor protection circuit which will shut off current when the door is inadvertently locked or otherwise prevented from opening.
- Include provision in the master control to provide interface with electric strikes, fire alarms, actuators, safety sensors, and related auxiliary contacts. Provide built-in power supply for peripherals with a maximum combined load of 1.0 amp at 12 or 24 v. DC.
- Emergency Breakout for In-Swinging Doors (Overhead Concealed): When door is in emergency breakout position, power shall be removed from the operator.

(e) Power Operation: Automatic pushbutton switch actuates door open; door closes after time delay expires. Opening and closing force, measured 1” out from the lock stile, shall not exceed 15 pounds to stop the door when operating in either direction. Operator shall include variable opening speed adjustment of 4 to 6 seconds and variable closing speed adjustment of 4 to 6 seconds to comply with ASTM Standard A156.19.

(f) Manual Operation: Manual opening force, measured 1” out from the lock stile, shall not exceed 15 pounds at exterior doors and 5 pounds at interior doors. Operator shall be provided with Push and Go option (manually pushing door activates opening cycle; door closes after time delay expires) but shall be set for automatic operation unless noted otherwise.

- (2) Horton* 4000LE.
- (3) LCN* “Astro Swing” conforming to the above requirements.
- (4) Besam* “Swingmaster” conforming to the above requirements.

b. Power Closer/Operator Systems for Access-Controlled Openings: Refer to Design Guideline DG 087400 for requirements pertaining to the use of power closer/operator systems on access-controlled openings. Coordinate the selection, specification and installation requirements of such devices with the UNL Facilities Access/Alarm Systems Manager.

c. Controls for Closer/Operator Systems: Every powered closer/operator system should incorporate push plate actuator switches on both sides of the door, along with RF receiver/actuators on the exterior side of exterior doors, activated by 300 megahertz hand-held two or four-channel transmitters. The receiver and transmitter code shall be set as follows: 1st Button (A) = 2-3-4-8-9; 2nd Button (B) = 2-3-4-8-9-10. On access-controlled openings, the RF receiver/actuator shall be integrated into the electronic access control system, the wiring details of which shall be coordinated with UNL **BSM**.

d. Warranties: Units shall be warranted by the manufacturer against defects in material and workmanship for a period of two years from the date of substantial completion. Manufacturer’s warranty is in addition to, and not a limitation of, other rights the Owner may have under the

Contract Documents. A two year distributor's warranty for labor and transportation charges for defective parts replacement shall also be provided.

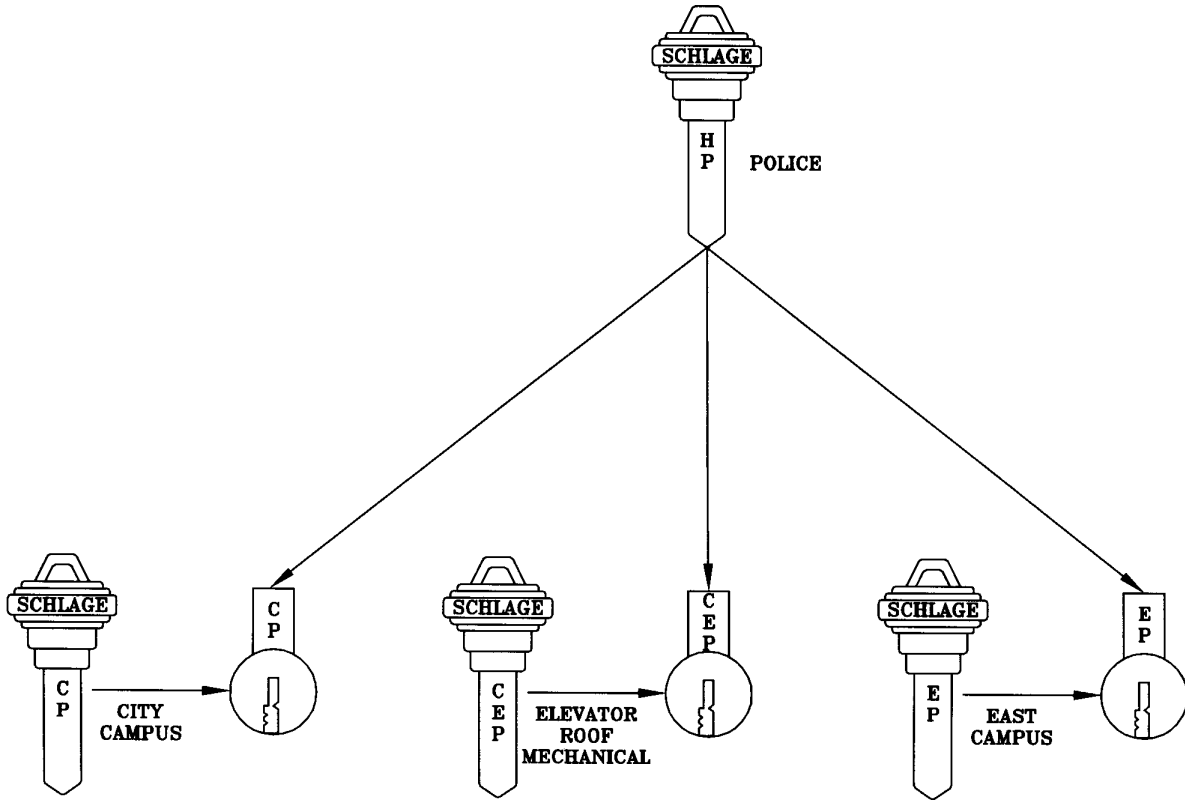
7. STOPS:

Type: Where possible, avoid the use of floor-mounted stops. Use wall-mounted target bumper stops wherever possible. Project details and specifications shall insure that adequate blocking is inserted in framed walls at locations to receive wall stops. If the use of wall-mounted stops is not feasible, use overhead stops, surface-applied and attached with through-bolts in heavy duty locations.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

PRIMUS KEYING DIAGRAM

KEY SELECTION ARRAY FOR SCHLAGE PRIMUS KEYING SYSTEM



UNIVERSITY OF NEBRASKA - LINCOLN
BSM DIVISION
4-09-03, wdl

ACCESS CONTROL HARDWARE

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4. FRAME PREPARATIONS FOR ACCESS CONTROLLED OPENINGS
5. DOOR PREPARATION FOR CARD ACCESS CONTROLLED OPENINGS

PART 1 - GENERAL

1. APPLICATION:
 - a. Requirements: Control systems, which admit persons and monitor passage through selected points of access into and within UNL buildings, should be provided in accordance with the requirements in this guideline. No door and frame assembly which cannot accommodate the installation of an acceptable access control system should be used on those openings designated to receive access control devices. Project consultants should establish the extent of the access-controlled openings in conjunction with the UNL Project Representative during the design process. All projects with a construction cost exceeding \$400,000 shall include access control systems.
 - (1) New Construction: The following categories of access points in new building projects, major renovations and building additions should have card/prox access control systems installed at the time of building construction:
 - (a) All exterior swing doors and large opening closures, such as rolling shutters or overhead panel doors.

- (b) Interior swing doors and large opening closures designated as security sensitive by the building user or by UNL administrative policy or Facilities Management policy. Telecommunications wiring closets shall have access control systems.
- (2) Remodel Projects: The following categories of access points in remodel projects should have card/prox access control systems installed at the time of project construction:
 - (a) Any exterior opening in which a new door and frame assembly is being installed.
 - (b) New interior swing doors and large opening closures within the project area designated as security sensitive by the building user or by UNL administrative policy or Facilities Management policy.
 - (c) Existing interior and exterior swing doors and closures in remodel projects of limited scope do not need to be retrofitted with card/prox access control systems as a part of the remodel project unless designated as security-sensitive by the building user or by UNL administrative policy or by Facilities Management policy.
- (3) Door Frame Factory Preparation and Rough-In for Future Card/Prox Access Control System: To facilitate the future installation of card/prox access control, the following categories of access points should have incorporated into their initial installation provisions requirements containing: welded-in-frame mortar boxes with cover plates (where necessary) and contractor-installed conduit from these mortar boxes to an accessible ceiling space common junction box.
 - (a) In new construction or remodel projects, doors and closures separating the building corridor system from groups or suites of rooms, such as office suites, data processing suites, or laboratory suites.
 - (b) In new construction or remodel projects, any other opening which may become designated security-sensitive.

2. ACCESS CONTROL SYSTEM DESIGN AND INSTALLATION:

- a. Design: The UNL Building Systems Maintenance (UNL BSM) will complete the design of the card/prox access control system, including the selection of all components of the system. The selection of finish door hardware and details of door and frame factory preparation and installations shall be coordinated by the PROJECT CONSULTANTS with UNL Control Systems Group. Refer to Article 3 of DG 230000.10 for table defining responsibilities for procurement and installation of access control system components.

- b. Installation:
- (1) Building Contractor(s): The following items associated with the access control system should be furnished and installed by the appropriate building contractor:
- (a) Finish hardware items, including electrified locksets and exit devices with electric latch retraction, electric strikes (if used), electric power transfer devices, door actuating devices for powered door operators.
 - (b) Non-factory provided frame preparations (provided with cover plate, if appropriate) and mortar boxes for associated door hardware: Sentrol flush-mount position switches; Von Duprin* latch bolt monitor switches; Von Duprin* electric power transfers (EPT-10), Marray* electrified hinges(TEF 2+4), Von Duprin* strike monitor switches; and Locknetics* electric strikes. (See 4 a-f below.)
 - (c) Electric conduit runs from mortar boxes on door frames to accessible ceiling space common junction box.
 - (d) Flush-mounted foursquare box and single gang mud ring with conduit to accessible ceiling space common junction box for UNL-provided card/prox access reader.
 - (e) 120VAC /20 amp building emergency power circuit, (if available) or separate 120VAC/20A circuit if there is no building emergency power circuit, run to **centrally-located support panels for doors** designated for card access, rough-in (future card access),and central building access net controller panel (location to be coordinated with UNL Building Systems Maintenance.
- (2) UNL Building Systems Maintenance (UNL BSM): The following items associated with the access control system will be furnished and installed by the UNL BSM:
- (a) Access readers, door position switches, latch monitor switches and all associated logic modules, relays, and other devices required for the integration of the system with the door hardware and the operation of the UNL's card/prox access system.
 - (b) All wiring and cabling required for the card/prox access system, excluding the power circuits referenced above. (See 1 e above.)

PART 2 - PRODUCTS

3. FINISH HARDWARE FOR ACCESS-CONTROLLED OPENINGS:

a. Finish Hardware Selection: Locking systems for card/prox access-controlled openings may include the use of panic exit devices with electric latch retraction, mortise or cylindrical locksets with electric operation, standard mortise or cylindrical locksets with an electric strike, or delayed egress panic exit devices (Von Duprin* with CX and RX function). The selection of the appropriate locking systems should be based upon the function of the opening, the degree of security required, and installation considerations, and should be coordinated with the UNL **Access Control Engineer**.

b. Finish Hardware Items:

(1) Panic Exit Devices Use Von Duprin* Series 99 touch bar rim-type exit devices keyed dogging features and RX (request-to-exit) designations, equal by Sargent or approved equal by UNL Building Systems Maintenance representative. Vertical rod type devices, either concealed or surface mounted, may be used only after the UNL project representative has determined that no suitable alternative is available.

(2) For security-sensitive interior doors or exterior doors not requiring panic devices, use Schlage* L9080EU RX 06A or Marray* L9080P 06A 626 REX or UNL approved equal if mortise locksets are being used. Order fail-secure with the request to exit option and 24VDC operation.

(3) For security-sensitive interior doors or exterior doors not requiring panic devices, use Schlage Command CLN80 LEURH24 – Finish-REXWHO1 or UNL approved equal if cylindrical locksets are being used. Order fail-secure with the request to exit option and 24VDC operation.

(4) Electric Power Transfer for Panic Devices: Use Von Duprin* EPT-10 electric power transfer.

(5) Electric Power Transfer for Electrified Locksets: Use Marray* TEF 2+4 electrified hinges or UNL approved equal.

(6) Electric Strikes: Use Locknetics* 9100 series electric strike with gold contacts, latch bolt monitor switch option, FSE (Fail Secure) and 24VDC operation or UNL approved equal.

PART 3 - EXECUTION

4. FRAME PREPARATIONS FOR ACCESS CONTROLLED OPENINGS:

a. Door Position Switch: Provide welded-in-place mortar box 1½” x 2½” x 2” in head of door frame for door position switch, centered 6” from lock edge of frame. Verify exact size of device to be used with UNL BSM. On frames not immediately receiving door position switch, mark location of back box with 1/8” diameter hole drilled in frame at center of back box.

b. Electric Power Transfer: Provide frame cutout and welded-in-place mortar box to fit model of electric power transfer scheduled for installation on access controlled openings. On frames not immediately receiving EPT, provide flush cover plate held in place with machine screws.

- c. Electric Strikes: Provide manufacturer's recommended standard frame preparation, with welded-in-place mortar box and necessary conduit run, on frames scheduled to receive electric strikes.
- d. Latch Bolt Monitor Switch: Provide welded-in-place mortar box 1½" x 2½" x 2" in frame jamb, behind the strike plate for latch bolt monitor switch.
- e. Electrified Hinge: Provide welded-in-place mortar box the same footprint dimensions as the hinge, 1 ½" deep in frame jamb, behind the electrified hinge.
- f. Pipe all mortar boxes listed above via ½" conduit to a conveniently accessible common junction box above the ceiling.

5. DOOR PREPARATION FOR CARD ACCESS CONTROLLED OPENINGS:

- a. Install Von Duprin* electric power transfer assembly and cable pathway to Von Duprin exit panic devices.
- b. Install electrified hinge and bore (cable pathway) through door to electrified locksets.
- c. Install Von Duprin* exit panic devices on door.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

Attachment 1 to DG 087400: Summary of Requirements for Access Control Systems

SUMMARY OF REQUIREMENTS FOR ACCESS CONTROL SYSTEMS							
PROJECT TYPE	A CATEGORY OF ACCESS POINT	B ACCESS CONTROL-RELATED HARDWARE ITEMS	C ACCESS CONTROL SYSTEM DEVICES AT DOOR	D PRE-INSTALLATION DOOR AND FRAME PREPARATIONS	E ELECTRICAL ROUGH-INS	F COMMUNICATION INTERFACE	
New buildings, major renovations, and building additions	1.1	Exterior swing doors, ADA accessible, in exit pathway	<ul style="list-style-type: none"> •Panic exit device with electric latch retraction or lever-handled mortise lockset with electric latch retraction, depending upon exiting requirements •Electric power transfer for panic exit device; electrified hinge for electrified mortise lockset •Powered closer/operator systems 	<ul style="list-style-type: none"> •Door position switch. •Access reader •Latch bolt reader for electrified mortise lockset 	<ul style="list-style-type: none"> •Frame cutout and back box for electric power transfer. •Frame opening and back box for door position switch. •Mortise in door for electric power transfer •Mortise in door for door position switch component. •Frame back box for latch bolt monitor •Door prep for electrified mortise lockset •Wire run to center electrified hinge •Back box in frame for electrified hinge 	<ul style="list-style-type: none"> •Conduit from back boxes on frame for electric power transfer and door position switch to accessible ceiling space. •4x4 box with conduit to accessible ceiling space for exterior access reader. •Box with conduit to accessible ceiling space for electric or pneumatic service to power closer/operator. •Boxes with conduit to accessible ceiling space for interior and exterior actuator switches for power closer/operator. 	<ul style="list-style-type: none"> •For each door or group of doors in close proximity to one another, provide a recessed steel control panel box not less than 12"x12"x3", with lockable door; connect to accessible ceiling space with one 1½" conduit. •For each building, provide a central control panel box located near the building telephone entrance point.
	1.2	Exterior swing doors, not in exit pathway	<ul style="list-style-type: none"> •Panic exit device with electric latch retraction •Electric power transfer •Power closer/operator systems, if used, OR 	•Same as Box C-1.1	•Same as Box D-1.1	•Same as Box E-1.1, except that boxes and conduit for power closer/operator not required if power closer/operator not used.	
			<ul style="list-style-type: none"> •Lever-handle mortise or cylindrical lockset with electric operation •Electric power transfer •Power closer/operator systems, if used 				
	2.0	Exterior overhead doors, rolling shutters or other large-opening closures	<ul style="list-style-type: none"> •Standard electric-operating mechanisms and control devices including keyed switches and RF actuators, or •Operating mechanism activated by access reader 	<ul style="list-style-type: none"> •Access reader interconnected to door control devices, or •Access reader directly activating door operating mechanism. 	•Surface-mounted boxes on door and track or frame for door position switch.	•4x4 box with conduit for access reader located adjacent to door control device.	
	3.1	Interior doors to rooms designated in design phase as security-sensitive.	<ul style="list-style-type: none"> •Panic exit device with electric latch retraction or lever-handled mortise lockset with electric unlocking, depending upon exiting requirements. •Electric power transfer or electrified hinge •Powered closer/operator systems, where used to make doors ADA accessible, OR 	•Same as Box C-1.1	•Same as Box D-1.1	•Same as Box E-1.1, except that boxes and conduit for power closer/operator not required if power closer/operator not used.	
<ul style="list-style-type: none"> •Electric strike, with standard locksets, where permitted by exiting requirements •Powered closer/operator systems, where used to make doors ADA accessible 							
3.2	All other doors opening onto primary and secondary corridors and other doors which could be designated as security-sensitive in the future.	•Standard locksets or panic exit devices as prescribed in DG 087100	•None during initial installation.	<ul style="list-style-type: none"> •Frame cutout with cover plate and back box for electric power transfer. •Back box for door position switch, with location marked by 1/8" diameter hole in frame 	•Conduit from back boxes on frame for electric power transfer and door position switch to accessible ceiling space		

SUMMARY OF REQUIREMENTS FOR ACCESS CONTROL SYSTEMS - (cont.)							
PROJECT TYPE	A CATEGORY OF ACCESS POINT	B ACCESS CONTROL-RELATED HARDWARE ITEMS	C ACCESS CONTROL SYSTEM DEVICES AT DOOR	D PRE-INSTALLATION DOOR AND FRAME PREPARATIONS	E ELECTRICAL ROUGH-INS	F COMMUNICATION INTERFACE	
Existing building remodel projects of limited scope or retrofit of existing doors to add access control system.	4.1	New exterior swing doors and designated existing exterior swing doors, ADA accessible, in exit pathway	<ul style="list-style-type: none"> •Panic exit device with electric latch retraction or lever-handled mortise lockset with electric latch retraction, depending upon exiting requirements. •Electric power transfer •Powered closer/operator systems 	<ul style="list-style-type: none"> •Door position switch. •Access reader 	Rework existing door and frame as required to install new hardware items and access control system devices if possible, otherwise, provide new door and frame with the following preparations: <ul style="list-style-type: none"> •Frame cutout and back box for electric power transfer. •Frame opening and back box for door position switch. •Mortise in door for electric power transfer •Mortise in door for door position switch component. 	<ul style="list-style-type: none"> •Conduit from back boxes on frame for electric power transfer and door position switch to accessible ceiling space. •4x4 box with conduit to accessible ceiling space for exterior access reader. •Box with conduit to accessible ceiling space for electric or pneumatic service to power closer/operator. •Boxes with conduit to accessible ceiling space for interior and exterior actuator switches for power closer/operator. 	<ul style="list-style-type: none"> •For each door or group of doors in close proximity to one another, provide a recessed steel control panel box not less than 12"x12"x3", with lockable door; connect to accessible ceiling space with one 1½" conduit. •For each building, provide a central control panel box located near the building telephone entrance point.
	4.2	New exterior swing doors and designated existing exterior swing doors not in exit pathway	<ul style="list-style-type: none"> •Lever-handled mortise or cylindrical lockset with electric operation •Electric power transfer 	Same as Box C-4.1	Same as Box D-4.1	<ul style="list-style-type: none"> •Conduit from back boxes on frame for electric power transfer and door position switch to accessible ceiling space. •4x4 box with conduit to accessible ceiling space for exterior access reader. 	
			<ul style="list-style-type: none"> •Standard lever-handled mortise or cylindrical lockset •Electric strike 			<ul style="list-style-type: none"> •Frame cutout and back box for electric strike •Frame opening and back box for door position switch •Mortise in door for door position switch component 	
	5.1	Existing interior swing doors designated as security sensitive; electric <u>lock</u> option.	<ul style="list-style-type: none"> •Panic exit device with electric latch retraction or lever-handled mortise or cylindrical lockset with electric operation depending upon exiting requirements. •Electric power transfer 	Same as Box C-4.1	Same as Box D-4.1	Same as Box D-4.2	
5.2	Existing interior swing doors designated as security sensitive; electric <u>strike</u> option.	<ul style="list-style-type: none"> •Standard locksets or panic exit devices as prescribed in DG 087100. 	Same as Box C-4.1	<ul style="list-style-type: none"> •Rework existing door and frame as required to install new electric strike and door position switch. 	<ul style="list-style-type: none"> •Conduit or wire path from electric strike and door position switch to accessible ceiling space. •4x4 box with conduit to accessible ceiling space for exterior access reader. 		

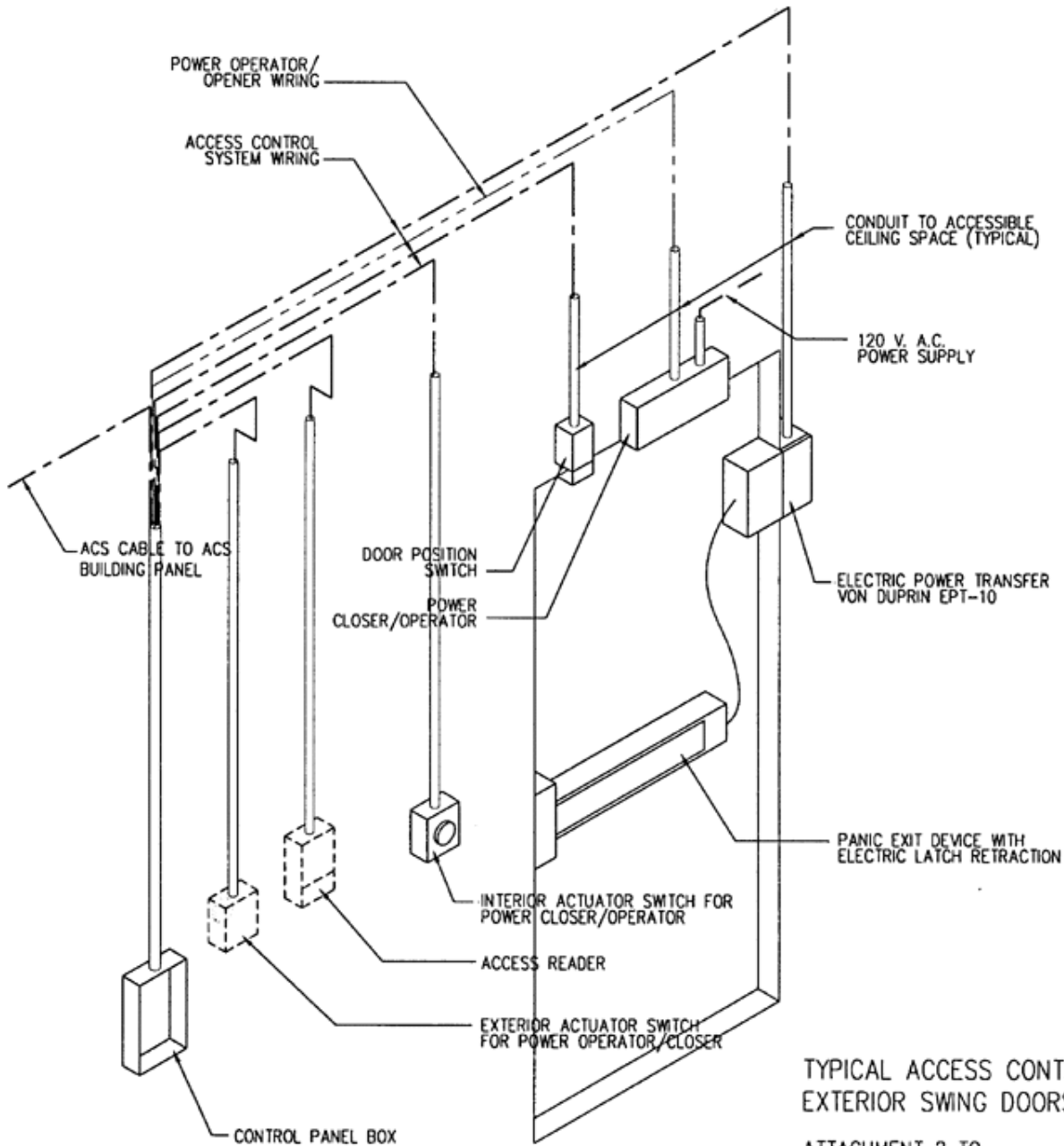
NOTES:

1. Access control system devices identified in Column C and related wiring will be furnished and installed by the UNL Control Systems Group. The cost of this work will be assessed against the project budget.
2. Hardware items mentioned in Column B, door and frame preparations mentioned in Column D, electrical rough-in work specified in Column E, and communication interface work mentioned in Column F should all be included within the project scope-of-work under the appropriate contract.

Attachment 1 to UNL Design Guideline DG 087400

Attachment 2 to DG 087400

Typical ACS Installation: Exterior Swing Door in Exit Pathway

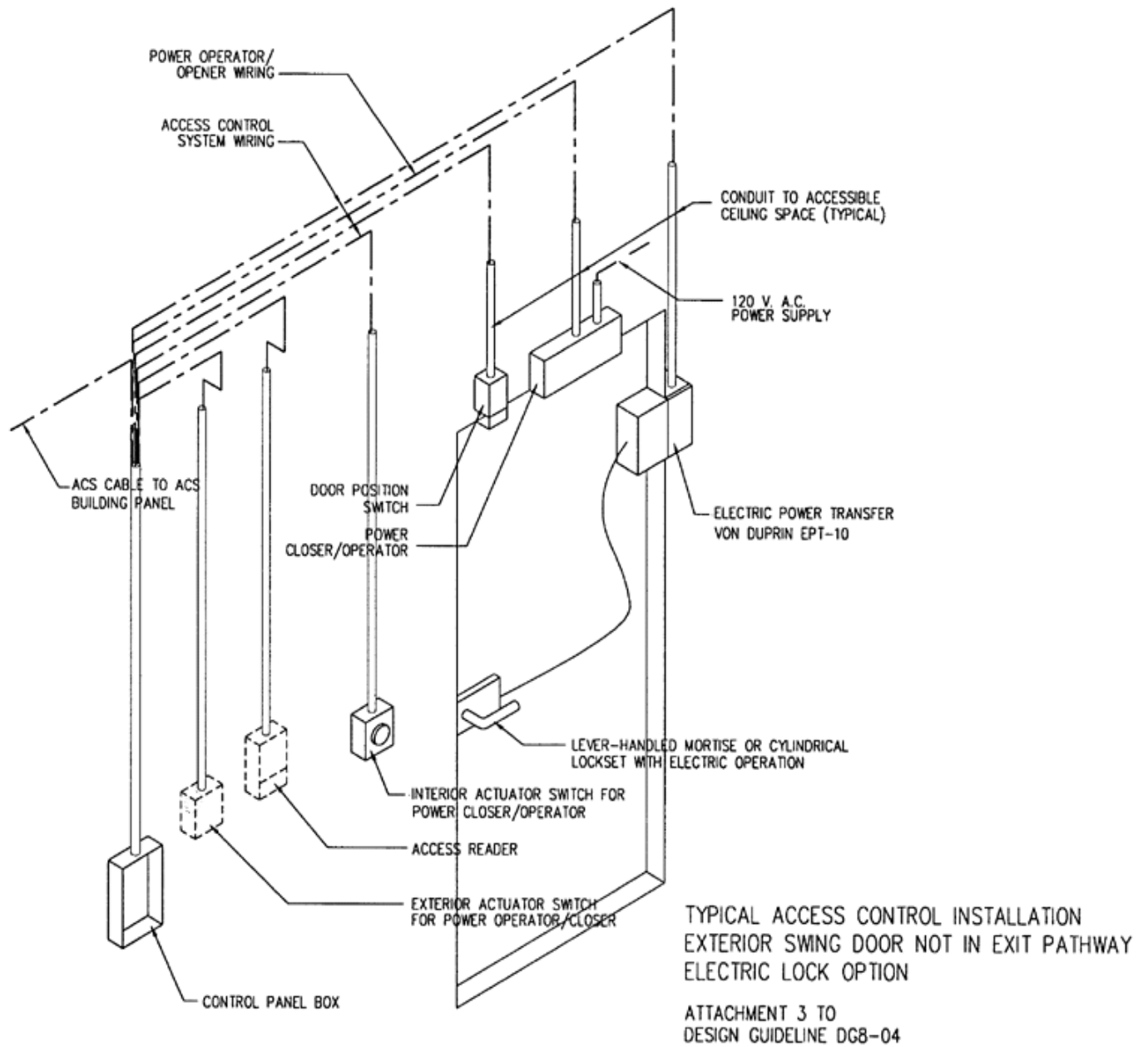


TYPICAL ACCESS CONTROL INSTALLATION
EXTERIOR SWING DOORS IN EXIT PATHWAY

ATTACHMENT 2 TO
DESIGN GUIDELINE DG8-04

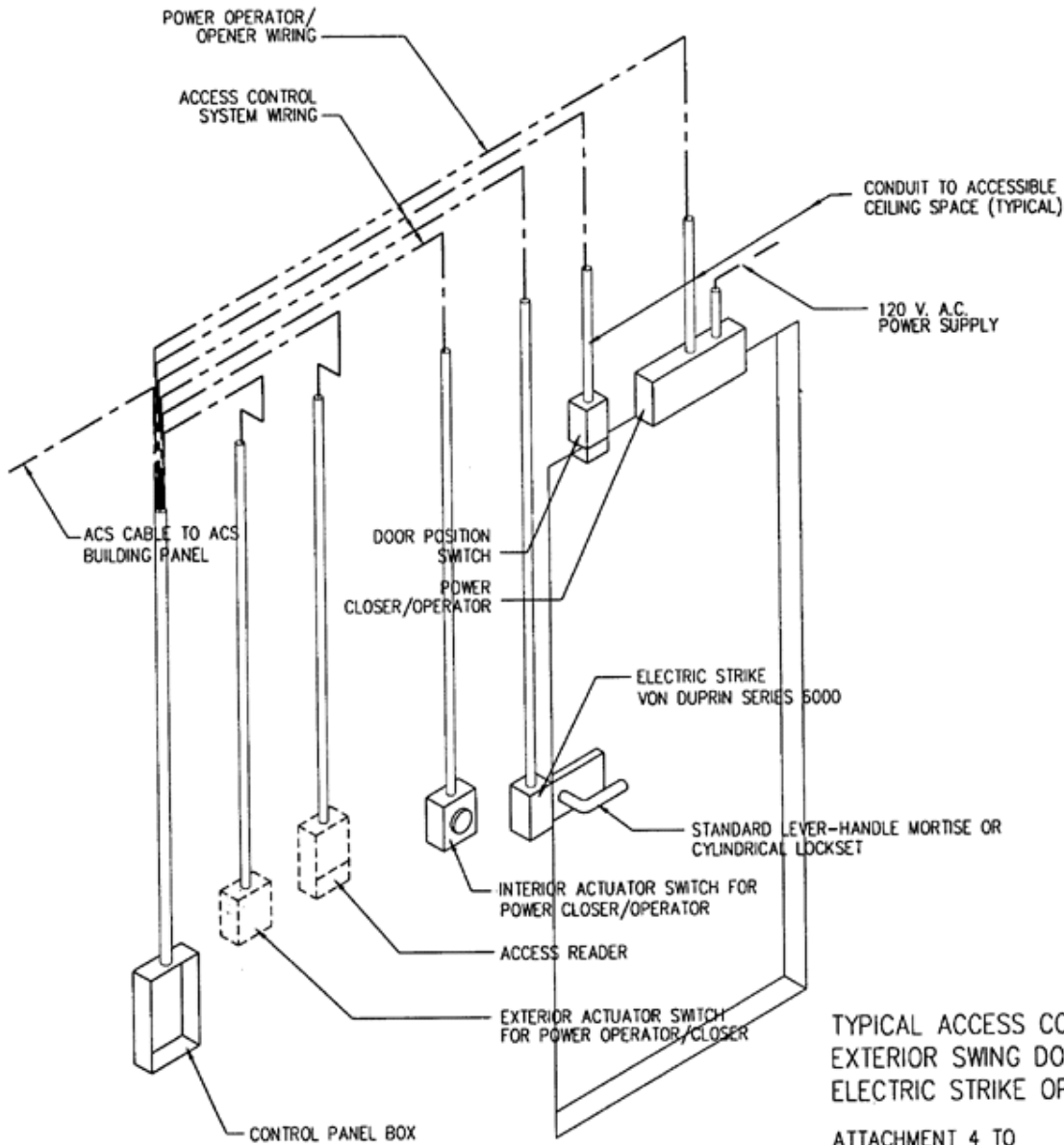
Attachment 3 to DG 087400

Typical ACS Installation: Exterior Swing Door Not in Exit Pathway, Electric Lock Option



Attachment 4 to DG 087400

Typical ACS Installation: Exterior Swing Door Not in Exit Pathway, Electric Strike Option

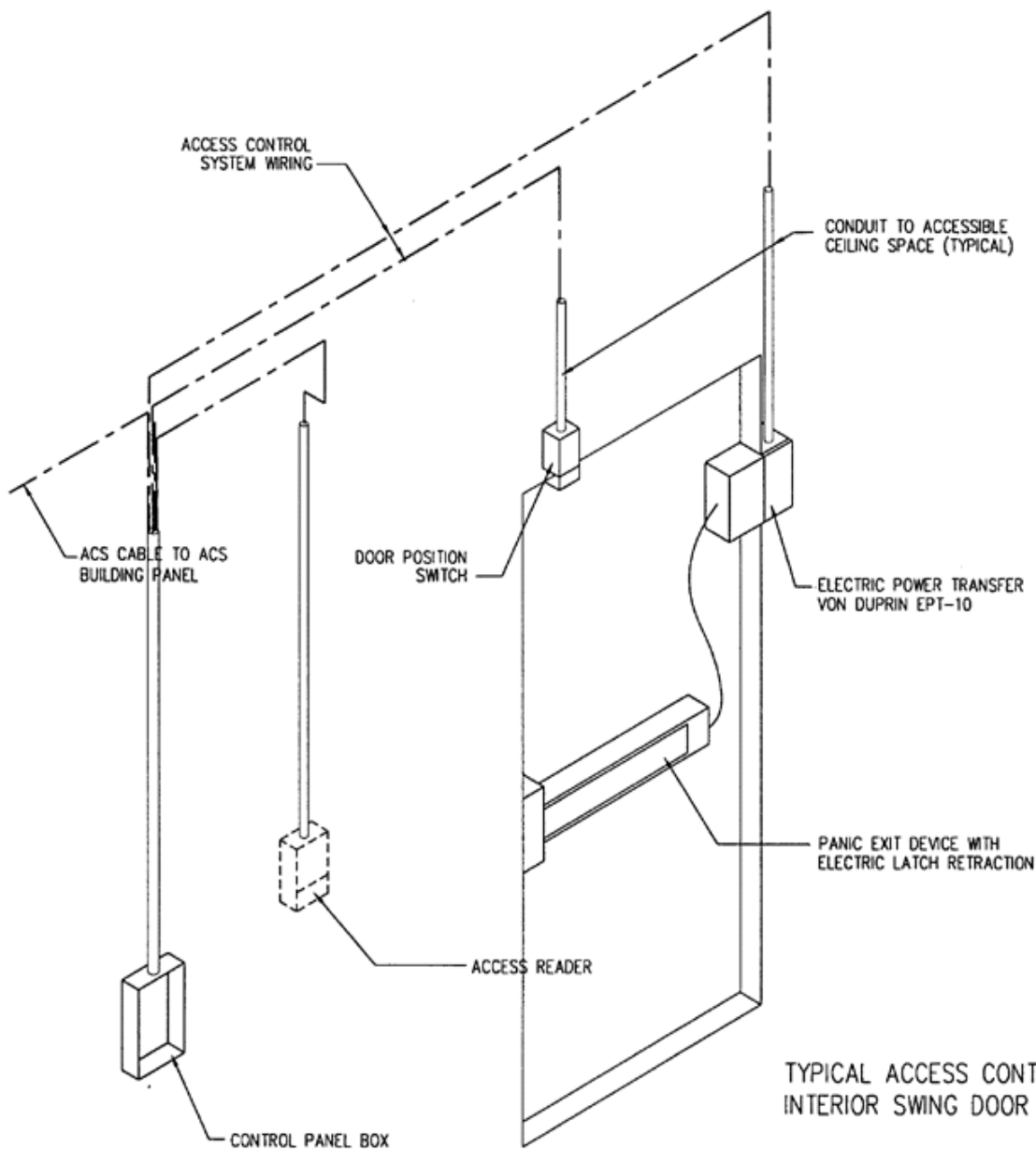


TYPICAL ACCESS CONTROL INSTALLATION
EXTERIOR SWING DOOR NOT IN EXIT PATHWAY
ELECTRIC STRIKE OPTION

ATTACHMENT 4 TO
DESIGN GUIDELINE DGB-04

Attachment 5 to DG 087400

Typical ACS Installation: Interior Swing Door in Exit Pathway

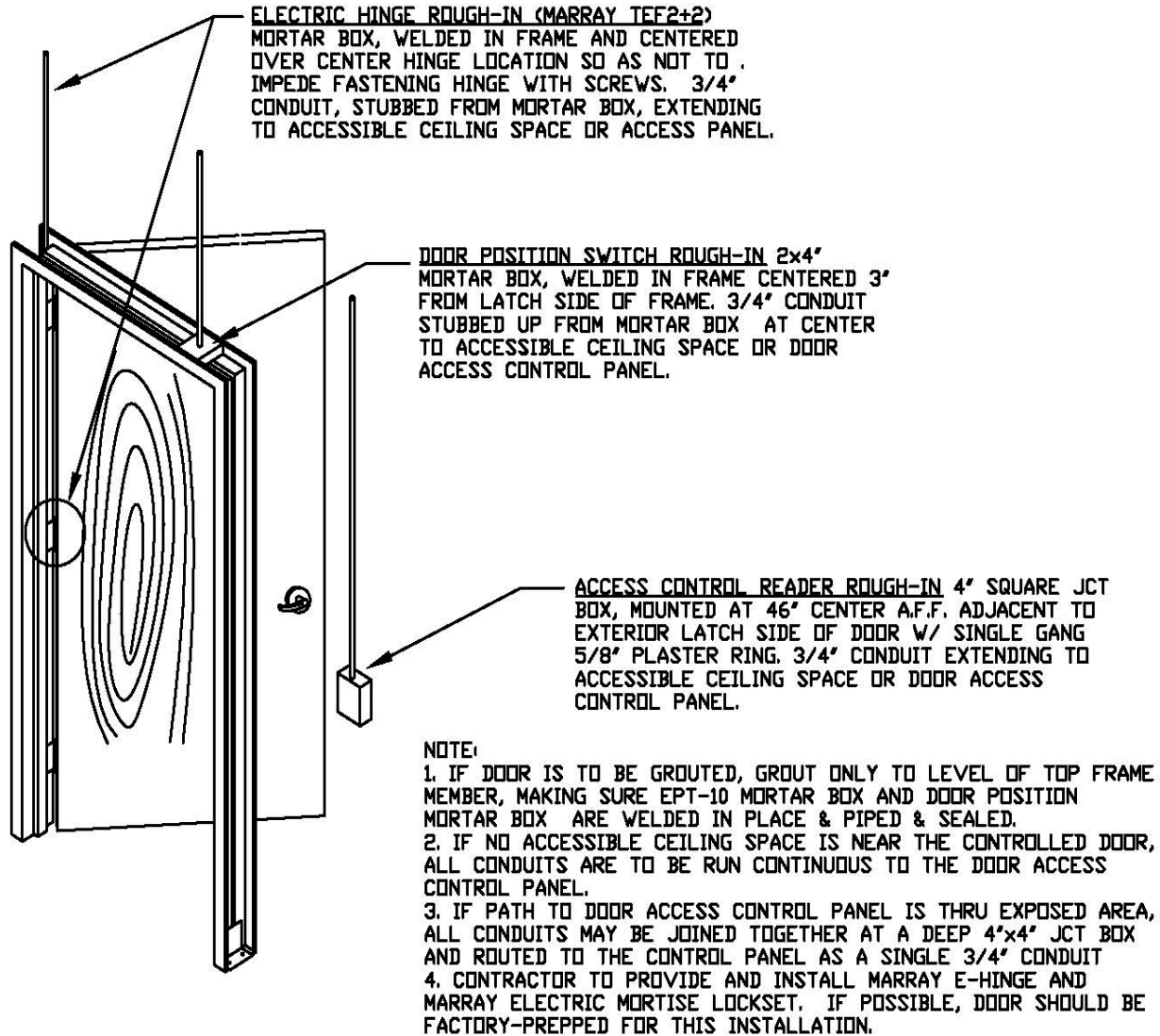


**TYPICAL ACCESS CONTROL INSTALLATION
INTERIOR SWING DOOR IN EXIT PATHWAY**

ATTACHMENT 5 TO
DESIGN GUIDELINE DG8-04

Attachment 6 to DG 087400

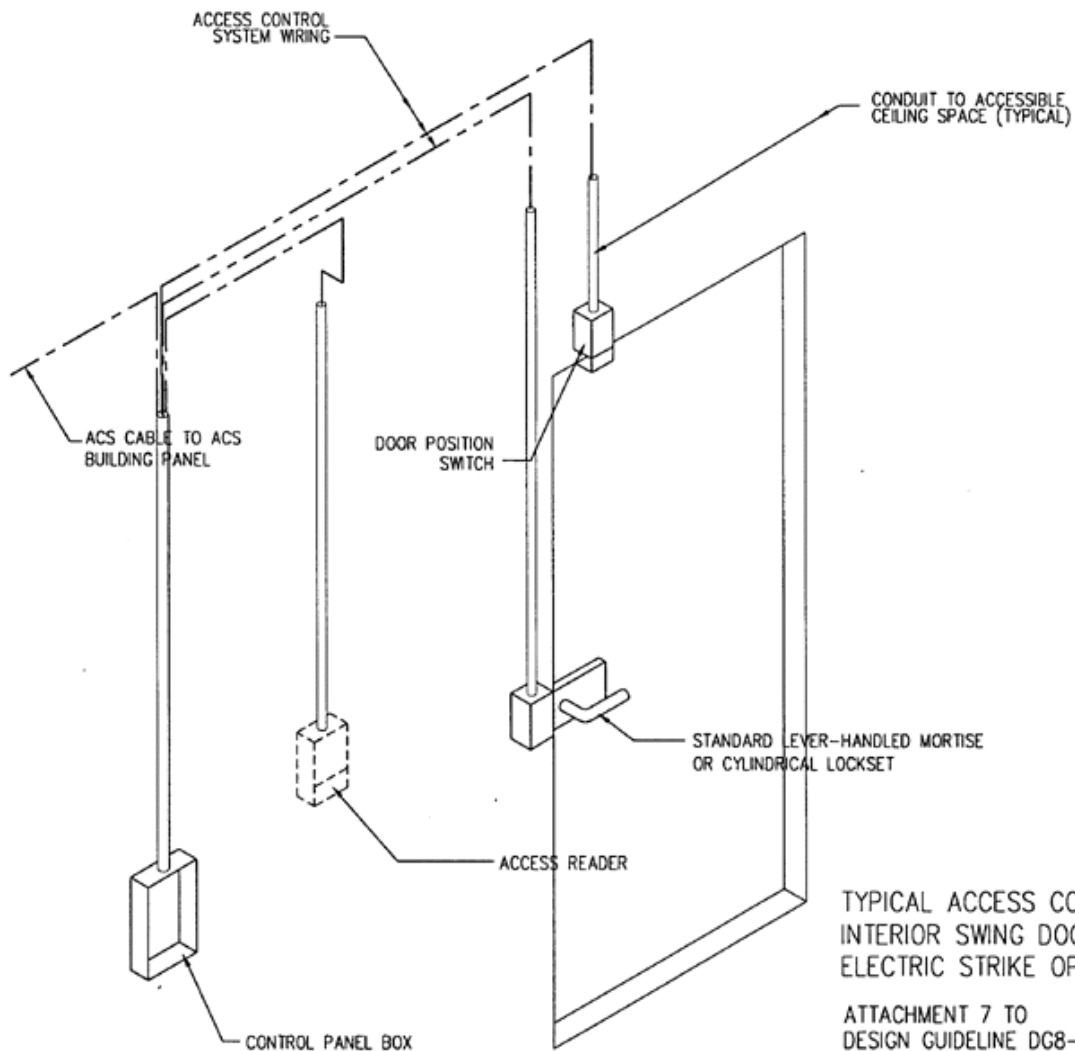
Typical ACS Installation: Interior Swing Door Not in Exit Pathway, Electric Lock Option



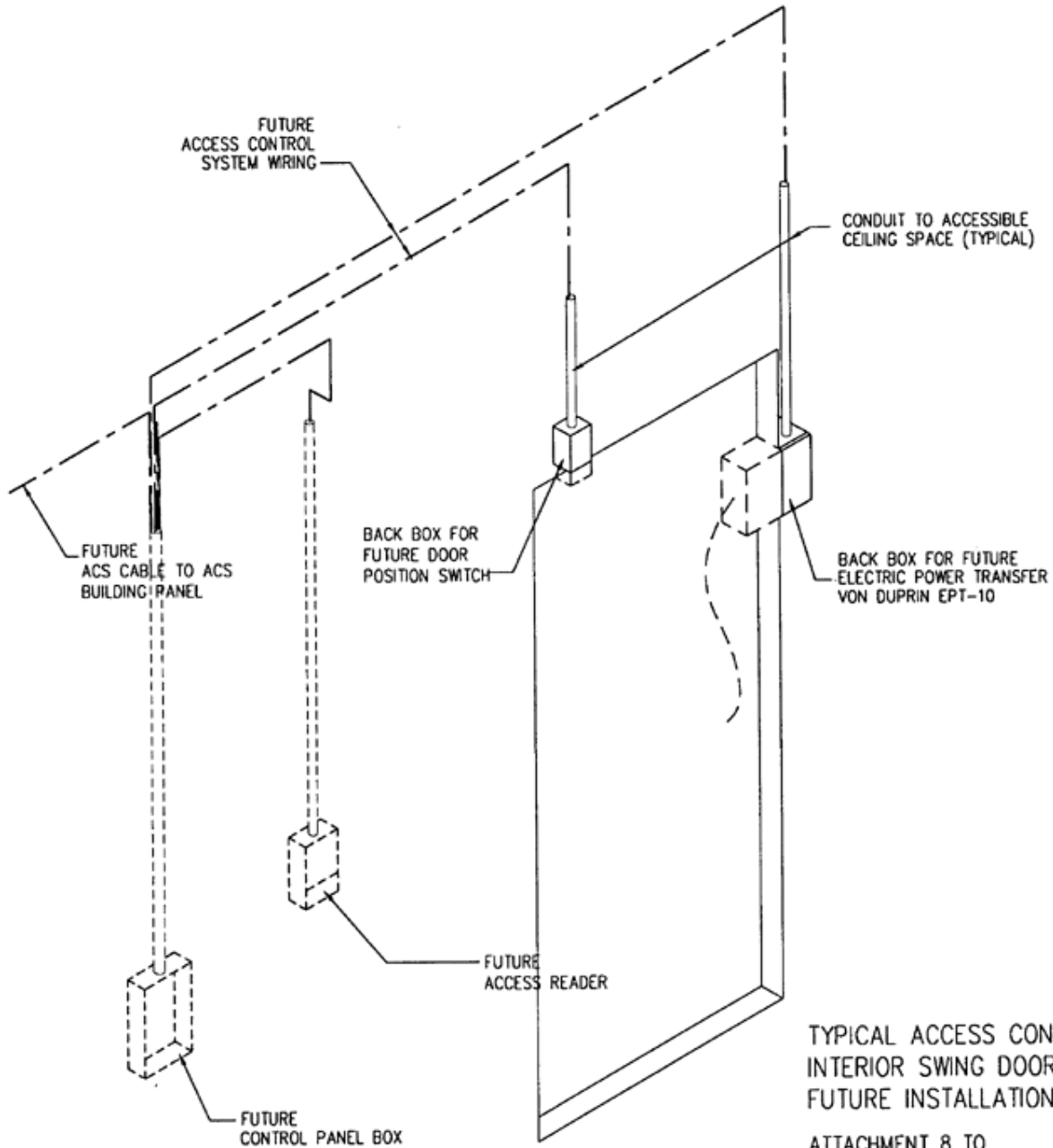
DOOR ACCESS CONTROL - ELECTRIC MORTISE LATCH INSTALLATION

Attachment 7 to DG 087400

Typical ACS Installation: Interior Swing Door Not in Exit Pathway, Electric Strike Option

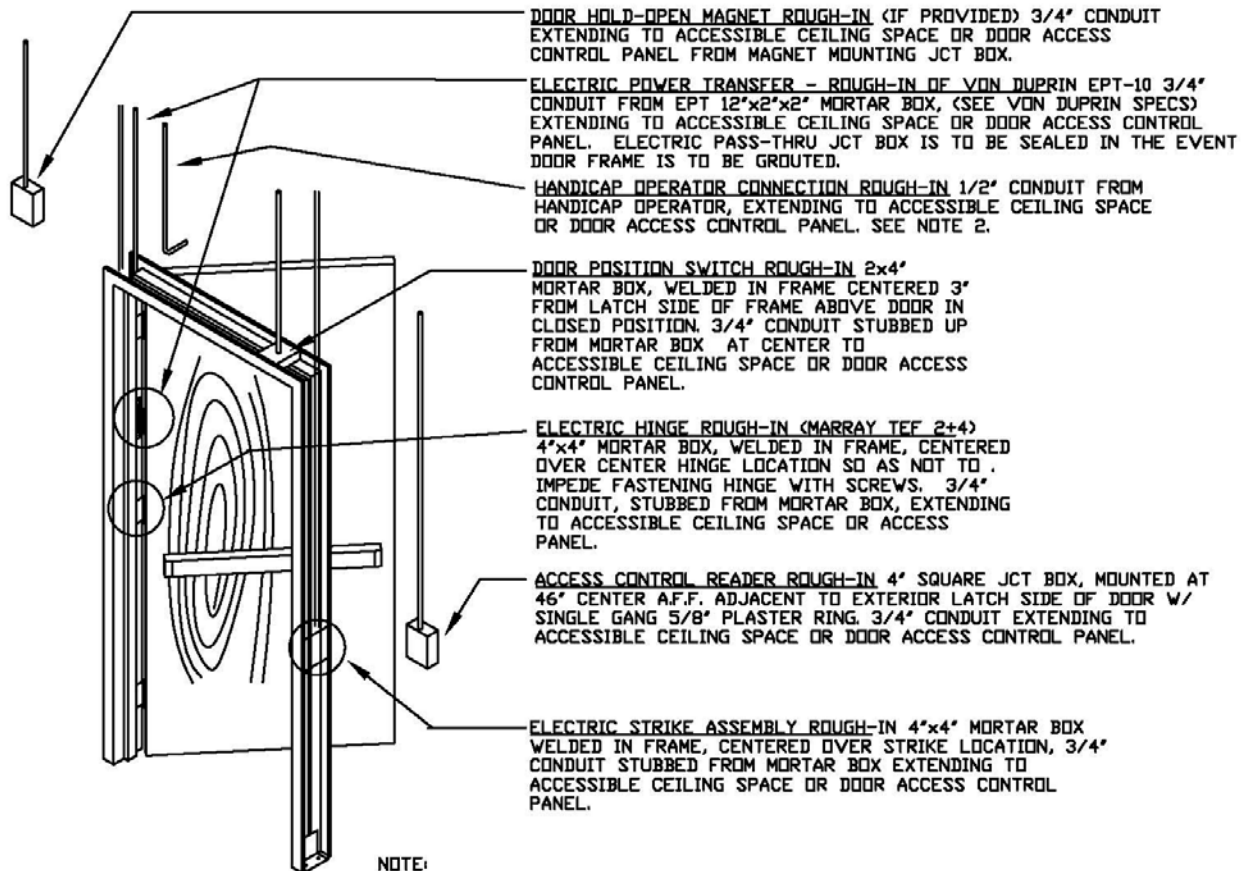


Typical ACS Installation: Interior Swing Door Rough-In for Future Installation



TYPICAL ACCESS CONTROL INSTALLATION
INTERIOR SWING DOOR ROUGH-IN FOR
FUTURE INSTALLATION

ATTACHMENT 8 TO
DESIGN GUIDELINE DG8-04



- NOTE:
1. IF DOOR IS TO BE GROUTED, GROUT ONLY TO LEVEL OF TOP FRAME MEMBER, MAKING SURE EPT-10 MORTAR BOX IS IN PLACE, PIPED & SEALED.
 2. IF DOOR IS TO BE EQUIPPED WITH HANDICAP ACCESS OPERATOR, THOSE ROUGH-IN PROVISIONS SHALL BE IN ADDITION TO THESE REQUIREMENTS. HANDICAP ACCESS OPERATOR SHALL HAVE CONDUIT RUN FROM ITS CONTROL PANEL TO THE DOOR ACCESS CONTROL PANEL.
 3. IF NO ACCESSIBLE CEILING SPACE IS NEAR THE CONTROLLED DOOR, ALL CONDUITS ARE TO BE RUN CONTINUOUS TO THE DOOR ACCESS CONTROL PANEL.
 4. FOR DOUBLE DOORS, DUPLICATE THE DOOR POSITION SWITCH ROUGH-IN AND ELECTRIC PASS THRU ROUGH-IN.
 5. IF PATH TO DOOR ACCESS CONTROL PANEL IS THRU EXPOSED AREA, ALL CONDUITS MAY BE JOINED TOGETHER AT A DEEP 4"x4" JCT BOX AND ROUTED TO THE CONTROL PANEL AS A SINGLE 3/4" CONDUIT.

ACCESS CONTROL - GENERIC ROUGH-IN DETAILS
DOOR HARDWARE SCHEDULE DETERMINES ACTUAL
ROUGH-IN REQUIREMENTS.

FINISHES

TABLE OF CONTENTS

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. FINISH MATERIALS IN HIGH TRAFFIC AREAS
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7. RESILIENT SHEET FLOORING
8. PAINTING
9. GYPSUM DRYWALL SYSTEMS
10. SUBSTRATE FOR CERAMIC TILE MATERIALS

PART 3 - EXECUTION

11. VENTILATION OF FRAMED-IN SPACES

PART 1 - GENERAL

1. GENERAL:
 - a. Application: Interior finish systems should be selected, detailed and specified in accordance with the requirements of these guidelines.

PART 2 – PRODUCTS

2. FINISH MATERIALS IN HIGH TRAFFIC AREAS:

a. Toilet Rooms (Single and Multiple Occupancy):

- (1) Floors: Ceramic tile. Do not use resilient tile or sheet materials.
- (2) Walls: Use ceramic tile behind lavatories, water closets, urinals and any other fixtures. Minimum height should be 4'-8" wainscot, although full height is preferred. Walls not finished with ceramic tile should be of durable material such as masonry or hard plaster, not painted gypsum drywall.
- (3) Substitutions: Concrete with epoxy finish, glazed tile or similar hard-surfaced materials may be substituted for ceramic tile.
- (4) Ceilings: Use hard surface materials such as hard plaster or moisture-resistant gypsum wallboard with eggshell enamel finish.

b. Corridors:

- (1) Walls: Use ceramic tile wainscot behind drinking fountains; use ceramic tile or other hard-surface material at elevator entrances.

3. CARPET:

a. Method of Purchase: The UNL Project Representative, in conjunction with the facility users and project designers and the UNL Purchasing Department, will determine the most advantageous method of procuring and installing carpet for each project, such as 1) including the carpet installation as a requirement of the prime construction contract; 2) seeking separate bids for the carpet installation, or 3) in the case of a small installation, negotiating directly with the then-current unit price vendor for floor covering work.

b. Approved Products: Where carpet is used in "program" areas, such as classrooms, lecture halls, seminar rooms, faculty and administrative offices, such products as Mohawk* "Barathea" or Bigelow* "Regents Row" have been found to be acceptable.. If the budget does not permit the use of these products, the UNL Project Representative may approve the use of less expensive products which are recommended by the UNL Purchasing Department. In areas of exceptionally high traffic, or in rooms or spaces of special architectural interest, other products may be used with the approval of the UNL Project Representative. The final decision as to the selection of carpet materials and the method of procurement will be made by the UNL Project Representative after conferring with the facility user and the project designers.

c. Installation in Remodel Work: Where new carpet is installed over existing mastic in remodel work, require that Contractor provide a floor stone coating or similar material over the existing mastic prior to the installation of new carpet to provide proper adhesion as required to fulfill the manufacturer's requirements for product warranty, except that the floor stone material is optional pending carpet manufacturer's recommendations for proper adhesion over existing mastic. The floor stone material should be a Portland-based product such as Ardex* Feather Finish (www.ardex.com/prod-sdf-bro.htm).

4. STAIR TREADS:

- a. Application: Where concrete stair treads and landings are to be finished with resilient flooring products, use materials conforming to this guideline.
- b. Approved Products: Where stairs are located near outside entrances or in other locations where tracked-in snow or water can cause hazardous footing, use RCA Rubber Co. No. 55 or No. 65 (depending on traffic exposure) smooth-surfaced abrasive-strip molded rubber stair treads. At other locations, use RCA Rubber Co. No. 50 or No. 60 smooth-surfaced molded rubber stair treads. At intermediate landings, require landing tile to match stair tread color and finish. Require that stair treads to be installed in one length on stairs up to 6'-0" wide.
- c. Unapproved Products: Do not use homogeneous vinyl stair treads/landing tile as a substitute for the materials mentioned above. Do not use raised or depressed "target" pattern products or incised diamond- or bar-type patterns.

5. ACOUSTIC PANEL CEILINGS:

- a. Application: Acoustic panel ceilings used in "functional" or "program" areas such as classrooms, lecture halls, laboratories, laboratory service areas, and administrative or faculty offices should conform to the requirements of this guideline. More specialized and/or elaborate variations of the suspension systems and acoustic panels may be used in those rooms or areas of special architectural interest within new or renovated facilities with the written approval of the UNL Project Manager.
- b. Acoustic Panels: 2' x 2' mineral fiber panels not less than 5/8" thick with non-directional fissured finish; panel edges may be square cut or revealed-edge (Tegular). If revealed-edge, reveal should be tapered (angular) with vertical edge of reveal sloping at an angle of approximately 20° from the vertical, or reveal may be beveled with a 1/8" bevel at the intersection of the face of the panel and the vertical revealed edge.
- c. Suspension Systems: The ceiling suspension system and its installation should conform to the requirements of ASTM C635 for Intermediate Duty service. Exposed face of suspension system tees should be 15/16" wide. Narrow face tees should not be used.
- d. Acoustic Panel Reinforcement: Provide reinforcement of acoustical panels where specified by acoustic panel manufacturer to support recessed lights, speakers, or similar items, consisting of a full-size piece of 1/2" AC plywood glued to the back surface of the panel. Where weight of supported item exceeds the recommendations of the manufacturer, support such items independently of the acoustic ceiling suspension system.

6. RESILIENT FLOOR TILE AND BASE:

- a. Application: Where resilient floor tile and base are selected as finishes, use materials conforming to this guideline.
- b. Floor Tile: Use vinyl composition tile, 1/8" thick, with full depth pattern, or smooth homogeneous rubber tile. Do not use homogeneous vinyl tile or rubber tile with raised stud pattern on exposed surface.

- c. Resilient Base: Use only homogeneous rubber base, furnished in rolls for seamless installation. Do not use vinyl base or base furnished in 4' lengths.
- d. Wax Finish on Resilient Floor Tile: Project specifications should not require the contractor/tile installer to wax new resilient floor tile. Wax finish will be applied by UNL Custodial Services around the time of project acceptance, the exact time of which will be coordinated by the UNL project manager.
- e. Installation in Remodel Work: Where new resilient flooring is installed over existing mastic in remodel work, require that Contractor provide a floor stone coating or similar material over the existing mastic prior to the installation of new resilient flooring to provide proper adhesion as required to fulfill the manufacturer's requirements for product warranty. The floor stone material should be a Portland-based product such as Ardex* Feather Finish (www.ardex.com/prod-sdf-bro.htm).
7. RESILIENT SHEET FLOORING:
- a. Application: Where resilient sheet flooring is selected as a floor finish, use materials conforming to this guideline.
- b. Sheet Vinyl Flooring: Use homogeneous vinyl floor with through-pattern construction not less than 0.080" thick, or commercial-grade backed sheet vinyl with a wear layer not less than 0.060" thick. Require sheet vinyl floor finish systems to be installed with heat-welded seams to provide one-piece installation. Typical products include Armstrong* "Medintech" or Armstrong* "Medintech Tandem".
- c. Sheet Rubber Flooring: Use homogeneous rubber with through-pattern construction, not less than 3/32" thick. Use 1/8" gauge material in high-traffic locations. Typical products include RCA Rubber Co.* "Flexi-Flor Sheet Rubber Flooring" or Mussen Rubber Co.* "No. 500L Sheet Rubber".
- d. Installation in Remodel Work: See requirements in paragraph 'e' of article 6 above.
8. PAINTING: See DG 099100.
9. GYPSUM DRYWALL SYSTEMS: See DG 092116.
10. SUBSTRATE FOR CERAMIC TILE MATERIALS:
- a. Ceramic tile materials should only be installed over cementitious backer board or concrete or concrete masonry substrates or cement plaster substrate.

PART 3 - EXECUTION

11. VENTILATION OF FRAMED-IN SPACES:

- a. Framed-in spaces, such as areas below stages or risers in classrooms, constructed with wood components, should be ventilated to adjoining occupied spaces to prevent dry rot of the wood members.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. GYPSUM WALLBOARD

PART 3 - EXECUTION

3. PARTITION CONSTRUCTION
4. BULKHEAD CONSTRUCTION

PART 1 - GENERAL

1. GENERAL:

- a. Application: Gypsum drywall systems should be designed and specified in accordance with this Guideline.

PART 2 - PRODUCTS

2. GYPSUM WALLBOARD:

- a. Wallboard Type: Type "X" (fire-retardant) wallboard should be used throughout except at locations where moisture-resistant wallboard is required.

- b. Thickness: In single thickness applications, 5/8" thick wallboard should be used. In multiple layer applications, use not less than 1/2" thick wallboard unless other thickness required for fire rating of partition system.

- c. Application: Single layer gypsum board should be erected with the long dimension horizontal, with ends located over firm bearing (at stud locations), and with joints staggered. These measures result in a stronger wall and facilitate the future installation of wall cabinets and equipment. Drywall joints should be finished with three coats of joint compound, sanded between coats.

PART 3 - EXECUTION

3. PARTITION CONSTRUCTION:

- a. Framing for Interior Partitions: Partitions should be framed with 3-5/8" deep, 25 gauge metal studs spaced at 16" o.c. and screw-attached (not crimped) to top and bottom runner channels. Studs at jambs of door and window openings in partitions should be 20 gauge, doubled, back-to-back to provide cavity for grouting frames.
- b. Partition Heights:
 - (1) Walls Enclosing Conference Rooms: Framing and drywall finish should extend to the underside of the structure above. Wall cavities should be filled with acoustic blankets and perimeter joints sealed with acoustical sealant. If STC rating of wall is critical, provide double layer of drywall on one or both sides of partition, depending on STC requirements. Require the use of non-hardening acoustical sealant in joints around entire perimeter of sound-rated walls or partitions. Sealant should be applied to fill the perimeter gap between the gypsum board faces and the surrounding floor, wall, and ceiling elements by placing a heavy fillet bead of caulking adjacent to the floor or ceiling runner or wall stud prior to the installation of the gypsum board so that when the gypsum board is subsequently installed it compresses the "bead" completely filling the gap of each gypsum board layer. Require that all penetrations through sound-rated wall systems, including electrical outlets, recessed cabinets, ductwork, piping and conduit, are caulked at their perimeter.
 - (2) Walls Enclosing Toilet Rooms: Same as indicated above for Conference Rooms.
 - (3) Walls Enclosing Offices for Deans, Managers and Directors: Same as indicated above for Conference Rooms.
 - (4) Fire Separation Partitions: Framing and finish should extend to underside of fire-rated structure above. Joint and fastener finishing above ceiling line is required only to the extent required by the building code to provide the fire rating for the partition.
 - (5) Other Dividing Walls: Framing and drywall finish should extend to 6" above ceiling line.
- c. Edge Treatment: Where new walls abut existing non-like walls or partitions, a wet-bead metal or vinyl tear-away termination should be used.

4. BULKHEAD CONSTRUCTION:

- a. Where bulkheads are required at changes in ceiling planes or at windows or drapery pockets, use gypsum drywall/metal stud construction. Do not allow the use of acoustic ceiling panel systems for bulkheads.

PAINTING

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. PAINT SYSTEMS
3. LEAD-BASED PAINT

PART 3 - EXECUTION

4. DISPOSAL OF UNUSED MATERIALS

PART 1 - GENERAL

1. GENERAL:

- a. Application: Painting and finishing systems for job-finished surfaces should be specified in accordance with this Guideline.
- b. Acceptable Manufacturers: Paint products produced by the following manufacturers are acceptable for use on University of Nebraska-Lincoln projects:

Devoe & Reynolds Co.
Iowa Paint Co.
Benjamin Moore & Co.
Kwal Paint (formerly Sophir Morris)
Diamond Vogel
Glidden Paint Co.
ICI Paints North America
Pittsburgh Paint Co.
Pratt & Lambert, Inc.
Sherwin-Williams Co.

- c. Standard Paint Colors: The UNL Building Systems Maintenance (UNL BSM) maintains a stock of standard paint colors for its use when repainting interior walls, partitions and trim as a maintenance activity. The use of these standard colors on renovation or new construction projects is not mandatory. If it is necessary to match the color of one of these stock paints, UNL BSM can provide the name of its current supplier and the designation for the colors currently in use. The standard colors may change from time to time as the vendor supplying the maintenance stock changes. A list of the current preferred UNL Standard Paint Colors and preferred Accent Colors now stocked by UNL BSM is included as Attachment "A" to this Guideline.

- (1) Stock Color for Interior Hollow Metal Frames:

To match PPG Semi-Gloss Enamel Color "Nut Brown" for work adjacent to existing frames which are not repainted; for new work use PPG "Architectural Brown".

- (2) Stock Color for Hardwood Veneer Doors and Hardwood Casework and Trim:

To match PPG Wood Stain "Dark Oak"

d. Exterior Paint Colors: Paint color for exterior items, such as railings, posts, and signs should match Glidden's color No. 4656; where a trim or contrasting color is required, use a color matching PPG Paints "Jersey Cream".

PART 2 - PRODUCTS

2. PAINT SYSTEMS:

a. Interior Paint Systems:

- (1) For interior walls and ceilings of plaster or gypsum wallboard, or concrete or concrete masonry not requiring a glazed finish, use the following paint system:

Prime Coat: Non-toxic, ready-mixed latex-based primer-sealer.

Finish Coats: Non-toxic, ready-mixed, latex-based low-sheen (egg shell) enamel, 2 coats.

Do not use proprietary paint systems, such as "Zolatone", which require the use of special products or application techniques for repair of maintenance of the surface.

- (2) For interior hollow metal door frames, hollow metal doors, and other ferrous metal and wood items designated for a painted finish, use the following paint system:

Prime Coat: Zinc chromate primer (metal surfaces) or alkyd-based wood undercoat (wood surfaces).

Finish Coats: Alkyd-based semi-gloss enamel, 2 coats.

- (3) For interior hardwood veneer doors and hardwood trim and casework:

Filler: Solvent-based, air-drying paste-type wood filler.

Stain: Oil-type penetrating wood stain.

Finish Coats: Urethane varnish, satin gloss, 2 coats.

b. Exterior Paint Systems:

(1) For exterior ferrous metal items, including hollow metal frames and doors, use the following paint system:

Prime Coat: Rust-inhibiting alkyd- or oil-based metal primer.

Finish Coats: Alkyd-based exterior gloss enamel, 2 coats.

3. LEAD-BASED PAINT:

a. The use of lead-based paint shall be specifically prohibited by the project specifications.

PART 3 - EXECUTION

4. DISPOSAL OF UNUSED MATERIALS:

a. The project specifications should require that the Contractor remove from the project site and legally dispose of all left-over and unused painting and finishing products. The UNL Project Manager, with the concurrence of UNL BSM and the facility user department may request that specific paints be saved in a location specified by UNL BSM.

ATTACHMENT “A”**PAINT COLORS STOCKED BY UNL BUILDING SYSTEMS MAINTENANCE**

1. Standard Colors: The colors listed below are identified by the name and number of Iowa Paint:

<u>Number</u>	<u>Name</u>	<u>Remarks</u>
5990W	Snow Shadow	White
5435N	Charcoal	Black/Brown; replaces Nut Brown for door frames
5910W	Oyster White	Previously identified as “Vanilla”
5760W	White Shadow	Previously identified as “Chalk Gray”
5380W	Baby’s Breath	
5400W	Belgian Gray	
5560W	Saltspray	
5500W	Rain Drop	
5940W	Marsh	
5440W	Mountain Fog	

2. Accent Colors: The colors listed below are identified by the name and number of Iowa Paint.

<u>Number</u>	<u>Name</u>	<u>Remarks</u>
5493M	Signature	
5433M	Swan Gray	
5403M	Otter	
5373M	Pelican	
5564M	Colony Green	
5503M	Parliament	Similar to Arch Hall accent color

SIGNAGE

1. Interior directional and door signage and building directories for new construction or renovation projects must conform to the placement, layout and construction requirements given in the current version of the UNL Interior Signage policy. The policy may be viewed at:
<http://fmp.unl.edu/fpc/InteriorSignage.shtml>
2. The purchase and installation of interior project signage may be included as part of the contract for general construction or may be handled under a separate contract, as determined by the Project Architect in conjunction with the UNL Project Representative.

PLAQUES

TABLE OF CONTENTS

1. GENERAL
2. PLAQUE DESCRIPTION

1. GENERAL:

- a. Application: A building dedication plaque conforming to these guidelines should be required for all new building projects.
- b. Location: The plaque should be located where it is visible to persons using the building's main entrance. Indicate location on construction documents.
- c. Approval: Project specifications shall require the submittal of a detailed drawing showing the exact layout and text of the plaque for review and approval by the offices of the Chancellor of the University of Nebraska-Lincoln and the President of the University of Nebraska.

2. PLAQUE DESCRIPTION:

- a. Size: 24" x 18".
- b. Material: Cast aluminum or cast bronze, as appropriate.
- c. Design Features: See Standard Details SD10-04, SD10-05a and SD10-05b for seal, plaque layout and lettering style. Border and raised copy should have standard satin polished finish.
- d. Plaque Content: Plaque should contain the following information:
 - (1) Project name and date of project completion or building dedication.
 - (2) Seal of the University of Nebraska.
 - (3) Name and place of residence of members of the Board of Regents. The Regents identified on the plaque shall be those Regents in office at the time of the building dedication.

(4) Name of University of Nebraska System president. The University president identified on the plaque shall be the president in office at the time the plaque text is approved.

(5) Name of University of Nebraska-Lincoln chancellor. The University of Nebraska-Lincoln chancellor identified on the plaque shall be the chancellor in office at the time the plaque text is approved.

TOILET ACCESSORIES

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. ACCESSORY ITEMS
3. TOILET COMPARTMENTS

PART 1 - GENERAL

1. GENERAL:

- a. Application: Toilet accessory items which dispense consumable supplies or which otherwise require servicing by custodial staff should be compatible with the types of products stocked by the UNL Custodial Services Division, as identified below.
- b. Installation: Toilet accessories should be mounted at heights which conform to ADA requirements.
- c. Finish: Do not specify accessory items with a plastic laminate finish.
- d. Accessory Locations: Mirrors should be located such that reflected images will not be available from adjacent spaces, such as corridors. Construction drawings should indicate with dimensions the location of all accessory items. Soap dispensers should be located with spouts above lavatory, to avoid drippage on floor.
- e. UNL Custodial Services Division Approval: Require that complete list of accessory items be submitted to UNL Custodial Services Division for review and approval prior to purchase and installation of accessory items.

PART 2 - PRODUCTS

2. ACCESSORY ITEMS:

- a. Paper Towel Dispenser: Paper towel dispensers should dispense roll towels, 800' x 8" size, Scott #1040, the standard re-supply item stocked by the UNL Custodial Services Division. Individual towel dispensers should be Kimberly Clark* Lev-R-Matic #09706, smoke color; or Bobrick* #B-2860 surface mounted dispensers.
- b. Combination Paper Towel Dispenser-Receptacle: Bobrick* #B-3961 with 12 gallon waste receptacle or #B-39617 with 18 gallon waste receptacle recessed touch free roll paper tower dispensers.

- c. Soap Dispenser: Soap dispensers will be purchased through UNL FM&P Custodial Services. Dispensers selected will utilize the standard stock soap used by UNL Custodial Services. Dispensers will be installed by UNL Custodial Services.
- d. Toilet Tissue Dispenser: Toilet tissue dispensers will be purchased through UNL FM&P Custodial Services. Dispensers selected will utilize the standard stock toilet tissue used by UNL Custodial Services. Dispenser will be installed by UNL Custodial Services.
- e. Sanitary Napkin Disposal: Recessed for installation in building wall, Bobrick* #B-353 or double unit to serve two toilet compartments, Bobrick* #B-354.
- f. Tilt Mirror for Handicapped Lavatory: Bobrick* #B-293.

3. TOILET COMPARTMENTS:

- a. Partition Type: Toilet partitions for non-spectator type facilities should be enameled metal, ceiling-hung type. The height of the suspended soffit enclosing the structural supports for the pilasters should not exceed 8'-4" above the floor. The type and construction of toilet partitions used in spectator facilities or other heavy-usage installations should be reviewed with the UNL Project Manager.
- b. Wall Attachment: Toilet partitions, dividers, and screens abutting building walls should be secured to the wall with a continuous channel or wall flange of stainless steel or extruded anodized aluminum running the full height of the panel. The channel should be secured to the wall at approximately 8" intervals. Wood header blocking should be provided in framed walls for the proper anchorage of the wall channel. The continuous wall channel should be similar to Capitol Partitions Inc.* No. 201C.
- c. Standard Stall Size and Layout: Standard toilet stall partitions (those not designed for accessibility by the disabled) shall be 36" wide by 60" clear inside dimension. Locate the centerline of the toilet fixtures 16"/20" within the 36" stall. Locate the toilet tissue dispenser on the partition wall which is 20" from the centerline of the toilet fixture to allow additional space for the dispenser. Where inward-swinging doors on standard toilet partitions are used they shall be 24" wide, hinged from the partition wall which is 16" from the centerline of the toilet fixture to maximize space adjacent to tissue dispenser. Where outward-swinging doors are used they shall be sized as appropriate to the design layout, but not less than 24".

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1. GENERAL:

- a. Door Hardware: Fire extinguisher cabinet doors must not be lockable.

COLD STORAGE ROOMS AND CABINETS

1. GENERAL:

- a. Application: All refrigerated walk-in and reach-in units and all growth chambers should be designed and/or specified to incorporate the features described in this guideline.
- b. Equipment Selection and Design:
 - (1) Air cooled condensing units should be utilized wherever possible.
 - (2) Condensing units of 2 HP or less should be located in mechanical equipment rooms wherever possible.
 - (3) If condensing units are located out-of-doors, a proper winterization kit should be installed to maintain correct operating pressures.
 - (4) Do not utilize condensing units which operate on a vacuum, except on special extra-low temperature equipment.
 - (5) On standard walk-in units, a pump-down cycle, utilizing a thermostat and solenoid, should be used.
 - (6) Copper tube, Type L-ACR (air conditioning and refrigeration) should be used for field service refrigerant piping. Follow ASHRAE guides for copper supports and piping.
 - (7) Suction lines should be insulated with moisture resistant insulation of the proper thickness. When piping runs through the cabinet wall, insulation shall run continuously through the wall with no gaps or joints.
 - (8) Use a solid core desiccant-type dryer on the liquid line. The largest size dryer should be used; e.g. on a 3/8" liquid line, use the largest available 3/8" dryer. All dryers should be mechanically removable.
 - (9) Liquid line sight glass indicator should have a moisture indicator on it, installed on the downstream side of the dryer.
 - (10) When the unit operates at temperatures below 36° F., an electric defrost should be provided on the cooling coil.
 - (11) Use vibration eliminators on the refrigeration lines, at the source of vibration.

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- (12) Use vibration pads under the condensing unit, if necessary to reduce the noise transmission.
- (13) Where possible, use 208 volt compressors on small units with fractional horsepower. (480 volt units are difficult to obtain.)
- (14) If a condenser has to be located on a roof, particular attention should be given to the design of the support pad and the correct installation of the roofing and flashing. See Standard Detail SD7-01.
- (15) Install suction line accumulators on low-temperature applications.
- (16) Follow the procedures described in DG 230000.20 when welding or installing copper lines or fittings.
- (17) Require that procedures employed in charging refrigeration systems with refrigerant or removing refrigerant from systems be carried out in strict compliance with E.P.A. guidelines. Technicians working with refrigerants should be required to be certified in compliance with E.P.A. requirements. Cold room controls shall be provided.

ELEVATORS

1. APPLICATION:

- a. Passenger elevators installed in conjunction with new building projects or building renovation projects should be designed and specified to incorporate the requirements contained in this Guideline. Elevator installation shall conform to ANSI Standard A17.1 for Elevators and State of Nebraska Elevator Inspector requirements.
- b. Freight elevators require that both the car doors and the hoistway doors shall be automatic. The emergency door release box shall be standardized EMS.
- c. Require that elevator installer notify UNL Project Representative and UNL Building Systems Maintenance Department (UNL BSM) of date and time of final inspection by State of Nebraska Elevator Inspector.

2. ELEVATOR INSTALLATION:

a. Hoistways:

Provide a 4' fluorescent light fixture with electronic ballast, wire cage and two T-8 lamps at top of hoistway. Provide the same light fixture at every level of hoistway and at the pit. Include switching to control all lights at every level. Provide a switch at every landing in the hoistway that controls all lights in the hoistway.

b. Cab Size: Minimum capacity shall be 2,500 lbs.

c. Elevator Lobbies:

Car riding jamb lanterns (directional arrows and audible signal) are more cost effective than hall lanterns on each floor.

d. Elevator Equipment Rooms:

(1) Provide air conditioning and exhaust that is independent from the building HVAC system.

(2) Main disconnects to elevator controllers should be fused type switches. Reference IBC 3006.2. Require HVAC to be totally independent.

(3) Provide a conduit and J-box connection to the elevator controller equipment enclosure for terminating the phone line with the conduit coming out of the box into the

elevator equipment. This is for connection by the elevator contractor. It will allow testing of the phone line without having to get into the elevator controller.

e. Elevator Pits:

- (1) Locate light switch and other devices in coordination with elevator installer.
- (2) In sprinkled buildings, a sprinkler head should be located within two feet of the bottom of the hoistway.

f. Hydraulic Jacks:

When possible, coordinate location of geo-technical test bore with elevator jack location to identify potential sub-grade obstructions or unusually high water tables which may be encountered during boring for the hydraulic jack.

g. Control and Signal Features:

- (1) Require LED-type lamps for all signal equipment including hall and car call buttons and hall and car lanterns.
- (2) Require door protective edges to be infrared array type. Janus 3-D edge or equivalent.
- (3) Require battery back-up emergency lowering option on hydraulic elevators.
- (4) Fire service **key identification** shall be **FEO-K1**.
- (5) Spare wiring required from elevator equipment room to elevator cab for security and CCTV use. Wiring shall consist of: 2 ea. RG 59 coax, and 3 ea. six conductor shielded twisted pair (18 ga.).

h. Signage:

- (1) UNL will provide signage "In Case of Fire, Do Not Use Elevators".
- (2) Require elevator installer to provide all other signage related to elevator use.

i. Emergency Communication Device:

- (1) UNL will provide "ring-down" telephone line to elevator controller in elevator equipment room.
- (2) Require that an ADA-compliant hand-free emergency communication device be installed in each cab. Device should be manufactured by Rath Microtech and shall be flush-mounted in the car operating panel.

j. Non-Proprietary Equipment:

The elevator control equipment proposed for the project identified below shall be Non-Proprietary. The following provisions comprise a warranty representing compliance with established standards for Universal Serviceability and Maintainability:

- (1) Equipment Purchase Unrestricted - Any elevator company shall be allowed to purchase and install this equipment. Permitted controllers are limited to:
 - MCE Motion Control Engineering

- EC Elevator Control Corp.
 - Vertitron
- (2) Spare Parts – Spare parts shall be available for sale for replacement or stock to be maintained at the building site, or the offices of any elevator contractor designated by the building owner to maintain their equipment.
- No exchange-only provisions shall limit any parts purchase.
 - No building owner approval shall be required to processing any parts order.
 - A published price list shall establish reasonable list pricing for parts.
- (3) Diagnostics – The control system shall be provided together with all available diagnostic tool functions, either onboard or in a separate device.
- Such maintenance, adjustment and troubleshooting device or system shall provide unrestricted access to all parameters, levels of adjustment, and flags necessary for maintenance of equipment.
 - No expiring software, degrading operation, or key shall be accepted. Any lost or damaged tool shall promptly be replaced or repaired at reasonable cost.
- (4) Training – Factory and/or on-site training shall be available from the original equipment manufacturer for enrollment by anyone who wishes to learn about installation, adjustment, maintenance and troubleshooting the equipment. Training fees shall be reasonable and appropriate.
- (5) Technical Support Hotline – A technical support hotline shall be provided by the original equipment manufacturer whereby anyone designated by the building owner shall be able to obtain assistance for installation, adjustment, maintenance or troubleshooting.
- (6) Engineering Support – The original equipment manufacturer shall provide engineering support to any maintaining contractor so designated by the building owner.
- (7) Documentation – Manuals, engineering drawings, circuit diagrams and prints shall be provided with the equipment at time of delivery. All documentation shall be available for replacement purchase, at reasonable cost, by any installing or maintaining elevator contractor or persons so designated by the building owner.

FIRE SUPPRESSION

PART 1 - GENERAL

1. GENERAL

PART 2 - PRODUCTS

2. SYSTEM COMPONENTS

PART 3 – EXECUTION

3. INSTALLATION REQUIREMENTS
4. CLEANING AND TESTING

PART 1 - GENERAL

1. GENERAL:

- a. Incorporate into the design of any facility appropriate fire suppression systems to suit the functional areas within the building, including wet sprinkler systems, pre-action dry pipe systems, standpipes, chemical systems, and special systems such as kitchen systems.
- b. All spaces within a facility should be covered by at least one automatic suppression system suitable to the hazard classification, as determined by UNL representatives in conjunction with the State Fire Marshal.
- c. Require close coordination by fire suppression system installer with the fire alarm system installer for all alarm tie-ins in order to produce a fully supervised system.
- d. Fire suppression systems required for a new facility may be designed by the project architect/engineer and incorporated into the contract drawings and specifications or the project specifications may require the fire-suppression system installer to fully design the system, such design to be prepared under the direction of a person qualified and registered to design systems of the type required. In either case, fire suppression system installers should be required, as a part of the contract requirements, to furnish shop drawings and/or the design drawings for review by the UNL project manager and architect/engineer and submittal to the State Fire Marshal for approval prior to the start of construction. Changes in any aspect of the design shown in such drawing submittals should not be approved without the concurrence of the UNL representative.
- e. Fire suppression systems should be based on hydraulic design. The system should be required to provide a 25% excess capacity at all points to allow for future expansion.
- f. Fire suppression system design drawings should carry the stamp of a registered professional engineer.
- g. Refer to DG 010000.15 for requirements relating to Telecommunications Wiring Closets.

h. All fire suppression system installations should be required to conform in all respects to NFPA Standards 13, 14, and 24 and all other applicable NFPA standards.

PART 2 – PRODUCTS

2. SYSTEM COMPONENTS:

a. Materials and equipment should be required to conform to the requirements of the Factory Mutual Engineering Corp.(FM) to the extent that FM standards are available for materials and equipment installed as components of the fire suppression system. Where FM standards do not exist, materials and equipment used in the fire suppression system installation should be required to conform to the requirements of the Underwriters' Laboratories, Inc. (UL). The fire suppression system installer should be required to submit proof that the items furnished conform to the requirements of these agencies. The Underwriters' Laboratories, Inc. (UL) label or seal or listing in the Fire Protection Equipment List will serve as acceptable evidence that the items conform to the requirements of the UL. The Factory Mutual (FM) label or seal or listing in the Factory Mutual Approval Guide will be acceptable evidence that the items conform to the requirements of FM.

b. The following requirements should be included in the specifications unless specific circumstances require variances. Such variances should be acknowledged in writing by UNL representatives.

(1) FD Connection: Siamese inlet installed at wall or pit location should be polished brass, grade-mounted angle body, fire-department connection with polished brass cover sleeve and identification plate, 2-1/2" connections in the quantity to suit the system size, threaded to match those of the local fire protection service, polished brass caps and chains. Identification plate should carry integral raised letters reading "Automatic Sprinkler". Provide connection with FM/UL approved swing check valve. Require that an automatic ball drip be installed between the Siamese connection and check valve.

(2) Piping:

(a) Adjustable Drop Nipple: Black steel, 2-1/2" to 5", consisting of body, nipple, retaining ring, O-ring and rollers, FM/UL-approved, 175 psig WWP.

(b) Black Steel Pipe: ASTM A53, A120, and A135, with malleable iron fittings, ANSI B16.3, or cast iron fittings, ANSI B16.4, or FM/UL-approved, bolted flexible groove-type couplings, fittings, mechanical-tee stub-ins, or fast installation-type products. Sections of branch lines, cross mains, feed mains, or risers may be welded, subject to the limitations described in NFPA Standard 13.

(c) Underground Piping: Underground piping from the building to the point of connection to the fire protection service pit-located primary valve valve should be ductile iron, AWWA C151, working pressure 150 psig, exterior bituminous coating, cement lined with matching fittings. Require flanged and anchored connections for the interior piping. All joints should be strapped, without using the building as a kick block, and full clearance should be maintained, 360 degrees around the pipe.

(d) Underground service piping to within 5 feet of the building should be provided in accordance with the requirements pertaining to the water service connection to the building.

- (3) Pipe Hangers: Pipe hangers should conform to the requirements of NFPA Standard 13, and FM/UL requirements for use in sprinkler systems.
- (4) Sprinkler Fitting: Hooking collar assembly that may be optionally used for connecting sprinklers or drop nipples to sprinkler pipe. Housing should be malleable iron or ductile iron, FM/UL-approved, 175 psig WWP.
- (5) Sprinklers:
 - (a) Sprinklers should conform to Fire Protection Equipment List of FM/UL for the required application and for upright pendent, sidewall, or other locations. Sprinklers should be placed in the upright or pendent position as required, with the deflector parallel to the ceiling. Clearances between the deflectors or other obstructions should be in accordance with NFPA Standard 13.
 - (b) Automatic sprinklers should be standard automatic closed type with 1/2 inch nominal size orifice. Temperature ratings of fusible elements should be in accordance with NFPA Standard 13. In areas of above normal temperatures, high temperature sprinklers suitable for temperature conditions involved should be provided.
 - (c) Sprinklers should be Standard* Model E, Viking*, Grimes*, or approved equal, upright, concealed and/or pendent, satin chrome finish. Central Sprinkler Model GB sprinklers should not be permitted.
- (6) Escutcheons should be steel satin chrome finish to match sprinkler heads.
- (7) Valves:
 - (a) Alarm check valves should be provided with standard trimmings including circuit closer, pressure gauges, retarding chamber, water motor gong, alarm switch, testing bypass, and all necessary pipe, fittings and accessories required for a complete installation conforming to NFPA Standard 13.
 - (b) Automatic ball drips should be FM/UL approved 3/4" cast brass in-line with both ends threaded with iron pipe threads. Two inch pipe drain and test line should penetrate building wall to outside discharge on concrete splash block at 45° angle.
 - (c) Butterfly valves should be gear-operated, indicating type, FM/UL-approved, 175 psig WWP.
 - (d) Check valves should be FM/UL-approved, 175 psig WWP.
 - (e) Fire department valves within the building should be bronze, 2½" threaded, provided with caps and chains. Valves should be provided exposed or with fully recessed cabinets. Cabinet boxes should be factory painted, with glass-faced stainless steel doors.
 - (f) The fire department valve located 36" above the roof line should be bronze, 2½" threaded, provided with cap, chain and brass wall flange.
 - (g) Gate valves should be OS & Y, FM/UL-approved, 175 psig WWP.

(h) Require identification sign (enamel on metal) on all valves in accordance with NFPA Standard 13. All valves except zone control, main entrance, service and test and drain valves should be sealed in open position. Each sign should have the area served specified on the back of the sign or on a wall posting adjacent thereto.

(i) Require tamper switch for service entrance valve in pit, at each zone valve and preaction system zone and drain valves. Switch should close contacts when valve tampering occurs.

PART 3 – EXECUTION

3. INSTALLATION REQUIREMENTS:

a. Additions to Existing Installations: UNL fire safety personnel should be present during any shut down or activation of sprinkler or alarm systems. Fire sprinkler modification should be done as specified in NFPA Standard 13 in all respects and meet or exceed the most stringent applicable codes. The fire sprinkler system must not be left inoperative overnight. Work, therefore, should be completed in such a way that caps and plugs may be used to allow the contractor to re-activate the system at the end of each work day before leaving the premises.

b. Testing: After all sprinkler work is completed, the system should be hydrostatically tested to 200 psi for two hours by the installing contractor but with the appropriate UNL representative present.

c. Installing Contractor's Qualifications: Require the submission of a notarized certification that installation of the entire system will be executed by a representative or licensee of a manufacturer of approved sprinklers and devices and that installer is currently and has been engaged in the installation of automatic sprinkler systems and fire protection devices and is currently licensed in the State to complete such work.

d. Spare Parts and Tools: The installing contractor should be required to furnish spare automatic sprinklers in accordance with NFPA Standard 13. The sprinklers should be packed in a suitable metal cabinet and should be representative of and in proportion to the number of each type and temperature rating of the sprinklers installed. The installing contractor should be required to furnish no fewer than two special sprinkler head wrenches, or at least one head wrench for each cabinet or sprinkler type, whichever is greater.

e. Specify the following requirements for installation of fire suppression systems:

(1) All materials and equipment should be installed in accordance with NFPA Standard 13.

(2) Arrange, phase and perform work to assure adequate services for the Owner at all times.

(3) All valves and switches should be installed within seven feet of the floor in accessible locations (chases, pipe shafts and similar locations) as required by code and as necessary to provide for economical maintenance services. Require the installation of access panels where appropriate. Locations of valves and switches should be marked for ready identification access for testing, maintenance, and emergencies.

- (4) Bracing and Clamping: Bends, plugs, and tees should be braced or clamped in accordance with the requirements of NFPA Standard 24. The connection between the underground piping and the base of the riser should be anchored by means of tie rods and pipe clamps.
- (5) New work should be connected to existing work in a neat and workmanlike manner. Where an existing surface must be cut, or existing utilities interfere, such obstruction should be bypassed, removed, replaced or relocated, patched or repaired. Work disturbed or damaged should be replaced or repaired to its prior condition.
- (6) The location of tubing, wiring, sleeves, inserts, hangers and equipment for this work should be coordinated with other trades. Piping, sleeves, inserts, hangers and all other equipment should be located out of the way of windows, doors, openings, light outlets and other services and facilities. Fire suppression system components shall not inhibit access to building system items requiring maintenance.
- (7) Flow Alarm Switch: FM/UL-approved water flow switches which will close contacts when flow is detected should be installed in sprinkler lines required by NFPA requirements. Water flow switches and adjacent valves should be installed to be easily accessible in chases or shafts, behind access panels, no more than 7'-0" above floor. Flow switches should be located no less than 12 inches from a fitting that changes the direction of flow and no less than 24 inches from a drain connection or 10 pipe diameters from a gate, check or alarm valve.
- (8) Flushing: Before connecting sprinkler system to underground supply connections, require that each supply connection be flushed out thoroughly in accordance with requirements of NFPA Standard 13.
- (9) No bushings should be used.
- (10) Pipe sleeves should be installed according to article 5-SUPPORTS, ANCHORS AND SLEEVES contained in DG 230000.20.
- (11) Require drains at the base of risers, on valves sections and at other locations requiring same for complete drainage of system. Drains should be valved and connected to central drain riser or should exit building to splash block. If drains exit buildings, they should be provided with a hose fitting to permit connection of a hose to direct drainage to the nearest paved drainage course.
- (12) Require test pipes in accordance with NFPA Standard 13. Main test pipes should be 2". Test pipes should be valved and piped to discharge through proper orifice. All test pipe should be daylighted outside the building. No test pipe should terminate inside the building.
- (13) The sprinkler system supply line should be laid below the frostline. Depths of cover over water pipes should be in accordance with NFPA Standard 24. Connections to the water supply main should be performed to minimize the inconvenience resulting from water service interruption.
- (14) Each sprinkler zone should coincide with each smoke zone as required by NFPA Standard 101 and should be shown on the fire protection system drawings. Require accessories to be installed as indicated on drawings, including valves, flow switch, sight glass, etc.

(15) Tamper switches for each sprinkler zone control valve, main entrance service valve and pre-action system valves should be connected to the fire alarm system.

4. CLEANING AND TESTING:

a. The installing contractor should be required to furnish UNL with one bound copy of complete instructions, including catalog cuts, diagrams, drawings, and other descriptive data covering the proper testing, operation, and the necessary information for ordering replacement parts. In addition, one copy of complete instructions should be posted at the alarm check valve location.

b. Upon completion of the system and prior to acceptance of the installation, the contractor should be required to subject the system, including the underground supply connection, to the tests required by NFPA Standards 13 and 15, in the presence of the State Fire Marshal and UNL representatives, and should furnish the Architect/Engineer with a certificate as required thereof.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

MATERIALS, EQUIPMENT AND METHODS (PLUMBING)

PART 1 - GENERAL

1. PLUMBING FIXTURE SELECTION AND LAYOUT
2. DESIGN AND INSTALLATION

PART 2 - PRODUCTS

3. PIPE AND PIPE FITTINGS
4. PIPE INSULATION

PART 3 - EXECUTION

5. CLEANING AND TESTING
6. PIPE AND VALVE IDENTIFICATION

PART 1 - GENERAL

1. PLUMBING FIXTURE SELECTION AND LAYOUT:
 - a. All plumbing fixtures shall be wall-hung.
 - b. All fixtures shall be vitreous china. Urinals shall be wall-hung, with integral flushing rim, semi-concealed overflow and integral trap.
 - c. The fixtures and valves shall be of the water saver type. Particular consideration shall be given to 1/8th gallon flush urinals.
 - d. All fixtures shall be required to have carriers.
 - e. Every restroom in new facilities shall have handicapped fixtures. If only one water closet is required by personnel count, provide two, one handicapped and one standard.
 - f. Fixtures designated for use by the disabled shall be mounted at heights specified in the design requirements for disabled persons. **All other fixtures shall be mounted at the standard heights recommended for the general population.**
 - g. Require handicapped water coolers with push bars on three sides.

- h. Require that all faucet handles be marked as follows:

Domestic Water	C & H
Industrial Water	IC & IH
Compressed Air	AIR
Vacuum	VAC
Natural Gas	GAS

- i. Require floor drains in all toilet rooms, janitor rooms where mop sink is not floor mounted, “wet” laboratories, and in all mechanical equipment rooms.
- j. Ensure that architectural drawings require that floors slope to drain.
- k. When washing machine connection is required, specify Watts* "Duo-Cloz" ball-type shut off valve as connection between hot and cold water supply piping and flexible rubber supply hoses, Valve No. 2 for exposed piping, Valve No. 2T for concealed piping, manufactured by Watts Regulator Co., Lawrence, MA*.
- l. Gas valves shall not be located above ceilings. Locate valves as close to the appliance as possible in readily accessible locations. In the case of laboratory benches, the valves are to be located in a pipe chase which runs from the ceiling to the top of the bench. The valves are to be covered with a readily operable door identified with the marking “Valves”.

2. DESIGN AND INSTALLATION:

- a. Use the requirements of the International Building Code to determine the number of toilet fixtures to be provided in new facilities or in renovation projects where new toilet rooms are being provided.
- b. No single stack (solvent) waste and vent system shall be designed into any facility.
- c. Design drawings shall include water risers, gas risers, and waste and vent risers.
- d. Where a building is served by a City of Lincoln water meter, it shall have a backflow preventer to protect the City lines.
- e. Isolation valves shall be installed at every reasonable branch to minimize shutdown areas, and at island sinks, reagent racks, and fume hoods.
- f. Require any rough-in stubs that do not have units installed under that contract to be valved and capped.
- g. Allow no drain lines less than 2" in diameter under floors.
- h. Connect acid waste piping to sanitary piping after a toilet group with heavy waste flow.
- i. Floor drains shall be flashed.
- j. Require all roof drains to be installed so as to permit full and complete rodding.
- k. Require all systems to be vented and provided with adequate valved drains.
- l. All vent pipes through built-up roofs shall be flashed.

- m. All other pipes through built-up roofs shall use lead flashing.
- n. Piping on the roof shall be a minimum of 12" above the roof. Mounts or supports shall be fully flashed and counter-flashed to provide a waterproof penetration.
- o. Any emergency shower line shall be a separate line from the main riser with only a service valve at the branch entrance as an obstacle. That valve shall be lockable in an open position and shall by its appearance indicate that it is open. Line size shall be determined according to the number of showers and eyewash units on the system but in no case less than 1" for a safety shower and 3/4" for an eye-wash. The type of eye-wash shall be determined by consultation with the specific users and the UNL Environmental Health and Safety Office.
- p. Josam* 75000 Series water hammer arresters or equal shall be included in all branch systems.
- q. All units with temperature or pressure relief valves shall have them piped to a drain through an air-gap fitting. Direct connections to waste lines shall not be allowed.
- r. If water-softeners are required, they shall be of the dual automatic regenerating type to provide a continuous flow of soft water.
- s. If sewage ejector pumps are required, they shall be installed as a duplex system in such a manner that either pump may be removed for maintenance without disturbing the other. A high water alarm shall be a part of the system. Provide column-type pump, with the motor out of the sewage liquid. Submersible pumps are to be used in gray water applications only.
- t. Hot water generators shall be tube bundled design. Variance from this requirement must be approved by UNL representatives prior to design.
- u. If a purified water system is required, it shall be equipped with all necessary accessories, including softener, carbon filters, meter (water), thermometers, pressure gauges, pre-filter bank, water quality monitor, storage tank, relief valves, pumps, deionizer tanks, ultraviolet sterilizer, final filter, and quality controller, all furnished by the same supplier, who shall be required to warranty the system and provide one year operation and maintenance service as well as instructions to UNL personnel.
- v. Require indirect drain for all backflow preventers to be the same size as pipe size.
- w. In areas requiring waste drain piping under supported structural floor slabs, the cleanouts shall extend above the floor line at least to the level of the highest fixture. All risers shall be properly plugged and painted to match the adjacent surface. Vertical to horizontal changes in main soil and waste stacks that occur above furred ceilings shall have a cleanout extended from the base to a floor cleanout through the floor above, or a wall cleanout in the vertical stack above the change in direction. All cleanouts in ceiling spaces shall be extended above the floor above.

x. When backflow preventers are installed for large systems (greater than 3 inch), consider dividing into multiple backflow preventers of similar cross section area with equal pressure drop for maintenance capability and installation economy.

If there is a water meter present, each device must be the same size as the meter. **Devices must be tested and certified as soon as practicable after installation.**

<u>Service Size</u>	<u>Backflow Preventer Size</u>
4"	two 2-1/2"
6"	two 4" or three 3"
8"	two 6" or four 4"

y. Do not allow any secondary piping for heating, cooling or domestic water to run underground below basement or first floor slabs-on-grade unless they are located in an accessible structural tunnel, chase, or plenum which permits full inspection and/or maintenance.

z. Require that valve systems are located where they are easily accessible for maintenance purposes.

aa. Refer to DG 010000.14 for plumbing requirements related to Custodial Facilities; refer to DG 010000.16 for plumbing requirements related to Non-Program Building Areas; refer to DG 010000.16 for requirements related to sill cocks on new buildings; refer to DG 328423 for requirements related to underground sprinklers.

PART 2 - PRODUCTS

3. PIPE AND PIPE FITTINGS:

a. Pipe Schedule:

<u>Service</u>	<u>Material</u>
Acid waste and vent	Fire-retardant "Fuseal" polypropylene
De-ionized water	Polypropylene (PE) with socket fusion joints
Domestic hot water, hot water return, cold water potable and non-potable	Type L copper, hard drawn
Fuel oil, above ground	Schedule 40 black steel
Fuel oil, below ground	Schedule 40 black steel in waterproof concrete trench (see UNL Utilities)
Laboratory air, vacuum and nitrogen	Type L copper, hard drawn
Natural gas, above ground	Schedule 40 black steel
Natural gas, below ground	Schedule 40 black steel, machine wrapped
Waste and vent, rainwater	Cast iron, hub and spigot, gasket joints
Waste and vent, above ground	Cast iron, no hub
Waste and vent piping below concrete and exterior wall foundation	Cast iron, hub and spigot, gasket joints

- b. Require all welders to be certified and to stamp their work.
 - c. All 2-1/2" and larger steel pipe shall be welded. Flanges shall be inserted to sectionalize the system as required for maintenance.
 - d. Require "MG" type couplings with stainless steel bolts for no-hub cast iron pipe above and below grade.
 - e. For domestic water systems, require lead-free solder for all copper pipe 1-1/2" and smaller. Domestic water piping 2" and larger shall be joined with minimum 15% silver bearing filler material. For dissimilar metals, (ie. copper to brass) the filler shall be 45% silver bearing and appropriate non-corrosive flux is to be used. When using "pulled-tee" fittings on copper piping, the joints shall be joined with minimum 15% silver bearing filler material. Drilled or cut taps on copper piping shall not be allowed. Direct buried copper domestic water piping up to and including 1 1/2" shall be flared joint construction. Direct buried copper domestic water piping 2" and larger shall be joined with minimum 15% silver bearing filler material and appropriate non-corrosive flux.
 - f. Allow no bushings; require standard eccentric reducing fittings.
 - g. Require "Clear-Flow" nipples to be used to provide electrolysis protection between ferrous and non-ferrous metals.
 - h. Require cut pipe to be reamed to full inside diameter. Only tools designed for this purpose shall be used.
 - i. Require pipe cut to size; forbid pipe springing or rubbing other pipe or equipment.
 - j. Require all underground pipe or pipe in concrete to be properly coated.
 - k. Require all pipe to be sloped 1 inch in forty feet, to be run parallel to the lines of the building, to have at least one inch clearance from other installations, and steam lines to have mud legs with blow-down valves.
4. PIPE INSULATION:
- a. Insulation Types:
 - (1) Type "B" Insulation: Molded, sectional fiberglass with factory-applied vapor-barrier jacket; typical thermal conductivity values at 75° F. are 0.22 to 0.26. Type "B" insulation can be used with pipe-surface temperatures between -60° F. and +450° F.
 - b. Application of Pipe Insulation: Project specifications shall include the following requirements:
 - (1) Insulation shall be applied only by mechanics skilled at such work. The appearance of the completed insulation shall be identified as a significant factor in determining the acceptability of the work.
 - (2) Insulation shall not be applied to piping until such time as those surfaces are sufficiently heated to properly dry out the insulation. Insulation shall not be applied until the system is tested and approved.

- (3) Vapor barriers shall be required for all domestic cold water and rainwater lines. All portions of the covering at joints and fittings shall be vapor sealed.
- (4) Insulation shall extend full thickness through walls, floors, ceilings, hangers, sleeves and supports. For pipes larger than 1-1/4", calcium silicate or high density cellular glass blocks shall be required between the pipe and the support in conjunction with metal shields to protect the insulation at all hangers and supports.
- (5) Fiberglass pipe insulation shall be applied over clean, dry surfaces with ends fully butted together. On cold lines, longitudinal jacket laps are to be imbedded in field-applied mastic, then laps are to be sealed with vapor barrier adhesive over the exterior of the laps. Transverse laps shall be covered with 3" wide tape set in mastic. A final coat of vapor barrier mastic shall be applied over the 3" piece of jacketing material. Staples shall not be permitted on cold pipe insulation.
- (6) Require that heated piping in exposed areas be insulated as described in the above paragraph. In concealed areas, heated piping insulation can be installed using the lapped joint fastened with outward-clinching staples on 2" centers, placed 1/4" from the edge of the longitudinal lap.
- (7) Fittings for Fiberglass Pipe Insulation:
- (a) Valves and fittings 2" and smaller shall be wrapped with strips of fiberglass blanket insulation to thickness approximately 1/8" less than the adjacent pipe insulation and then covered with a wrapping of PVC tape and a coating of barrier mastic. Tape shall lap insulation a minimum of 2".
- (b) Valves and fittings larger than 2" shall be insulated with pre-molded fiberglass insulation fittings or cut segments of pipe insulation wired in place and coated with vapor barrier mastic and PVC tape with a minimum 2" overlap onto adjacent pipe insulation as described in the previous paragraph.
- (c) On exposed applications, the fiberglass insulation shall be covered with one-piece PVC fitting cover. The PVC fitting cover shall be sealed at the butt joints using a PVC tape and a coating of vapor barrier mastic.

c. Pipe Insulation Schedule: Require insulation of piping systems in accordance with the following schedule:

<u>Fluid Design</u> Operating Temperature	Type	<u>Nominal Pipe Diameter</u>					
		Runouts 1" & to 2"	1" & less	1" to 2"	2½" to 4"	5" & 6"	8" & over
<u>Domestic and Service Hot Water Systems</u>							
Above 105°	B	½"	1"	1"	1½"	1½"	1½"
<u>Roof Drains</u>							
40° to 55°	B	1"	1"	1"			
Below 40°	B	1½"	1½"	1½"			

PART 3 - EXECUTION

5. CLEANING AND TESTING:

- a. Require pressure tests for all piping systems, including non-metallic systems, at 1.5 times operating pressure, with no loss over a four-hour time period.
- b. Require hydrostatic tests of drain pipe systems, 10 foot head.
- c. Require either smoke test or odor test on drain lines after all traps are installed and filled with water.
- d. Require complete flushing of all systems, cleaning where necessary and purifying where necessary. Require cleaning of screens and replacement of filters after four weeks of usage by the Owner. Require that critical control valves be bypassed as required for safety and functionality during these processes and placed back into service thereafter.
- e. Require Contractor to collect samples from the building's potable water supply system and submit such samples for coliform purity testing to the State of Nebraska Department of Health Laboratory prior to acceptance of the project.

6. PIPE AND VALVE IDENTIFICATION:

- a. Pipe and Valve Marking: Require stencil identification and flow direction arrows on all pipes after finish painting (if any), no more than 20 ft. apart, at every change of directions greater than 45°, and on each side of wall and floor penetrations, in accordance with the following schedule. Require two bands of ¾" wide polyvinyl color-coded electrical tapes of 2-mil thickness with directional arrow and code letters at each location:

<u>Service</u>	<u>Color</u>	<u>Code</u>
Domestic Cold Water	Light Blue	CW
Domestic Hot Water Circulating	Blue	HWC
Domestic Hot Water Return	Blue	HWR
Fire Mains	Red	F
Gas	Violet	G
Condensate Drains	Dark Blue	CD
Storm Drains	Grey	ST
Air	Grey	AIR
Vacuum	White	VAC

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

**PROCEDURES, DESIGN STANDARDS,
AND DESIGN CRITERIA (HVAC)**

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1. APPLICATION:

a. All projects shall be designed to conform to the guidelines and standards contained in these construction Design Guidelines. If it appears that the project budget is not sufficient to allow the full application of these standards to the project, the UNL project manager shall be advised. If it is determined that reduced standards are to be permitted for certain systems or portions of the project, such a decision will be transmitted in writing to the mechanical systems designer and made a part of the permanent project records.

b. The mechanical systems designs shall be detailed and complete, leaving no area to be designed by the contractor.

c. When designing a renovation or interior alteration project, the effect of any modification or increase in load on existing systems shall be considered. Heating or cooling shall not be diverted from an existing area to another area without analyzing the effect of such a decision. Because many existing buildings and their mechanical systems have been modified from the design shown on the original construction documents, testing and field verification of the system layout and performance are essential elements of the design process. UNL Facilities staff personnel are willing and able to assist in this endeavor.

d. Refer to DG 010000.14 for HVAC requirements relating to Custodial Facilities; refer to DG 010000.15 for HVAC requirements relating to Telecommunications Wiring Closets; refer to DG 010000.16 for HVAC requirements relating to Non-Program Building Spaces.

2. DESIGN PROCESS AND DOCUMENTATION:

a. Pre-Design Conference: During the schematic design phase, the design team, including the mechanical systems design engineer, will meet with representatives of the UNL Facilities Management office and Building Systems Maintenance Controls Engineers to discuss and identify appropriate mechanical systems for the project.

b. Schematic Design Phase: The Schematic Design submittal shall contain all information required for this phase of the work by the Owner-Consultant Agreement.

c. Design Development Phase: The Design Development submittal shall include all information required for this phase of the work by the Owner-Consultant Agreement. This submittal shall include, as a minimum, the following information:

(1) A description of each HVAC system to be utilized on the project, along with the design criteria and the calculations for the project's heating and cooling loads and estimated energy usage for the project.

(2) Riser diagrams and automatic control schemes for heating, cooling, ventilating, and fume-hood exhaust systems.

(3) Schematic arrangement of equipment for refrigeration and air conditioning systems, with design quantities.

(4) Flow and riser diagrams and projected design quantities for water systems and industrial water systems, with special attention to special pressure systems.

(5) Flow and riser diagrams for drainage systems with projected design quantities.

(6) Flow and riser diagrams for laboratory systems, including gas, air, vacuum, laboratory steam, distilled and/or de-ionized water, and special gasses.

(7) A complete tabulation of the environmental conditions proposed for each space within the project, including room temperature, humidity, and pressure (positive or negative) design parameters. This information will be forwarded to the user representative by the UNL Project Representative for review and written approval.

(8) A life-cycle cost analysis of each HVAC system considered for the project, in the format described in the ASHRAE HVAC Applications.

d. Construction Documents:

(1) Provide schedules on drawings for mechanical equipment items (such as fans, pumps, converters and air handlers) and other mechanical system components (such as grilles and diffusers, air valves, mixing boxes, and similar items). Include sufficient information in such schedules to provide an unequivocal description of the item. Schedules shall contain sufficient information to facilitate proper testing and balancing operations.

(a) Blower rpm.

(b) Motor horsepower.

- (c) System pressures, suction and discharge.
- (d) Design re-circulated air cfm.
- (e) Outside air cfm.
- (f) Fan design cfm and static pressure.
- (g) Entering and leaving air temperature of each air handling unit, D.B. heating and cooling, W.B. cooling.
- (h) Design value for each diffuser, grill, and register.
- (i) Inlet water and air temperatures at each cooling and heating element.
- (j) Outlet air and water temperatures at each cooling and heating element.
- (k) Pressure drop at each coil.
- (l) Pump operating suction and discharge pressures.
- (m) Room schedule for VAV boxes, showing information on box, valve, type of operation, and additional information as required by UNL Building Systems Maintenance (BSM). The HVAC Room Schedule should be prepared on a Microsoft Excel template provided by UNL BSM. The completed schedule shall appear on the contract documents and an electronic file copy of the schedule and shall be furnished to UNL BSM. The following headings shall be included in the schedule:

ARCH RM NO.	UNL RM NO.	AIR TERMINAL UNIT	REHEAT CAPABILITY	COOLING		HEATING	SERVED BY AHU NO.	REHEAT	SUPPLEMENTAL HEAT	
				CFM MAX	CFM MIN			COIL GPM	U.H./FCU	FTR

- (2) **Three dimension drawings using Revit are preferred. When Revit is not available,** depict ductwork with scaled double-line drawings. Single-line representation of ductwork is not acceptable.
- (3) Show locations of VAV boxes and system control valves, both of which must be readily accessible through a removable ceiling system or appropriately sized and located access panel or door.
- (4) Show detail of VAV box, including fiber-free liner, damper bearing type, center-pivoted round disk damper with full shut-off capability, full-length metal damper shaft, multiple point flow sensor in inlet, and location of control panel. Fully define VAV boxes in the project specifications
- (5) Provide single line flow diagram of each air system, properly balanced.

e. Access Requirements for Concealed Mechanical and Electrical Components: See Article 4 of Design Guideline DG 010000.12 for requirements related to correlating and cross-referencing construction documents to insure that appropriate accessibility measures are provided to concealed mechanical and electrical components.

3. COORDINATION OF MECHANICAL, ELECTRICAL AND UNL-FURNISHED SYSTEMS

a. Project A/E consultants shall structure contract documents to reflect the assignment of responsibilities for procuring materials and equipment and installing/setting/placing of such procured materials and equipment in accordance with the following table.

COORDINATION OF RESPONSIBILITIES FOR MECHANICAL, ELECTRICAL AND UNL FURNISHED SYSTEMS	NOTES: GC=GENERAL CONTRACTOR MC=MECHANICAL CONTRACTOR EC=ELECTRICAL CONTRACTOR BSM=UNL BUILDING SYSTEMS MAINTENANCE UNL UTIL=UNIV OF NEBR-LINCOLN UTILITIES			
ITEM	FURNISHED BY	SET BY	POWER WIRING	CONTROL WIRING
Equipment Motors	MC	MC	EC	BSM
Motor Control Centers	EC	EC	EC	BSM
Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters	MC	MC	EC	BSM
Loose Motor Starters, Contactors, Disconnect Switches, Thermal Overloads and Heaters	EC	EC	EC	BSM
Pushbutton Stations and Safety Stop Switches – Air Handling Systems and Hydronic Systems	EC	EC	NA	BSM
Variable Speed Drives and Associated Safety Disconnects	BSM	EC	EC	BSM
Temporary Heating/Cooling and Connections	GC	MC/EC	EC	MC/EC
Chiller and Boiler Controls	MC	MC	EC	MC
Computer Room Air Conditioning Systems	MC	MC	EC	MC
Lab Ventilation Control Systems Air Valves	MC	MC	NA	NA
Lab Ventilation Control Systems Controls	BSM	BSM	BSM	BSM
Control Systems Compressed Air High Pressure Main Riser	MC	MC	NA	NA
Control Systems PRV Stations	BSM	MC	NA	BSM
Control Systems Compressed Air Mains 20PSI	BSM	BSM	NA	NA
Thermostats And Terminal Controls – Line Voltage	BSM	EC	EC	EC
Room Controls Transformer Panels	BSM	EC	EC	BSM
Thermostats And Terminal Unit Controls – Low Voltage	BSM	BSM	BSM	BSM
Air Terminal Units And Hydronic Reheat Coils	MC	MC	EC	NA
Air Terminal Units And Electric Reheat Coils	MC	MC	EC	NA
Automatic Flow Control Devices	MC	MC	NA	NA
System Controls Temperature Control Panels	BSM	BSM	EC	BSM
Air Handling And Hydronic Systems Controls	BSM	BSM	NA	BSM
Air Handling Systems Pressure Sensors	BSM	BSM	NA	BSM
Automatic Control Damper Actuators	BSM	BSM	NA	BSM
Automatic Control Dampers	BSM	MC	NA	BSM
Smoke/Fire Dampers	MC	MC	EC	BSM

(cont.) COORDINATION OF RESPONSIBILITIES FOR MECHANICAL, ELECTRICAL AND UNL FURNISHED SYSTEMS				
ITEM	FURNISHED BY	SET BY	POWER WIRING	CONTROL WIRING
Automatic Control Valves And Actuators	BSM	MC	NA	BSM
Air Handling Systems Air Flow Stations	BSM	BSM	NA	BSM
Hydronic Systems Temperature Sensor Wells	BSM	MC	NA	BSM
Hydronic And Steam Systems Pressure Taps	MC	MC	NA	NA
Hydronic And Steam Systems Pressure Sensors	BSM	MC	NA	BSM
Chilled Water Meters	BSM	MC	EC	BSM
Heating Water Flow Meters	BSM	MC	EC	BSM
Steam Condensate Meters	BSM	MC	EC	BSM
Steam Condensate Level Alarm	MC	MC	NA	BSM
Card Access Bldg Controllers	BSM	BSM	EC	BSM
Card Access Network Connections	GC	GC	NA	NA
Card Access Door Controllers	BSM	BSM	EC	BSM
Card Access Door Hardware	GC	GC	EC	BSM
Card Access Handicap Door Hardware	GC	GC	EC	BSM
Handicap Door Hardware (No Card Access)	GC	GC	EC	EC
Video Surveillance Bldg Computers	BSM	BSM	EC	BSM
Video Surveillance Network Connections	NA	NA	NA	NA
Video Surveillance Cameras	BSM	BSM	EC	BSM
Video Surveillance Circuits	BSM	BSM	EC	BSM
Security Systems Building Controllers	BSM	BSM	EC	BSM
Security Systems Communications Circuits	NA	NA	EC	BSM
Security Systems Field Devices	BSM	BSM	EC	BSM
Fire Alarm Panels	BSM	BSM	EC	BSM
Fire Alarm Communications Circuits	NA	NA	NA	NA
Fire Alarm Detectors, Pull Stations, Horns & Strobes	BSM	BSM	EC	BSM
Fire Alarm Cabling and Conduit	BSM	BSM	EC	BSM
Fire Alarm Relays	BSM	BSM	EC	BSM

4. **CODES AND STANDARDS:**

a. **General:** Facilities shall be designed to comply with the editions of the following codes which are in current use by UNL Facilities Management and those State agencies having code jurisdiction.

(1) **General Building Construction:**

See list of codes in Design Guideline DG 010000.13.

(2) **Heating, Ventilating and Air Conditioning Systems:**

- Applicable NFPA Pamphlets
- SMACNA - Duct Construction Standards
- ASHRAE - Manuals as applicable for design and construction methods
- **International** Mechanical Code

- American Conference of Governmental Industrial Hygienists - Industrial Ventilation
- 2003 IECC

(3) Plumbing Systems:

- Applicable NFPA Pamphlets
- AGA Plumbing Standards
- **International** Plumbing Code

b. Boiler and Water Heater Installations: Contract documents should require that gas-fired and electric boiler installations shall meet the requirements of the Nebraska Department of Labor and the Factory Mutual Engineering Corp. Project specifications shall indicate that final acceptance and payment for such installation will not occur until these agencies have approved the installation and issued a valid inspection certificate. The same requirements shall also apply to gas-fired or electric water heaters where they are of such capacity as to fall under the jurisdiction of either or both of the inspection agencies mentioned above.

5. MECHANICAL SYSTEMS DESIGN CRITERIA:

a. Typical Room Level HVAC: The standard arrangement for delivering HVAC to exterior rooms shall provide individual room temperature control with perimeter hot water fin tube heating located below windows on exterior walls and variable air terminal units with hot water reheat. Interior rooms shall have individual room temperature control with conditioning provided by variable air terminal units with hot water reheat.

b. HVAC Systems, Air Flow Requirements: Air Flow Requirements shall conform with NFPA 45, ASHRAE 62.1 standards and **ASHRAE 52.2 for filtration.**

c. HVAC Systems, Noise Criteria: All spaces shall meet current ASHRAE Recommended Guidelines for Background Sound in Rooms. (See 2007 ASHRAE Handbook, HVAC Applications, Chapter 47, Table 42.)

d. **Mechanical designer shall provide all duct system(s) pressure drop calculations prior to or with the 95% design review documents.**

6. GENERAL DESIGN PARAMETERS:

a. Equipment Spaces and General Layout:

(1) The mechanical systems designer shall insure that adequate space, properly located, is provided for the installation of mechanical equipment. A firm grasp of mechanical space requirements and input during the schematic design phase is necessary for this to occur. Refer to Article 8 of Design Guideline 010000.16 for additional requirements for mechanical equipment spaces, including area within space for storage of attic stock materials.

(2) Attic mechanical spaces are expensive to maintain and are acceptable only when no other alternative is available.

(3) Mechanical equipment which will require maintenance shall be placed at floor level to facilitate servicing. Where this is impossible, provide a catwalk with an adequate, permanent ladder.

- (4) Pumps, coils, control valves and similar equipment which are certain to require disassembly for maintenance shall be installed with isolation valves on both sides to facilitate repair without drain down of entire building.
- (5) Access to both sides of coils, filters, motors, and similar equipment shall be provided to permit cleaning and servicing.
- (6) Space for coil, fan, filter or motor removal shall be provided to insure that removal of a wall or other structural element will not be required when these items need to be repaired or replaced.
- (7) Air valves with and without reheat coils require equalizing distances on both the inlet and outlet by the manufacturers. Design and installation shall conform to such manufacturer's recommendations.
- (8) Sound attenuators shall be engineered to comply with item #7 above, and shall have minimal, but calculated, impact on system pressures and flows.
- b. Mechanical material and equipment shall be new standard catalog products of manufacturers regularly engaged in the manufacture of those product models for a period of not less than two years. Where two or more units of the same type are specified, they shall be of the same manufacturer.
- c. Bare, scratched or marred areas on equipment shall be cleaned and touched up with the same paint as applied at the factory or an approved substitute.
- d. Require the lubrication of all equipment prior to its operation. Extension fittings shall be provided where needed. Require that oil fill ports are vertical and upright. Require a final lubrication of all equipment immediately prior to acceptance by the Owner. Provide documentation of lubrication to BSM for inclusion in equipment service log.
- e. Require the installation of access panels in surfaces concealing equipment, valves, controls or other operating mechanical system components. Panels shall be heavy gauge steel units, with key lock, and carry a fire rating equivalent to the surface in which they are installed.
- f. Require that each equipment item be installed with sufficient clearance and without interference from piping, ductwork, electrical conduit or structural members to allow the equipment to be serviced and/or dismantled. Coil pull space shall be provided. Generally, mechanical equipment shall be located in a single, adequately sized equipment room rather than in multiple, smaller rooms.
- g. In rooms without ceilings, require that all terminal units, including reheat coils, valves, actuators, controls, filters, and similar equipment requiring maintenance service, be located within 12 feet of the finish floor. In rooms with ceilings, such equipment shall be required to be located not more than two feet above the ceiling line.
- h. Hydronic systems which use a glycol medium shall not have an automatic plain water make-up.
- i. Isolation valves shall be installed at every branch to minimize shutdown.
- j. Require that testable devices, such as backflow preventers, be located to facilitate convenient testing and maintenance from the floor level, and never be placed above ceilings or in

other areas where they might be concealed from view. Require that backflow preventers be tested and certified by a Grade VI Water Operator with thirty days of installation or substantial completion, whichever is later. Test results must be given to BSM and the City of Lincoln and the device must be registered with the City of Lincoln.

k. Housekeeping pads shall be required for all equipment. **In addition to pads**, inertia pads shall be considered for vibrating equipment not located on grade.

l. Tachometer access openings through protective guards shall be provided at each rotating axle.

m. The Contractor shall be required to supply any special tools needed for assembly, adjustment, setting or maintenance of equipment as a part of the contract. If such tools are required, they shall be turned over to UNL BSM upon acceptance of the project.

n. Require that penetrations in existing roofing systems be engineered and completed by qualified roofing installers.

o. In laboratory buildings, waste and vent stacks, water lines, ducts, conduits and other utilities shall be located in shaft ways with access at each floor. The shaft ways shall be sized to allow for future expansion by increasing the initially required area by 50%.

p. Do not specify installations to be made "in accordance with manufacturer's recommendations", except in cases where the diversity of acceptable materials and their methods of installation would otherwise make the specifications unnecessarily lengthy. Where a single type of material is acceptable and the method of application is uniform for all manufacturers' products, the specification shall state the installation requirements explicitly and in detail.

q. Require that valve actuators, VAV actuators, and all automatic temperature control devices be masked off or otherwise protected during the application of paint and insulation. Require contractor to pay for replacement of items where this was not accomplished.

r. Do not use ceiling plenums for return air pathways above laboratories where chemicals are handled or other areas where chemicals are handled.

s. In buildings with laboratory spaces, design make-up air systems to provide the capability for limited expansion of the system beyond its initial requirements. The degree of the excess capacity shall be determined and documented in conjunction with the UNL Project Representatives **including Building Systems Maintenance Controls Engineers**.

t. Require that items of mechanical and electrical equipment be provided with lockable energy-isolating devices at the time of their installation. Devices shall effectively isolate the equipment item from the unexpected release of hazardous energy which would endanger maintenance or repair personnel,

u. Fresh Air Intakes and Exhausts:

(1) The preferred location of fresh air intakes for air handling units is on the roof. If fresh air intakes are to be in the sidewalls of buildings, they shall be located on the north or east side and not less than ten feet above the adjoining grade.

- (2) Do not locate fresh air inlets and exhaust air outlets in close proximity to one another. The preferred arrangement would be to use the side of the building for the exhaust air outlet and the roof of the building for the fresh air inlet.
- (3) Locate fresh air inlets to minimize the chance of contamination from operations which may take place on the exterior of the building, such as idling motor vehicles or other machinery.
- (4) Locate exhaust air outlets well apart from fresh air inlets to minimize the chance of re-entrainment of contaminants being exhausted.
- (5) Prevailing wind modeling shall be done to ensure exhaust air paths do not become re-entrained into the building air intakes or affect adjacent spaces or buildings. Modeling shall be done by either wind-tunnel model test or by the use of computational fluid dynamics software.

7. LABORATORY FUME HOODS:

a. General:

- (1) Utilize one fan of the industrial unitary type (preassembled package unit) for each fume hood. Manifold systems are to be considered as an option for high density lab fume hood applications, except for perchloric hoods. Properly designed variable volume systems are encouraged. Prior approval of manifold systems and variable volume systems by UNL representatives is required. Energy recovery will be required when manifold systems are installed. Fume hoods and their associated base cabinets or stands shall be designed and specified as part of the mechanical designer's responsibility.
- (2) Fume hood fan and motor sheaves shall be the continuously adjustable type.
- (3) Fume hoods shall be provided from the factory without air flow indicator and shall be field fitted with air flow indicator and controls as designed and installed by UNL BSM, unless the air flow indicator is integral to the operation of the fume hood. Designer shall coordinate fume hood design with UNL BSM representative.
- (4) Provisions shall be included in the system design to notify the user and/or the UNL maintenance staff when a chemical fume hood is not functioning. Remote alarms, where specified, shall be through a dry contact and wired to the nearest mechanical space and terminated on a terminal block for future connection to an annunciation panel.
- (5) The system shall be energy-efficient within the design criteria.
- (6) Fume hoods with built-in exhaust fans are not allowed. When relocating or remodeling fan-enclosed fume hoods, they shall be removed and replaced.
- (7) Generally laboratory areas shall be maintained at a negative pressure relative to corridors and non-laboratory areas. One possible exception to this criteria is a "clean laboratory" where the processes conducted in the laboratory are not hazardous and where the laboratory must be kept free of uncontrolled contamination.
- (8) Direct pressurization controls, which use a sensor to control the pressure differential, are not acceptable. Volumetric tracking, using a constant offset of 100 CFM per fume hood, between supply and exhaust is desirable and predictable.

(9) If flammable or hazardous materials are to be dispensed in storage areas from storage containers to smaller containers, the ventilation rates mentioned herein and in ANSI/NFPA 30 might not be adequate. If the amount and frequency of dispensing is sufficient to exceed these requirements, special exhaust hoods shall be provided.

(10) Each laboratory shall be evaluated for catastrophe potential in terms of the maximum credible accident, involving the properties of the chemicals used and the nature of the operations. Examples of such a catastrophe would be:

- Explosion.
- Violent ejection of life-threatening chemicals into the room.
- Overheating of the exhaust duct.

If it is determined a definite potential for catastrophe is present, special designs to prevent or limit the consequences shall be implemented. Examples of such provisions would be:

- Special hood design.
- Fire or explosion suppression systems.
- Redundant-installed spare exhaust blowers.
- Emergency power supply.

b. Acoustics:

See paragraph 5c above for background sound criteria.

c. Flow Rates:

(1) Fume hood flow rates shall conform to applicable standards and UNL Environmental Health and Safety acceptable guidelines based on type of use.

(2) Laboratories shall be designed to be the most energy efficient possible, and air change rates (ACH) shall meet ANSI Standards.

Laboratory spaces shall be designed for once-thru air and all exhaust from laboratories shall exit the building by way of up-blast fan systems.

(3) For hoods requiring a face velocity of 100 feet per minute, a maximum duct velocity of 1600 feet per minute shall be provided through ductwork up to the exhaust valves.

(4) The exit velocity from ductwork located on the building roof shall be a minimum of 3,000 feet per minute directed straight up from the exhaust duct or stack for a stack without internal condensation; or a discharge velocity of 2,000 feet per minute or less if internal condensation might occur. The minimum exhaust stack height shall be not less than ten feet **above work zones**.

d. Fume Hood Ductwork:

(1) Design:

(a) Laboratory ventilation ductwork shall be designed to comply with appropriate Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) standards. Exhaust ductwork shall be designed in accordance with ANSI Z9.2 and the ASHRAE Fundamentals handbook.

(b) Small labs or alcoves with hoods shall have make-up air distributed through radial flow diffuser(s) to prevent air velocity disturbance of hood capture.

e. Laboratory Fume Hood Fans:

- (1) Fans and air movers shall be selected to provide design flow rates in the hood and duct system. Fan wheels and housings shall be constructed of materials compatible with chemicals being transported in the air through the fan.
- (2) Types of fans suitable for exhaust systems are flat blade and backwardly curved blade centrifugal.
- (3) If flammable gas, vapor, or combustible dust is present in concentrations above 20% of the Lower Flammable Limit, the fan construction shall be as recommended by AMCA's Classification for Spark Resistant Construction.
- (4) Exhaust fans shall be located outside the building housing the laboratory or in a separate room that is maintained at negative pressure to the rest of the building and provides direct access to the outside for fan discharge ducts. (NOTE: This requirement responds to the fact that, under some operating conditions, centrifugal fans leak small amounts of system gases at the fan shaft hole. Shaft seals are available but are expensive or require frequent maintenance. Fan discharge ducts typically are under positive pressure, therefore, any leakage would be into the area housing the fans.)

f. Manifolds:

- (1) General Design: Exhaust ducts from two or more hoods may be connected to an exhaust manifold, frequently to avoid a multiplicity of small stacks on the roof of the building or to reduce the pipe chase that would be required in a multi-story laboratory.
- (2) Constant Suction: Such manifolds shall be provided with an exhaust fan or fans and be maintained under negative pressure. The manifold shall be designed as a plenum (i.e. the suction at any point in the manifold will be reasonably constant regardless of the flow into it from individual hoods).
- (3) Compatibility of Sources: Exhaust streams that might form explosive compounds, or reaction products that will condense on the walls of the manifold or combine to produce compounds of significantly higher toxicity or lower odor thresholds, shall not be combined into one manifold.
- (4) Reliability: Unless the use of all laboratory exhaust hoods connected to a manifold can be stopped completely without creating a hazardous situation, provision shall be made for continuous maintenance of adequate suction in the manifold. This requirement could be satisfied by providing:
 - An installed spare manifold exhaust fan that can be put into service rapidly by energizing its motor and switching a damper.
 - Emergency power to the manifold exhaust fans.

Alternative methods of maintaining manifold suction may be utilized, subject to the approval of the Owner's representative.

(5) Maintenance Access: Provision shall be made for safe and reasonably convenient access to all mechanical and electrical equipment including, but not limited to, fans, motors, dampers and filters or other ACD's. Provision shall also be made, especially for duct systems with internal coating corrosion protection, for adequate space to repair damaged or leaking ductwork and to make modifications.

g. Noise:

Follow requirements of ASHRAE APPLICATIONS HANDBOOK 2007, Ch. 47, table 42.

8. BIOLOGICAL SAFETY CABINETS

a. Class II Type A1 and A2

(1) Class II Type A1 and A2 biological safety cabinets may be served by a manifold or dedicated laboratory exhaust system through a canopy connection.

b. Class II Type B1 and B2

(1) Class II Type B1 and B2 biological safety cabinets shall be served by individual fans and dedicated exhaust ducting.

(2) Ductwork shall run undiminished in size from the cabinet collar to the air valve.

9. SUBMITTALS FOR MECHANICAL SYSTEMS:

a. General:

(1) The project specifications shall require six (6) sets of submittal documents and include a complete description of submittal documents required.

(2) Require that submittals identify any item which differs from the manufacturer or generic specification given in the construction documents for such item. Include the requirement that any item not so identified must be removed and replaced with the specified item at no additional cost.

(3) Substitutions for items scheduled and/or specified in the construction documents after such documents have been approved by UNL must have the concurrence of UNL before they can be accepted.

(4) Requirements for submittals and instructions for their subsequent processing shall be consistent with the standard UNL Division 1 Section addressing this subject.

b. Operations and Maintenance Manuals:

(1) Require a complete operations and maintenance manual referenced to the specifications and plans by Division, Section and sheet numbers. Manual shall contain manufacturers printed data of operation and maintenance instruction books, parts lists,

catalogs, special tools required, fan curves, pump curves, valve directories, and any other information pertinent to that system or equipment.

(2) In addition to the normal operations and maintenance manuals required for each major item of mechanical equipment, the Contractor shall also be required to furnish a current service manual and appropriate DVD or VCR tapes which show the proper service and the manner in which it is to be performed. Where an unusually sophisticated piece of equipment is installed, this service training shall be required to be provided by a factory instructor at the project site. Maintenance service training shall be required for all mechanical equipment, including but not limited to the following:

230913.13	Actuators and Operators	236100	Refrigerant Compressors
230913.33	Control Valves	236300	Refrigerant Condensers
221123	Domestic Water Pumps	236400	Packaged Water Chillers
221519	Air Compressors	236500	Cooling Towers
263000	Engine Generators	237119	Ice Storage
223200	Domestic Water Filtration Equip.	237200	Air-to-Air Energy Recovery Equipment
210000	Fire Suppression	237300	Indoor Central Station Air Handling Units
232500	HVAC Water Treatment	238000	Decentralized HVAC Equipment
225200	Fountain Plumbing Systems	233416	Centrifugal HVAC Fans
226100	Compressed Air Systems/Lab	233413	Axial HVAC Fans
226200	Vacuum Systems/Lab	238200	Convection Heating & Cooling Units
226300	Gas Systems/Lab	233433	Air Curtains
232316	Refrigerant Piping Specialties	230900	Instrumentation and Control for HVAC
232123	Hydronic Pumps	250000	Integrated Automation
235300	Heating Boilers		All Special Equipment
235300	Boiler Feedwater Equipment		NOTE: The specification section numbers need not
237400	Pkged Outdoor HVAC Equip.		necessarily coincide with those shown above

c. Record Drawings (See also DG 010000.21):

(1) Require that Contractor maintain daily a set of drawings at the job site and record thereon all installation changes which differ from the contract drawings and indicate exact locations of all access panels and valves. Drawings shall be reviewed at least monthly by the Contractor's superintendent and the UNL project field representative; a log indicating the date of such reviews and containing the signature of the UNL representative shall be maintained by the Contractor. Upon completion of the project, the record of all changes shall be transferred to a set of Mylar reproducible tracings. Such information shall be drawn to scale with appropriate drafting instruments (not free hand) and be legible. The tracings shall be identified as "record" drawings, signed, and attested to by the Contractor that they reflect the work "as built" and delivered to the project Architect/Engineer.

(2) The "record" drawings shall also indicate the equipment actually furnished in lieu of that which was specified on the Equipment Schedules. These changes shall be coordinated with the "Shop Drawings" and duly noted on the "as built" Equipment Schedules.

(3) In addition to the "record" Mylars as previously described and upon completion of the project, the Architect/Engineer is responsible for providing "as built" documents in electronic form to the Owner. The electronic transfer media and methods shall be consistent with the University's Computer-Aided Design (CAD) program and hardware. The final product shall allow the Owner to change, modify, plot, and reproduce the documents.

(4) The Contractor shall be required to maintain a set of "record" specifications. The make and model number of each piece of equipment shall be annotated under the respective paragraph in the specifications. The materials and methods used for each piping system shall be indicated. The Contractor should review each paragraph within the specifications and annotate the project specifics if different from that contained in the specifications. The name and address of each supplier, equipment vendor, or subcontractor shall be indicated under the respective paragraphs. The Contractor shall be required to provide to the Architect/Engineer three copies of the annotated "record" specifications in a permanent binder with the name of the project indicated on the cover. Prior to reproducing and binding the marked-up "record" specifications, the Contractor shall be required to submit the final version of the document to the Architect/Engineer for approval.

(5) Upon completion of the project, the Architect/Engineer shall be responsible for providing an annotated "record" specification in electronic form to the Owner. The electronic transfer media shall be consistent with the University's word processing program, which in this case is Microsoft Word. The final product shall allow the Owner to change, modify and reproduce the specification document.

d. Shop Drawings:

(1) See requirements pertaining to shop drawings and other submittals in the UNL standard Division 1 specification sections.

(2) Require that submittals identify any item which differs from the manufacturer or generic specification given in the construction documents for such item. Include the requirement that any item not so identified must be removed and replaced with the specified item at no additional cost.

(3) Substitutions for items scheduled and/or specified in the construction documents after such documents have been approved by UNL must have the concurrence of UNL before they can be accepted.

(4) Requirements for submittals and instructions for their subsequent processing shall be consistent with the standard UNL Division 1 Section--Submittals.

MATERIALS, EQUIPMENT AND METHODS (HVAC)

PART 1 - GENERAL

1. GENERAL

PART 2 – PRODUCTS

2. PIPE AND PIPE FITTINGS
3. PIPE INSULATION
4. VALVES
5. DUCT INSULATION
6. PUMPS AND COMPRESSORS
7. SUPPORTS, ANCHORS AND SLEEVES
8. HVAC SPECIALTIES
9. HVAC EQUIPMENT
10. EXHAUST FANS/UTILITY FANS
11. MOTORS, MOTOR STARTERS AND DRIVES
12. METERS
13. AIR COMPRESSORS

PART 3 - EXECUTION

14. PIPE, EQUIPMENT & VALVE IDENTIFICATION

PART 1 - GENERAL

1. GENERAL:

- a. **Application:** Design and specify mechanical systems to utilize components conforming to the requirements defined in these guidelines. Deviations from these guidelines must be approved in writing by the UNL Project Manager.

PART 2 – PRODUCTS

2. PIPE AND PIPE FITTINGS:

a. Pipe Schedule:

<u>Service</u>	<u>Material</u>
Condensate return	Schedule 80 black steel
In-building condensate return from pumps to tunnel and in tunnel	Schedule 80 black steel
Chilled water supply and return	Schedule 40 black steel
Chilled water supply and return in tunnels, larger than 6"	Schedule 40 black steel
Condensate from equipment and drain pans	Type M copper, hard drawn
Heating water supply and return	Schedule 40 black steel; Type L copper, hard drawn
Steam <2", low pressure to 100 psig	Schedule 40 black steel, threaded
Steam >2", low pressure to 100 psig	Welded Schedule 40 steel
Steam >2", high pressure above 100 psig	Schedule 80 steel, welded
Refrigeration	ACR, dehydrated type with capped ends, Type L

b. Require all welders to be certified and to stamp their work.

c. All 2-1/2" and larger steel pipe shall be welded. Flanges shall be inserted to sectionalize the system as required for maintenance.

d. Require "MG" type couplings with stainless steel bolts for no-hub cast iron pipe above and below grade.

e. For hydronic systems, copper piping shall be joined with minimum 15% silver bearing filler material. For dissimilar metals, (ie. copper to brass) the filler shall be 45% silver bearing and appropriate non-corrosive flux is to be used. When using "pulled-tee" fittings on copper piping, the joints shall be joined with minimum 15% silver bearing filler material. Drilled or cut taps on copper piping shall not be allowed. As new, proven effective measures are established, alternative fillers will be considered with specific approval by UNL project representative.

f. ACR refrigerant piping shall be joined with minimum 15% silver bearing filler material. For dissimilar metals, (ie. copper to brass) the filler shall be 45% silver bearing and appropriate non-corrosive flux is to be used. As new, proven effective measures are established, alternative fillers will be considered with specific approval by UNL project representative.

g. When joining valves or specialty fittings to copper piping, follow good work practice by providing heat-sinking methods to protect the materials from damage or warping. Follow manufacturer's recommendations for filler material and heat range. Where high temperature or vibration are of concern, the installation may require special valves such as 3-pc. valves or assembly procedures such as pre-assembled pipe stubs.

h. Screwed fittings for steam and condensate shall be cast iron; malleable fittings should not be permitted.

i. Allow no bushings; require standard eccentric reducing fittings.

- j. Require "Clear-Flow" nipples to be used to provide electrolysis protection between ferrous and non-ferrous metals.
 - k. Require cut pipe to be reamed to full inside diameter. Only tools designed for this purpose should be used.
 - l. Require pipe cut to size; forbid pipe springing or rubbing other pipe or equipment.
 - m. Require all underground pipe or pipe in concrete to be properly coated.
 - n. Require all pipe to be sloped 1 inch in forty feet, to be run parallel to the lines of the building, to have at least one inch clearance from other installations, and steam lines to have mud legs with blow-down valves.
 - o. Require pipe size to reheat coil to be ¾", unless capacity requires larger size. Size flow rates for minimum 1 gpm when determining pump selection.
 - p. Require that VAV controller, VAV box termination panel, and reheat coil valve be located in proximity to one another so that all three items are within reach of a single point of access, whether access door or panel or opening in accessible ceiling.
 - q. Require the use of "auto-flow" regulators at each terminal device and each zone of fin tube radiation, for balancing.
 - r. Provide adequate pipe taps for balancing.
 - s. Require that any pipe compound used shall be rated for glycol.
 - t. Require that hydronic system piping taps shall be made off the top of the system headers, never off the bottom. This applies to heating systems and to chilled water systems.
 - u. Require that hydronic systems be fitted with an air and dirt separator fitting. Such fitting shall incorporate copper coalescing medium to facilitate air and dirt separation. Unit shall be equipped with integral float-actuated air vent and manual blow-down connection at the base to allow dirt removal. Unit shall be designed for variable flow rate with while maintaining effectiveness. Unit shall be rated to remove 100% of free air, 100% of entrained air, and 99% of dissolved air in either plain water or 50% propylene glycol solution, as well as minimum 80% of dirt particles 30micron or larger within 100 passes. Air and dirt separator shall be as manufactured by Spirotherm*.
 - v. Flanged connections of steam service piping shall be fitted with gaskets approved for the pressure class. Mating flanges shall be fitted parallel and true to ensure proper seal. All flange gaskets on piping serving 50 psi or greater steam service shall be spiral wound metallic as manufactured by Flexitallic* under the model name Flexite Super, or UNL approved equal.
3. PIPE INSULATION:
- a. Insulation Types:
 - (1) Type "B" Insulation: Molded, sectional fiberglass with factory-applied vapor-barrier jacket; typical thermal conductivity values at 75° F. are 0.22 to 0.26. Type "B" insulation can be used with pipe-surface temperatures between -60° F. and +450° F.

(2) Type "E" Insulation: Hydrous calcium silicate, composed of diatomaceous earth and non-asbestos reinforcing fibers in lime; typical thermal conductivity value at 500° F. is 0.5. Recommended temperature range is +100° F. to +1,500° F.

b. Application of Pipe Insulation: Project specifications should include the following requirements:

(1) Insulation should be applied only by mechanics skilled at such work. The appearance of the completed insulation should be identified as a significant factor in determining the acceptability of the work.

(2) Insulation should not be applied to piping until such time as those surfaces are sufficiently heated to properly dry out the insulation. Insulation should not be applied until the system is tested and approved.

(3) Vapor barriers should be required for all domestic cold water, chilled water, and rainwater lines. All portions of the covering at joints and fittings should be vapor sealed.

(4) Insulation should extend full thickness through walls, floors, ceilings, hangers, sleeves and supports. For pipes larger than 1-1/4", calcium silicate or high density cellular glass blocks should be required between the pipe and the support in conjunction with metal shields to protect the insulation at all hangers and supports.

(5) Fiberglass pipe insulation should be applied over clean, dry surfaces with ends fully butted together. On cold lines, longitudinal jacket laps are to be imbedded in field-applied mastic, laps are to be then sealed with vapor barrier adhesive over the exterior of the laps. Transverse laps should be covered with 3" wide tape set in mastic. A final coat of vapor barrier mastic should be applied over the 3" piece of jacketing material. Staples should not be permitted on cold pipe insulation.

(6) Require that heated piping in exposed areas be insulated as described in the above paragraph. In concealed areas, heated piping insulation can be installed using the lapped joint fastened with outward-clinching staples on 2" centers, placed 1/4" from the edge of the longitudinal lap.

(7) Fittings for Fiberglass Pipe Insulation:

(a) Valves and fittings 2" and smaller should be wrapped with strips of fiberglass blanket insulation to thickness approximately 1/8" less than the adjacent pipe insulation and then covered with a wrapping of PVC tape and a coating of barrier mastic. Tape should lap insulation a minimum of 2".

(b) Valves and fittings larger than 2" should be insulated with premolded fiberglass insulation fittings or cut segments of pipe insulation wired in place and coated with vapor barrier mastic and PVC tape with a minimum 2" overlap onto adjacent pipe insulation as described in the previous paragraph.

(c) On exposed applications, the fiberglass insulation should be covered with one-piece PVC fitting cover. The PVC fitting cover should be sealed at the butt joints using a PVC tape and a coating of vapor barrier mastic.

c. Pipe Insulation Schedule: **Comply with IECC 2009.**

4. VALVES:

- a. Valves 4” and larger should be gear operated with chain when 8’-0” or more above the floor.
- b. Horizontal valves for hydronic systems should be installed with valve stems upright.
- c. System balancing cocks shall be required.
- d. Butterfly valves shall be lug-threaded so they can remain on one end of the pipe.
- e. Gas valves shall not be located above ceilings. Locate valves as close to the appliance as possible in readily accessible locations.
- e. Steam valves with electronic actuators should be tilted a minimum of 45° or to a maximum of 90° from vertical. Such valves should not be located directly above any kind of heat source.

5. DUCT INSULATION:

a. Type of Insulation:

(1) Duct Liner: Duct liner shall not be used in HVAC systems. Where the mechanical system designer feels liner is necessary for the purposes of acoustical treatment, he shall obtain specific written permission from the UNL project representative. When approved, duct liner shall be of a non-fibrous type with anti-microbial coating as manufactured by NOMACO*, Zebulon, North Carolina, under the product name of IMCO Sheet. Notwithstanding the foregoing limitation, duct liner may be used as necessary for non-pressurized transfer boots in the return air stream for the purpose of acoustical treatment.

(2) Duct Wrap Insulation: Duct wrap insulation shall be the recommended, approved type of insulation as listed for the specific application in paragraph “b” below.

b. Duct Wrap Insulation Types:

Type "A" Duct Insulation: Flexible glass fiber; ANSI/ASTM C553; commercial grade, 'k' value of 0.26 at 75° F.; 1.5 lb./cu. ft. minimum density; 0.002" foil scrim facing for air conditioning ducts.

Type "B" Duct Insulation: Semi-rigid glass fiber board insulation; ANSI/ASTM C612, Class 1, 'k' value of 0.24 at 75° F.; 0.002" reinforced foil scrim facing; 3.0 lb./cu. ft. minimum density.

c. Duct Wrap Schedule:

<u>Concealed Applications</u>	<u>Type</u>	<u>Thickness</u>	<u>Finish</u>
Outside Air Intake Ducts	A	2"	AS-J
Medium Pressure Supply Air Ducts	A	1½"	AS-J
Low Pressure Supply Air Ducts	A	1½"	AS-J
Return Air Ducts in Unconditioned Areas or Spaces	A	1½"	AS-J
Relief/Return Air Duct From Plenum at Louver Back to Relief Damper Plus 36"	A	1½"	AS-J

<u>Exposed Applications**</u>	<u>Type</u>	<u>Thickness</u>	<u>Finish</u>
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Round Supply Ducts (All)	A	1½"	Canvas+AS-J
Round Return Air Ducts in Unconditioned Areas or Spaces	A	1½"	Canvas+AS-J
Rectangular Supply Air Ducts	B	1½"	AS-J
Rectangular Return Air Ducts in Unconditioned Areas or Spaces	B	1½"	AS-J

**Ductwork exposed in mechanical equipment rooms should be insulated as though it were concealed.

d. Application of Duct Insulation:

(1) Type "A" Insulation: Insulation should be cut slightly longer than the circumference of duct to insure full thickness at corners. Adhere flexible insulation to ducts with adhesive applied in 6" wide strips on 16" centers. All insulation should be applied with a 3" lap of facing material secured with mastic and edges tightly stitched with staples. Staples should be sealed with vapor barrier mastic on cold ducts. The insulation should additionally be secured to the bottom of all square ducts 18" or wider by means of welded pins and speed clips. Adhesive pins are not allowed. The protruding ends of the pins should be cut off flush after the speed clips have been applied. The vapor barrier facing should be thoroughly sealed where the pins have pierced through with a tape of the same material, by applying a vapor barrier adhesive to both surfaces as recommended by the manufacturer.

All joints and penetrations of the vapor barrier shall be sealed with 3" aluminum foil tape by applying a vapor barrier mastic to both surfaces to secure strips to facing material.

Insulation should be applied to ductwork from unit housing to ends of duct runs, including diffuser necks and register ducts.

(2) Type "B" Insulation:

(a) Impaling Over Pins: All insulation should be applied with edges tightly butted. Insulation should be impaled on pins welded to duct and secured with speed clips. Spacing of pins should be as required to hold insulation firmly in place but not less than one pin per square foot. At joints and penetrations of the vapor barrier should be sealed with a 3" wide strip of same material, applied with adhesive to both surfaces to secure strips to facing material.

(b) Other Methods of Attachment: If, through space or size restriction or other causes, the welded pin method of attachment is not feasible, require that insulation be secured to the duct with adhesive that meets NFPA 90A, 25-50 Code. The adhesive should cover the entire surface of the sheet metal when applied to underside of horizontal duct. Adhesive application may be limited to 50% coverage, applied in strips or spots on tops and sides of ducts. Edges should be reinforced with roll-on corner bead.

6. PUMPS AND COMPRESSORS:

- a. All pumps shall be base-mounted on a concrete inertia base where above grade, and a housekeeping pad, where on grade. In-line pumps are acceptable where they are accessible.
- b. Specify all pumps to be base mounted end suction, capable of internal component servicing without disturbing the pump piping.
- c. Require that HVAC pumps be provided with inverter duty motors.
- d. Require flexible pipe connectors at each compressor.

- e. On lines 3/4" and larger require filter dryers of the replaceable core type, sight glass indicators and suction accumulators. On lines 5/8" and smaller, use items with flared fittings to permit their removal.
- f. Require that pumps be installed with a minimum of ten pipe diameters of straight pipe on the suction side of the pump or use a suction diffuser if unable to meet this criteria. Combination or triple duty valves may not be used. Flow measurement and balancing shall be accomplished by means of a check valve, a fixed venturi flow measuring device (Griswold Quickset or equal), and a separate balancing valve. Particular attention should be given to "straight run" requirements or measuring device manufacturers.
- g. Require that all compressors be provided with a five-year warranty.

7. SUPPORTS, ANCHORS AND SLEEVES:

- a. Pipe sleeves should be installed through all concrete walls or slabs at the time of construction with a minimum 1/4" clearance to be packed and sealed.
- b. Pipe sleeves of Schedule 40 steel pipe should be specified for all pipe passing through fire-rated floors or walls. Pipe sleeves of 18 gauge sheet metal should be specified for all pipes passing through non-rated walls. Pipes in the sleeves should be sealed with an U.L. approved flexible material to the fire rating of the wall. Sleeves through floors should extend a minimum of 2" above the floor. Sleeves through walls should be flush with the finished wall surface. All pipe sleeves should be large enough to pass insulated piping without crushing the insulation.
 - (1) Sleeves should not support pipes in order to prevent the transmission of vibration and sound to the structure.
 - (2) Solid, chrome-plated steel escutcheon plates should be provided to cover the sleeves at walls in exposed locations.
- c. When copper pipe is supported by Uni-Strut*, Hydra-Zorb* type clamps should be required.
- d. Vertical pipe should be supported at each floor and at intervals of not more than 12 feet. Copper pipe should also be supported between each floor to prevent vibration.

8. HVAC SPECIALTIES:

- a. Chilled Water/Heating Water Systems:
 - (1) Heating water/glycol systems shall be designed to operate at a temperature no greater than 180 degrees Fahrenheit.
 - (2) Safety relief discharge for heating systems using glycol as the heat transfer medium shall be piped to the associated make-up tank or to barrel located near a floor drain.
 - (3) Thermometers and gauges should be legible from the operator floor.
 - (4) Temperature indicators, both thermometers (seven or nine inch, red reading) and remote sensors should be installed before and after each air handler coil, chiller, at building entrance and exit and at other heat exchanging equipment, to provide complete

operating information. Require “Pete’s Plugs” only (without thermometers) before and after all terminal unit coils and radiation.

- (5) Pressure gauges should be installed before and after all items of equipment that cause pressure changes, such as pumps, air handler coils, and compressors, and at building entrance and exit. Require “Pete’s Plugs” only, (without pressure gauges) before and after terminal units.
- (6) Require all air vents at coils and at strategic areas for control of air to be automatic type. Relief of these vents should be piped as acceptable by Code.
- (7) Require all expansion tanks to be bladder type with completely replaceable bladders.
- (8) All preheat coils should be a minimum 40% concentration glycol type.
- (9) Glycol safety valves should be piped to a glycol/water feed tank, sized to capture an average size dump or release, in the event the glycol is released because of a system problem.
- (10) All hydronic system makeup shall be through manual, piped, open feed system.
- (11) All closed loop hydronic systems shall be equipped with side-stream filtration.
- (12) Air separators shall cause not less than one foot of water pressure drop and a velocity not to exceed four feet per second through the unit at the highest anticipated gallons per minute of flow.
- (13) Require that all heating hot water system strainers be disassembled and cleaned after four weeks of the systems initial “seasonal” operation. Require that the UNL representative be given not less than a 72 hour notification before the cleaning is performed.
- (14) Hydronic system cleaning. Require that all hydronic systems be cleaned after assembly and before activation. Cleaning process is to be in accordance with accepted good practice, and is to be as specified by an approved water treatment specialist. Cleaning products are to be selected to have minimal environmental impact. MSDS shall be provided to UNL project representative for all cleaning products used.

b. Steam Systems:

- (1) Steam pressure regulators should be furnished with pressure gauges with dampers and cocks, inlet and outlet valves, inlet strainers with blowdown valve, and globe-valved by-pass line installed in the same vertical plane as the main. Each should be vented to outside the facility through a relief valve.
- (2) Steam pressure reducing stations shall be external pilot type, Fischer*, Spence*, or Leslie* brand, or equivalent product approved by UNL representatives. Acceptable brands shall be provided with a three-year warranty.
- (3) Steam drip traps shall be installed immediately upstream of all control devices, such as pressure reducing stations and automatic control valves.
- (4) Steam traps shall be of float and thermostatic type for modulating loads (converters, humidifiers) and of thermostatic only type for drip service.

(a) Float and thermostatic steam traps shall be TLV brand or equivalent product approved by UNL representatives.

(b) Thermostatic steam traps shall be Gestra* brand or equivalent product approved by UNL representatives.

(5) Steam pipe size feeding pressure reducing stations or automatic control valves shall be reduced with eccentric reducers, rotated up to prevent condensation from carrying through control devices.

(6) Vacuum breakers on steam vessels shall be manufactured and rated for such service. Swing or poppet check valves shall not be used.

(7) Steam vacuum breakers should be required at the inlet to all steam coils and heat exchangers.

(8) Specify condensate return pumps with duplex pump sets and sufficient head capability that slight impeller erosion will not disable the pump. Pumps should normally handle the load alone and alternate, but should also operate together if needed. Tanks should be vented to a safe location outside of the building.

(9) Y-strainers for steam service shall be installed only in the horizontal position with the strainer oriented horizontally (to the side).

9. HVAC EQUIPMENT:

a. Require all air handling units to be constructed in accordance with the SMACNA Manual, current edition, with access doors, observation ports, full insulation, and rigid, double-wall construction. Access doors should be provided to all areas of the AHU to provide access to both sides of all coils, fans, filters, dampers, etc. Require that permanent lighting be provided in all sections, protected with explosion-proof fixtures. **Construction of all new air handling units shall meet the following requirements: 1% leak rate; L/240 deflection at 8" static; full thermal break between inner and outer wall; minimum 2" G90 galvanized double wall with minimum 3 pound fiberglass (or foam) insulation; base shall be welded aluminum channel with welded aluminum tread plate floor; chilled water coil headers, frames and drain pans shall be 304 stainless steel.**

b. Use "plug" fans in all air handling units except where the use of this type of fan would be inadvisable because of technical reasons. When the systems design allows, the project designer should utilize "fan wall" technology due to greater energy efficiency as well as space savings for the mechanical equipment.

c. Require motors for air handlers to be inverter duty rated type.

d. See Article 11 of this Design Guideline for requirements related to fan drive sheaves.

e. Require air handler Economizer section to be provided with air blender.

f. Require filtration of all incoming air at a minimum of 35 percent. Minimum effective filter area shall be not less than 4 square feet to 1 square foot of face area for the 2" thick filter and not less than 7 square feet to 1 square foot of face area for the 4" thick pleated filter. Final dust holding capacity shall be a minimum of 200 grams at 1.0" w.g. Filters should be U.L. approved. **Laboratory HVAC systems shall have MERV13 or better final filtration.** Better filtration should be provided as required for specific areas after consultation with the anticipated user and UNL representatives. Maximum face velocity across filters should be 450 fpm. All

coils, including preheat coils, should be protected with pre-filters. Final filters shall be rated at not less than 60%.

- g. Temporary filters same as required for the unit should be required to be installed prior to start-up. Require these to be changed as required by static pressure drop readings during construction and again, regardless of static pressure drop readings, just before acceptance by UNL. Use **MERV 13 filters on return air grilles if HVAC has to be used during construction.**
- h. Specify pre-filters on all 60 percent and higher filter banks.
- i. Design any desired rotary coolers to use a de-ionized water supply with a bronze rotor assembly on a stainless steel shaft, and require 80 percent minimum evaporative efficiency certified by the manufacturer's independent laboratory test data.
- j. Require all floor-mounted equipment to be mounted on its own base directly to the structural floor. Do not allow such equipment to be mounted on a raised computer floor or any other raised flooring.
- k. Specify an automatic water treatment system for open system such as cooling towers. Provide complete layout and operational description. Require water treatment systems to be placed in operation, specify water conditions to be attained and require at least one week such operation prior to final test with UNL representative present. Require recording of 1) raw water total hardness ppm, 2) concentration cycles, 3) raw water pH, 4) system water pH, 5) system water hardness ppm, 6) chemicals used, 7) quantity of chemical per cycle, 8) make-up water required gpm, 9) waste water requirement gpm.
- l. Require all air handlers to have propylene glycol preheat coils in the air handler. Design for minimum ventilation requirements at -20° F. design temperature.
- m. Require that chilled water coils be installed after the supply fan and that preheat coils be installed before the supply fan.
- n. Require systems with any hydronic piping subject to freezing to have 40% propylene glycol mixture to provide protection to -20° F.
- o. New and remodeled hydronic systems shall be filled with a factory premix of propylene glycol and de-ionized water equivalent to Dow* Frost HD. Hydronic systems for preheat coils shall be filled with a 40% solution of glycol and DI water. Hydronic systems for reheat coils shall be filled with a 30% solution of glycol and DI water.
- p. Design all chilled water coils for a maximum face velocity of 450 fpm. Design all coils for a maximum of 8 rows.
- q. Require all coils to be such that they can be easily replaced, copper tubing, not more than 10 fins per inch, expanded tube or continuously soldered fins. Coil ends should have removable insulated casing panels. Coils should have air vents which extent out of the casings so that they are accessible.
- r. Every unit with a cooling coil to have a condensate pan, drain and drain line with trap to a building floor drain or sink. Require that condensate pan, drain, and drain line be located so that they are easily accessible for cleaning and maintenance.
- s. Specify pot feeders for all closed loop systems and provide recommended treatment method and chemicals.

- t. Design cooling towers to utilize as much polyethylene and/or PVC as possible, consistent with structural strength requirements. Require adequate access to fan, motor, and water reservoir as feasible, including platforms and ladders or steps if needed.
- u. Specify heat exchangers of the plate and frame type for 125 psi pressure for use with chilled water systems to isolate building chilled water flow from campus distribution system. When utilizing chilled water heat exchangers, the units shall be protected by way of fully redundant duplex strainers with isolation valves and 1/16" screen baskets.
- v. Design any fan coil units with filters in the return air grill, fully accessible for easy replacement.
- w. All blowers and fans shall be AMCA-labeled. Fan construction shall be Class I for systems with up to 2" S.P.; Class II for systems with up to 6" S.P.; Class III for systems with over 6" S.P. Require all oiling and lubricating points to be accessible without unbolting or unscrewing panels. All air-handlers should be blow-through configuration and selected with quietness in mind. System effect should be considered in all applications. All blowers should have a fan curve that when used in a VAV system, the fan should not move back and forth across the peak point, causing noise and turbulence problems. For this reason AF and BI type fans are preferred for VAV applications. Plug fans or plenum fans should be used on all air handlers.
- x. All VAV boxes should have a fiber-free liner, nylon bearing at both ends of damper, a center-pivot round disk damper with full shut-off capability, a metal damper shaft through full length of blade, and a multiple point flow sensor in the inlet to the box. Liner should be fiber-free type, such as Titus* Fiber Free. VAV boxes should be selected so that the initial design air volume targets 80% of the box capacity. VAV box shall be sized to provide 400 fpm inlet velocity at minimum flow (heating).
- y. All automatic control dampers shall be installed in accordance with Standard Detail SD23-07.
- z. Buildings requiring humidification should not utilize direct injection of steam from campus central utilities or building steam systems. Humidification should be maintained with steam-to-steam humidifiers in buildings supplied with central steam. Buildings not served with central steam should be humidified with electric self-contained humidifiers. Humidifier feed water should have a hardness of 10 grains or less. Softened, de-ionized (DI) or reverse osmosis (RO) water should be used for humidifier feed water in buildings with water treatment system. A stand-alone water treatment system, appropriate for the application, should be installed to serve humidifiers in buildings without treated water available. Steam humidifiers should be as manufactured by Dri-Steem Ultrasorb* and utilize rapid absorption dispersion tube design. Humidifiers shall be fitted with full electronic control package with 2-10vdc control signal interface. Other technologies of humidification may be considered with prior authorization from the owner's operations staff.
- aa. Provide air blenders for any stratified air stream which needs to be measured for control. Mixing ductwork should be designed to prevent stratification.
10. EXHAUST FANS/UTILITY FANS:
- a. Require utility fans for fume hood exhaust systems to be certified AMCA B certified, belt driven, spark resistant with aluminum wheel, steel housing, motor and drive housing, adjustable motor supports, solid core sheave, and anti-friction ball bearings. Where required, specify an inside fan coating chemically resistant to the anticipated fumes. Specify fans to discharge vertically, with a 1/4" drain hole in the bottom of the fan housing. Laboratory discharge duct should terminate no lower than 10 feet above walking surface and have a stainless steel bird

screen on exterior face of discharge grille. Zero loss termination should conform to ACGIH Figure 6-30, A or C.

- (1) See article 7-FUME HOODS of Design Guideline DG 230000.10 for additional requirements relating to fans for fume hoods.
- b. General-use roof exhaust fans should be aluminum housed high efficiency fans, fully vibration isolated with motor and drive housing completely sealed from the exhausted air, and electric damper.
- c. The maximum rpm for all utility fans should be 1,800. If a fan cannot be selected within this range, select a type of fan that is specifically designed to operate easily at a higher rpm such as a radial blade type.
- d. In-line fans should not be used without approval of UNL representatives.
- e. Exhaust fans are to be provided with contactor/disconnect with 120vac coil for interface with EMCS system.

11. MOTORS, MOTOR STARTERS AND DRIVES:

- a. Electrical Work: All electrical work should be done in accordance with Division 26 requirements.
- b. Electric Motors: All electric motors should be induction type, 1750 rpm unless approved otherwise. Motors ½ HP and larger should be 3-phase. Generally, motors should have a minimum 1.15 service factor for continuous duty. Five horsepower and smaller motors should have factory-sealed permanently sealed ball bearings. All motors should be high efficiency type. Specify that motors be inverter-duty-rated to work with variable frequency drives.
- c. Motor Starters: All motor starters should be provided as a part of the work described in Division 16-Electrical unless provided as an integral part of the manufacturer's package equipment. Starters should conform to the following:
 - (1) Single-phase motors shall have manual starter with integral overload.
 - (2) For three-phase motors, thermal protection should be provided on all three legs, with auxiliary contacts as required for control interlocks. VFD units should be used for motors larger than 5 HP.
 - (3) Equip starters with control transformer and fuse protection in secondary. All starters should have 110 volt AC control circuitry. On renovation projects, replace all non-110 volt motor starters with 110 volt controls.
- d. Belt Drives: Generally, belt drives should be used with "V" belts, provided with adjustment capability for tension and alignment. Belt speed should not exceed 5,100 fpm. Belts should be rated at 150% of the motor horsepower.
- e. Sheaves: Sheaves for fan motors should be statically and dynamically balanced, close-grained cast iron free of sand holes and other defects. They should be solid core sheave sized to match design criteria (motor speed, load and fan speed).
- f. Multiple Belts: Systems requiring multiple belts should use the cog-type belts (direct drive belts).

12. METERS:

Moved to DG330000 10.

13. AIR COMPRESSORS:

- a. Air compressors shall be duplex Quincy* QRB Model with cast iron heads, sized for 30% run time, with 120 gallon or larger storage tank.
- b. Air filtration devices for compressed air systems are to be provided by UNL BSM or per specific approval of UNL BSM.
- c. Compressed air dryers are to be sized to achieve delivery of 35° F. 100 psig air at dew point. Where lower dew point air is required, alternative moisture removal systems shall be allowed when specifically approved by UNL project representatives.
- d. Bypass piping is required for filters and strainers wherever practicable.

PART 3 – EXECUTION

14. PIPE, EQUIPMENT AND VALVE IDENTIFICATION:

- a. Pipe Marking: Require stencil identification and flow direction arrows on all pipes after finish painting (if any), no more than 20 ft. apart, at every change of directions greater than 45°, and on each side of wall and floor penetrations, in accordance with the following schedule. Require a labeling system equal to two bands of ¾” wide polyvinyl color-coded electrical tapes of 2-mil thickness with directional arrow and code letters as shown below at each location:

<u>Service</u>	<u>Color</u>	<u>Code</u>
Chilled Water Supply	Dark Green	CWS
Chilled Water Return	Dark Green	CWR
Condenser Water Supply	Light Green	COND. WS
Condenser Water Return	Light Green	COND. WR
Heating Water Supply	Maroon	HWS
Heating Water Return	Maroon	HWR
Low Pressure Steam	Orange	LPS
Medium Pressure Steam	Orange	MPS
High Pressure Steam	Orange	HPS
Steam Condensate Return	Yellow	COND.
Condensate Drains	Dark Blue	CD
De-ionized Water	Green	DI
Reverse Osmosis Water	Green	RO

- b. Nameplates: Require nameplates (stamped metal or engraved plastic) on each piece of equipment, permanently attached. Manufacturer's name, model number and characteristics shall be included on the plate.
- c. Valve Tags: Require all valves, except fixture stops, to be tagged with 1-1/2” diameter brass discs having depressed black filled letters and numbers not less than ¼” high and ½” high, respectively. Tags should be color coded to indicate the fluid controlled. Attach tags to valves with 12” long braided copper wire meter seals.
- d. Valve Directories: Require typewritten valve directories framed under acrylic and aluminum frame with valve number, service, location, size, make, model, normal position, and special remarks. Require mounting in each equipment room and providing three unframed copies of each to owner.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

INSTRUMENTATION AND CONTROL FOR HVAC

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1. GENERAL
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3. DESIGN CRITERIA
4. MECHANICAL ROOM REQUIREMENTS
5. DEVICE AND EQUIPMENT INSTALLATION
6. INSPECTION, TESTING AND AIR AND WATER BALANCING

1. GENERAL:

a. Energy management and control systems for newly-installed HVAC systems should be designed and installed in accordance with the procedures contained in this guideline.

b. The definition of control system functions and control sequences should be prepared by the party preparing the HVAC system design. This information should be completed and submitted to UNL Building Systems Maintenance (UNL BSM) within a time frame which would allow UNL BSM to complete the engineering of the control systems and prepare control system drawings which would be included in the project Bid Documents. Prior to establishing the completion date for the Bid Documents, the UNL Project Manager will confirm that the mechanical systems designers have or will have provided sufficiently complete information to the UNL BSM ~~CG~~ to enable it to complete a technical review and the engineering and documentation of the control systems requirements in time to include with the Bid Documents.

(1) The mechanical systems design engineer shall develop a sequence of control for all HVAC systems to establish a baseline of design criteria and such information shall be included on the mechanical systems schedules/drawings. General office and classroom systems may be text based. All laboratory-type systems shall have text as well as graphic representation of system operation showing room pressurization relationships.

c. The mechanical system designers should review the completed control systems documents in conjunction with the mechanical systems plans and specifications and the applicable portions of the electrical systems plans and specifications and initiate such action as may be necessary to remove omissions, duplications or other conflicting requirements which are discovered during such review.

2. MATERIALS FURNISHED BY UNL CONTROL SYSTEMS GROUP:

a. The UNL BSM will furnish all thermostats and other control system devices indicated on the control systems Bid Documents as being "furnished by UNL BSM".

b. The project specifications should require the "controls systems installer" to rough-in and mount all such devices and install all the conduit and wiring for the system. The project drawings should also require the installation of electrical feeds, electrical receptacles, and similar work which is indicated on the control systems drawings to be provided by "the Electrical Contractor" or "the Mechanical Contractor", as appropriate.

(1) Consultants designing mechanical and electrical systems should cross reference their own design drawings to the project's Energy Management & Control System (EMCS) drawings wherever interface between systems designed by them and energy management/control systems occurs.

3. DESIGN CRITERIA:

a. As a general rule, control systems should permit individual room control of temperatures. Where the project budget or some other restriction does not permit this approach, written approval must be provided by the UNL Project Representative, after receiving the concurrence of the Director of UNL Building Systems Maintenance.

4. MECHANICAL ROOM REQUIREMENTS:

a. Control systems should be located in rooms that are reasonably conditioned where ambient temperatures in the range of 50° to 90° F. are maintained.

b. Adequate spaces to access and service control panels should be provided. Doors should be capable of being opened fully without obstruction.

c. Electrical receptacles should be provided adjacent to all control panels and in all mechanical rooms for power service tools.

d. Adequate lighting should be provided in mechanical rooms and inside all air handling equipment for service personnel, including supplementary lighting above all automatic control panels, motor control centers and variable frequency drives.

5. DEVICE AND EQUIPMENT INSTALLATION:

a. Insure that manufacturer's specifications for the installation of flow measuring stations (such a sufficient length of straight ductwork on each side of the device) are enforced.

b. Do not provide more than one perimeter automatic control valve per room unless room size dictates otherwise and then only with the approval of the UNL BSM.

6. INSPECTION, TESTING AND AIR AND WATER BALANCING:

a. General: Project specifications should indicate that testing and balancing of new heating, ventilating and air conditioning systems will be carried out by an independent contractor employed directly by UNL BSM or performed by UNL BSM personnel.

b. Testing and Balancing Parameters: Project specifications should indicate to the installing contractor(s) that testing and balancing will be completed within the following parameters:

(1) Operational tests will be performed during the appropriate weather season, even if such timing would delay the completion of such testing several months following acceptance of the project.

(2) Tests will not be performed until systems have completed a minimum of 10 full days of operation.

(3) The construction schedule should allow time for the completion of testing and balancing prior to the date established for project completion.

(4) Installing contractor(s) will be required to furnish personnel to make any changes in sheaves, belts, dampers, valves, or similar points of adjustment to bring the system into conformance with the design criteria.

(5) Installing contractor(s) will be required to remove any adjustable sheaves following completion of testing and balancing and furnish and install replacement permanent solid-core sheaves.

(6) Weekly coordination meetings will be scheduled by the Testing and Balancing Contractor while testing and balancing is underway. Specifications should require attendance at these meetings by supervisory personnel of contractors installing mechanical, electrical and control systems work.

c. Specifications should direct the timely completion of the power circuits required for the control system components to enable UNL BSM to test and calibrate components of the control system installation. This should occur well in advance of the date at which the control system is to be made operational.

HVAC AIR DISTRIBUTION

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1. GENERAL
2. DUCTWORK DESIGN
3. DUCTWORK ACCESSORIES

1. GENERAL:

a. Application: Design and specify ducts and ductwork systems to utilize components conforming to the requirements defined in these guidelines. Deviations from these guidelines must be approved in writing by the UNL Project Manager.

2. DUCTWORK DESIGN:

a. General Design Parameters:

- (1) Require all low pressure duct for HVAC to be constructed of galvanized steel and sealed in accordance with SMACNA and these guidelines.
- (2) Require submittals of samples for odd or questionable duct connections, diffusers, grilles, dampers, etc.
- (3) Require complete cleaning of the inside of the air distribution system before the fans are turned on. Then require filters of the same efficiency as specified to be put in place prior to operation and to be changed during construction if needed and just before acceptance.
- (4) Clamps for flexible duct should be stainless steel with worm gear tightener; nylon draw bands are unacceptable.
- (5) Do not allow round duct to be fitted to an oval fitting by collapsing the duct. A round to oval transition should be used.
- (6) All duct through exterior walls should be flashed.
- (7) Supply air ductwork upstream of terminal units shall be minimum 4" pressure class construction, such as DuctMate*, and shall be sealed with appropriate methods.
- (8) Supply air ductwork downstream of terminal units shall be 1" pressure class construction and shall be sealed with appropriate methods.

- (9) Require all duct exposed to the weather to be 1) made watertight by sealing each cross joint with G.E*. 1200 Silicone applied to all contact surfaces prior to assembly and sealing each longitudinal joint internally, 2) if conditioned air duct, apply rigid 2" insulation and cover with watertight aluminum sheet.
- (10) Allow no flexible duct runs over 3 feet in length to any diffuser supply. All flexible duct must be at least as large as the diffuser neck size. Do not allow 90° changes in direction with flexible duct. Design for a minimum straight section of flexible duct equal to the diameter of the diffuser for vibration control.
- (11) Require horizontal duct supports at each joint and at 4 ft. o.c. maximum. Anchor hanger strips to structure. Impact driven anchors in steel or concrete structure should not be permitted.
- (12) Require vertical duct supports at each floor that will support the weight of ductwork in that section without any deflection or distortion.
- (13) Require all joints to be sealed air tight with flange-type connections. Require joints to be inspected before insulation is applied.
- (14) Specify maximum transition angles of 20 degrees for convergent airflow and 30 degrees for divergent airflows. Blunt transitions should not be permitted. Transitions between air handlers and ductwork should be designed for maximum efficiency to minimize system effect.
- (15) Require upstream duct attached to VAV box to be straight, rigid, and without size change for not less than five duct diameters upstream of box.
- (16) Ductwork should be specified to withstand the pressures which run-away fans are capable of producing should controls fail. Pressure relief safety dampers may be used to relieve excess pressures with the approval of appropriate UNL representatives.
- (17) Underfloor ductwork beneath slab-on-grade floors buried directly in the earth is not allowed. If underfloor ductwork below slab-on-grade floors is necessary, it should be installed in an accessible tunnel.
- (18) Supply air distribution shall not discharge air directed at electronic thermostats room temperature controls. Air distribution shall be designed in such a manner as to prevent airflow being directed at the occupant or at the room temperature controls. A blank-off section on a 4 way diffuser is allowed on the thermostat side where locations are limited.

b. HVAC Ductwork Materials:

- (1) It is essential that contract plans require that the entire duct system be assigned a pressure classification equal to the total pressure at the fans. The duct system should be constructed of the gages shown on SMACNA tables relative to the total design static pressure of the system.
- (2) All joints for round duct should be equal to "Ductmate-Spiralmate*" as indicated in SMACNA tables.
- (3) All joints for oval duct should be equal to "Ductmate-Ovalmate*" as indicated in SMACNA tables

(4) All joints for rectangular duct shall be equal to "Ductmate* '25' or '35'" as indicated in the SMACNA tables. S-lock and drive cleat joined ductwork is not acceptable.

c. Chemical Fume Hood and Hazardous Exhaust Ductwork:

(1) Chemical fume hood and hazardous exhaust ductwork shall be constructed of an appropriate grade stainless steel to be compatible with the chemical processes exhausted. All transverse joints on rectangular, round, spiral, and flat oval duct shall be constructed with stainless steel Ductmate, Spiralmate, Ovalmate or other pre-approved stainless steel flange system. All joints shall be sealed with appropriate chemical-resistant sealant. Chemical fume hood and other hazardous exhaust ductwork shall be constructed according to SMACNA 2005 edition for the proper pressure class. Duct design shall be in accordance with Chapter 35 of the 2005 ASHRAE Fundamentals Handbook.

(a) When fully welded duct is required and specifically called out (i.e. Radioisotope Hoods), exhaust duct shall be constructed of an appropriate grade stainless steel to be compatible with the chemical processes exhausted and be fully welded on all longitudinal and transverse joints.

(2) Perchloric Acid Hoods:

(a) The exhaust air ductwork from a perchloric acid hood should be constructed of Type 316 stainless steel with welded longitudinal seams and joints. Elbows 8" and smaller should be Type 316 stainless steel of the long radius design, stamped and smooth. Elbows larger than 8" shall be Type 316 stainless steel, gored type with joints welded and ground smooth inside.

(b) Washdown provisions should be incorporated into the design in accordance with NFPA standards.

(c) All ductwork should be sloped to drain back to the hood.

(d) Each perchloric acid hood should have an individual exhaust blower and duct system through the roof.

(e) Exhaust fan shall be located outside the building and be specifically designed for perchloric acid use with wash down and drain provisions. The bearing lubrication should be specifically designed for use with perchloric acid.

(f) The exhaust discharge should be vertical, using a "No-Loss" rain proof termination similar to Industrial Ventilation Figure 6-30, 19th Edition and terminate at least 10 feet above the roof.

(3) Radioisotope Hoods:

(a) Radioisotope hoods shall be constructed of materials and duct design as to meet requirements of UNL Environmental Health and Safety.

3. DUCTWORK ACCESSORIES:

- a. Require 4 inch wide flexible connections with one inch (1") slack between fan units and ducts.
- b. There should be no volume dampers or fire dampers in the fume hood exhaust ducts.
- c. Require volume dampers with through-duct shaft and mounting at all diffuser take-off locations.
- d. Require factory-fabricated, single-wall turning vanes in all 90° bends unless the elbow has an inside and outside radius with a center line radius of 1-1/2 times the greater duct dimension.
- e. Use only low-loss fittings at takeoffs; do not permit the use of extractors.
- f. Require fire dampers to have blades outside the air stream, to be sealed in the wall with fireproof cement and to have an adequately sized access into the damper and in the ceiling to the damper. Fire dampers should be fitted with electric fuse link and auxiliary proof switch to allow unit to be monitored by fire alarm system.
- g. Manual balancing dampers are to be provided with shaft protruding through both sides of duct, and shall be fitted with quadrant control with standoff to extend through insulation.
- h. Actuated fire/smoke or smoke dampers are to be built with electronic fuse link technology and fitted with auxiliary switch for use by EMCS system or fire alarm monitoring.
- i. Require that all fire, smoke, and fire/smoke dampers be tested in the presence of a representative of UNL BSM following completion of the ductwork system.
- j. Control devices for terminal boxes should be of the type selected by UNL BSM. See Design Guideline 230913 for procedure to be employed in selecting and specifying control systems.
- k. Require all return air grilles opening into a ceiling plenum to be provided with a duct boot with minimum longitudinal dimensions of 2 feet by 2 feet.
- l. Threaded cap test holes should be provided in the return air, outside air and the supply air duct of each air handler. Test holes should be installed after balancing damper in each zone of multi-zone units and in the discharge plenums of each mixing box. Additional test holes should be provided where directed or necessary for using pitot tubes for taking air measurements to balance the air systems. At each of these locations where the duct or plenums are insulated, extensions should be provided to accommodate the thickness of the insulation. The test hole bracket should consist of heavy screw cap, pipe extension, duct flange and gasket. Concave gaskets should be used for adapting test holes to round duct. Duct test holes should be "Ventlok" or approved equal.
- m. Require that all exterior louvers be fitted with a birdscreen of not less than 1/4" by 1/4".
- n. Air extractors are not allowed.
- o. Locate and space diffusers so as to prevent air collision and dumping.

p. Supply air diffusers are to be provided without integral dampers. Diffusers shall be designed to provide adequate throw in heating mode (low flow).

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

**PROCEDURES, DESIGN STANDARDS,
AND DESIGN CRITERIA (ELECTRICAL)**

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8. ELECTRICAL WORK FOR ENERGY MANAGEMENT & CONTROL SYSTEMS
9. ELECTRICAL WORK FOR BUILDING CARD ACCESS SYSTEM
10. ADDITIONAL PROJECT-SPECIFIC SPECIFICATION AREAS

1. GENERAL DESIGN REQUIREMENTS:

a. Quality of Workmanship and Materials: The selection, design, and specification of the materials and workmanship to be incorporated into the electrical systems of the project should respond to the demanding environment of a major educational institution providing reliable, durable, low-maintenance, long-life usage, while recognizing the budget constraints for the project.

b. Code Compliance: All work should comply with the applicable laws and regulations of the State of Nebraska, with all requirements of the latest edition of the National Electric Code (NEC), including 2008 IECC, as adopted by the State of Nebraska, and the requirements of the Lincoln Electric System.

c. Special Systems:

(1) Clock/Bell Systems:

- (a) As a general rule, clock/bell systems are not required in new UNL facilities. The project design process should include a determination as to whether the major project occupant requires such a system.

(2) Fire Alarm Systems:

- (a) All new buildings shall be provided with fully addressable fire alarm systems.
- (b) Additions to existing buildings shall have existing fire alarm systems extended and expanded if necessary to include the new construction.

d. Separation of Systems: Require that different systems be run in separate conduits as complete systems with conduits, wireways, boxes, and remaining components, i.e.

120/208 volt systems
277/480 volt systems
fire alarm

emergency lighting and power
computer/data systems and telephone/CCTV systems
intrusion alarms
building automation

e. Rooftop Outlets: On rooftops with mechanical equipment installed, provide an electrical outlet (not on the mechanical equipment circuit) located within 25 feet of the equipment.

f. Emergency Power to Perimeter Heating System: Where new buildings or building renovation projects are provided with an emergency generator, all perimeter **heating systems shall** be connected to the emergency panel through a manual or automatic transfer switch.

g. Power for Energy Management and Control Systems: Specifications should direct the timely completion of the power circuits required for the control system components to enable the Control Systems Group to test and calibrate components of the control system installation. This should occur well in advance of the date at which the control system is to be made operational. **EMCS controls shall also be on the generator where a generator is provided.**

h. Refer to DG 010000.14 for electrical requirements relating to Custodial Facilities.

i. **Refer to DG 01000.25 for electrical requirements in Telecom rooms.**

2. COORDINATION OF MECHANICAL, ELECTRICAL AND UNL-FURNISHED SYSTEMS

a. Project A/E consultants shall structure contract documents to reflect the assignment of responsibilities for procuring materials and equipment and installing/setting/placing of such procured materials and equipment in accordance with the table in Article 3 of Design Guideline 2300000.10. **A responsibility table shall be provided for electrical/mechanical responsibilities.**

3. POWER QUALITY AND HARMONICS CONTROL:

a. Three-Phase Computer Loads:

(1) **Design system to mitigate harmonics and neutral overload.**

(2) In computer rooms with raised floors, provide copper ground grid on 2' centers bonded to floor stands and each junction. Bond all equipment to floor grid with jumpers less than 2' long. Bond to building steel at all accessible locations.

b. Single-Phase Non-Linear Loads:

- (1) Provide delta/gye shielded isolation transformer as close as possible to loads. Specify the proper "K" rating for these transformers, **if applicable**.
- (2) Specify oversized or separate neutrals for multi-wire branch circuits with high harmonic loads.
- (3) Require that ballast manufacturer submit input current spectrum analysis for their ballasts with shop drawings. Analyze transformer heating characteristics of these ballasts.

4. TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

a. TVSS System Requirements:

- (1) Specify service entrance TVSS device with clamping voltage of 2 - 3 KV and high heat dissipation capabilities.
- (2) Specify panelboard TVSS clamped at 500 - 600 volts **for panelboards serving sensitive loads**.

5. LIGHTING:

a. General:

- (1) Switch office, classroom, and lecture hall lights on multiple switches to allow multiple light levels. Provide dimming where required.
- (2) Arrange toilet room light fixtures so that failure of a single ballast will not leave room in darkness. If a single two-tube fixture is used in room, provide two ballasts in fixture.
- (3) Provide individual lighting fixtures above sink mirrors in all toilet rooms, both single occupancy and multiple occupancy.
- (4) In 277 volt fluorescent lighting systems, where inside tubes and outside tubes are switched separately, use same phase for both sets of tubes so that 480 volts is not accessible in fixture. Require the use of barriers in any boxes where 480 volts would be accessible.
- (5) Recessed fluorescent fixtures in solid ceilings should not be connected with fixture whips. Associated junction boxes should be accessible without removing fixture from ceiling.
- (6) Where head of emergency lighting fixture is located remotely from battery pack, **a printed** label should be provided, indicating the location of the battery pack.
- (7) In classroom buildings, provide motion sensor switches in toilet rooms.
- (8) Circuit fluorescent and HID lights installed in sports or machinery spaces to minimize "strobe" effect.

(9) All lensed fluorescent fixtures shall have .125" acrylic lenses. Glass lenses are not allowed. Provide cutoff or indirect fixtures in areas where CRT's are in use minimize glare on the work surface. Where deep-cell parabolic grids are used, lamps shall be centered behind the parabolic grid.

(10) Where multiple lighting levels are desired, use three- or four-lamp fixtures with center lamp(s) on separate ballast and separate switches. If budget allows, provide dimmable system.

(11) In areas with fixed seating and/or tiered or sloping floors, locate light fixtures to facilitate their relamping by UNL custodial/maintenance personnel.

(12) Do not permit the use of self-illuminating exit or safety light fixtures containing radioactive material.

(13) Coordinate lighting control with UNL Building Systems Maintenance who provide occupancy sensing and control in all new buildings.

b. Lighting Fixtures and Lamps:

(1) Fluorescent lamp ballasts shall be high-frequency ballasts with <10% total harmonic distortion (THD), a power factor >95% ballast factor (BF) between 85% and 100% instant- or programmed-start with parallel circuitry. Manufacturers should provide certified test of current spectrum as part of shop drawings submittal.

(2) Unless directed otherwise, fluorescent lamps shall be 4-foot T8, T5 or T5HO, 4100K color temperature, low-mercury, with color rendering index (CRI) no less than 70.

(3) Where fixtures are recessed into fire-rated ceilings and fire-rated enclosures are required, the fixtures scheduled for use in such areas should be approved and suitable for use in such areas.

(4) Fixtures operating in low-temperature or exterior locations should have appropriate ballasts.

(5) The use of ornamental or decorative fixtures, particularly those of foreign origin, should be strictly limited to locations of special architectural emphasis and then only where it has been established that domestic-made fixtures providing the same effect are not available. All fixtures should bear the label of the Underwriter's Laboratories. Considerations which should enter into the selection of decorative fixtures should include the long-term availability of replacement parts, including lenses and other glass components and the costs associated with cleaning and relamping the fixtures. The use of fixtures falling into this category should be approved by the UNL project representative prior to their incorporation into the project construction documents.

(6) Prohibit lighted bollards and underground luminaries or fixtures.

(7) Avoid manufacturers whose replacements ballasts or parts are not in line with customary cost.

c. Emergency Lighting: Where budget permits, provide emergency lighting system wired back to a single point and only one backup system, i.e. generator or inverter.

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- d. Exit Lights: Should be LED type. Do not use units containing radioactive material.
- e. Fluorescent Light Fixture Standards: **New fixtures shall conform to applicable requirements of subsection a. (above). Lamps and ballasts shall conform to requirements of subsection b. (above) in this section.**
- f. Lighting Design Standards:
- (1) General **design** illumination levels should **not exceed** the criteria listed below and should not exceed the average raw foot candle values that are recommended in the IES Lighting Handbook, **latest** edition. Maximum to minimum ratios and average to minimum ratios should comply with IES guidelines for each application.
- (2) Light Levels:
- (a) Corridors and Stairwells: 10 fc to 15 fc.
 - (b) Waiting Room and Lounge Areas: 10 fc to 15 fc.
 - (c) Toilet Rooms: 20 fc general illumination, plus separate fixtures above sink mirrors.
 - (d) Circulation Areas Between Work Stations: 30 fc.
 - (e) Conference and Seminar Tables: 30 fc.
 - (f) Filing and Duplication Areas: 30 fc.
 - (g) Auditoriums: 50 fc, dimmable with switches and dimmers to minimal light levels.
 - (h) Bulletin Boards and General Displays: 30 fc.
 - (i) Cafeterias and Dining Areas: 30 fc.
 - (j) Locker Rooms: 30 fc.
 - (k) Museum Galleries: 30 fc.
 - (l) Food Preparation Areas: 50 fc.
 - (m) Support Shops: 50 fc.
 - (n) Secretarial Desks, Staff and Faculty Offices: 50 to 70 fc.
 - (o) Classrooms and Lecture Halls: 50 fc to 70 fc general illumination; up to 100 fc on chalkboards.
 - (p) Accounting and Business Machines: 85 fc.
 - (q) Drafting: 110 fc.
 - (r) Laboratories:

- (1) General: 50 fc.
- (2) Close: 100 fc.
- (s) Library:
 - (1) Reading Rooms and Carrels: 70 fc.
 - (2) Stacks: 30 fc.
- (t) Mechanical Rooms: 30 fc, except that supplementary lighting should be provided to provide a light level of 100 fc at control panels, motor control centers and variable frequency drives.
- (u) Custodial Work Rooms and Custodial Storage Rooms: 50 fc.

6. ELECTRICAL REQUIREMENTS FOR COMMUNICATIONS CLOSETS:

a. Entrance Conduit:

- (1) Telephone/Data: Provide conduit from exterior of building into telephone entrance area in telecommunications wiring closet, sized in accordance with the following:

<u>Telephone Entrance Pairs</u>	<u>Conduit Size</u>
1-99 pairs	One 2-inch conduit
100-300 pairs	One 3-inch conduit
301-1000 pairs	One 4-inch conduit
1001-2000 pairs	Two 4-inch conduits
2001-3000 pairs	Three 4-inch conduits

Confirm number of phone/data jack locations with UNL Facilities Management and UNL Telecommunications offices. For initial planning purposes, on combination telephone/data outlet should be allowed for each 50 to 60 sq. ft. of net office or laboratory area.

- (2) Fiber Optics: Where fiber optic entrance is required, provide one 4-inch conduit, with three inner ducts (two 1-1/2" and one 1").
- (3) Television Coaxial Cable: Provide separate conduit for coaxial cable entrance; do not combine with other telecommunications entrances.
- (4) Installation Requirements:
 - (a) Do not include more than two 90 degree bends between pulling points when installing underground conduit. Require that bends be long sweep type, with a radius of not less that six times the internal diameter of conduit for 2" or smaller conduit and ten times the internal diameter for conduit larger than 2".
 - (b) Securely attach conduit to building in a manner that will withstand placing and pulling operations.

- (c) Keep area around entrance conduit free of any construction, storage, mechanical apparatus, pipes or other items which might interfere with installing or maintaining cables.
 - (d) Seal the inside-building end of conduit to prevent entrance of water or gases. Reseal conduits after cable is placed.
 - (e) Provide pull string in all entrance conduits.
 - (f) Terminate entrance conduit with metallic insulated-throat threaded bushing at terminal board or at cable tray. Secure conduit to cable tray with Gedney* CTC or comparable clamp.
- b. Electrical Protection:
- (1) Require conformance with Article 250-Grounding and Article 800-Communications of the National Electrical Code (NEC) for grounding, bonding, and protecting electrical and communications circuits.
 - (2) Provide appropriate grounding system in telecommunications equipment and server rooms.
- c. Distribution Raceways:
- (1) Telephone/Data: Provide adequate raceways, for the distribution of telephone/data wiring, "homerunning" the cabling from the telecommunications wiring closet to the work area outlet, without "daisy-chaining" boxes together. The raceways should be sized according to the number of telephone/data outlets to be served. Raceways may be horizontal and vertical conduit, cable trays, cable ladders, or any combination of the foregoing. Install all work area conduits to within three feet of the cabletray.
 - (a) Provide fire stops for any cable tray system or riser system as required by the NEC.
 - (2) CCTV (and CATV): Provide TV trunk raceways (1" minimum conduit) to each wing or floor of the building, terminating in a secure, accessible area, such as an electrical closet. Provide branch paths (3/4" minimum conduit) from trunk termination to each television receiver location, terminating in a standard 3" x 5" box.
- d. Electrical Receptacles:
- (1) Telecommunications Wiring Closet: Provide 100 amp 120/208 volt 3 phase panel in each closet, connected to the emergency system if available. Receptacles in each room should include a minimum of one each L6-30R, one each L 6-20R, one each L14-30R, 2 each 120 volt 20 amp quad plex receptacles. A ground plate connected to the building main electrical ground system shall be mounted in the room with wiring sized as necessary by the engineer. The door to the room should be on the building card access system.
 - (2) Television Receiver Location: Provide one 110 volt duplex receptacle at each television receiver location, located adjacent to television cable outlet.

- e. Room Lighting: Provide a lighting level of 50 ft. candles at worktop level in telecommunications wiring closets.
- f. Computer Cabling Conduit Size:

CONDUIT SIZING								
No. of Wires or Cables	1	5	8	14	18	26	40	60
Conduit Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"

7. ELEVATORS:

- a. Elevator outlets should be installed in metal boxes and grounded in accordance with code requirements.
- b. Emergency lights should be installed in all elevators.
- c. Fireman switches on elevators should be keyed alike and in accordance with UNL and Lincoln Fire Department standards.
- d. Refer to DG 142000 for additional provisions related to elevator installations

8. ELECTRICAL WORK FOR ENERGY MANAGEMENT AND CONTROL SYSTEMS:

- a. Coordinate construction documents with Energy Management and Control Systems documents prepared by UNL BSM. Show location of electrical work for control devices on electrical drawings. Refer to Article 2 of Design Guideline DG 230913.
- b. Low voltage control wiring in mechanical rooms or other occupied spaces should be run in EMT, except than final connection from junction box to actuators should be run in 3/8" flexible aluminum conduit. The length of the flexible conduit should not exceed 24" or the length of the actuator's power cord.
- c. Project specifications should require electrical work installer to provide temporary lighting for UNL BSM personnel at ATC panels to facilitate the installation of energy management and control systems wiring and devices.

9. ELECTRICAL WORK FOR BUILDING CARD ACCESS SYSTEM:

- a. Coordinate construction documents with Card Access System documents prepared by the UNL BSM. Show location of electrical work for access devices on electrical drawings. Refer to Article 2 of Design Guideline DG 087400.
- b. Low voltage wiring in mechanical spaces or other occupied spaces should be run in EMT, unless concealed or routed in cable tray.
- c. Provide conduit (EMT or flex) and appropriate mortar boxes in door frames as necessary to protect wiring and provide future path.

10. ADDITIONAL PROJECT-SPECIFIC SPECIFICATION AREAS:

-
- a. Submittals: Coordinate specification requirements with material in UNL standard bidding requirements, general conditions, supplemental conditions and Division 1 sections for the following:
- (1) Manufacturer's data.
 - (2) Shop drawings.
 - (3) Maintenance and operating manuals.
 - (4) Record drawings.
- b. Testing: Define requirements for testing of electrical systems.
- c. Service Interruptions: Provide instructions for arranging for service interruptions.
- d. Existing Exterior Area Lighting: Provide instructions in contract documents for keeping exterior area lighting in the vicinity of the project in service during the construction of the project. Where it is necessary to interrupt service to existing area lights, provide temporary service connections to such lights or provide temporary lighting arrangements with equivalent illumination and area coverage as provided by interrupted permanent fixtures. Control temporary area lighting with photo cells or time clocks.
- e. Temporary Facilities: Insure that requirements for temporary electrical service and temporary lighting are properly defined and coordinated.
- f. Access: Define responsibilities for placing sleeves, cutting and patching, and placing roof penetrations.
- g. Removal of Abandoned Conduit: On remodel projects, require that existing electrical conduit which is not concealed in wall or floor slab construction and which is not being reused be removed. Wires should be removed and abandoned conduit should be cut off flush where it enters floor or wall construction.
- h. Clean Up: Define responsibilities of electrical systems installer for clean up during and at conclusion of construction period.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION
(600 VOLTS AND ABOVE)

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1. GENERAL
2. CONDUIT/RACEWAYS
3. UNDERGROUND CABLE
4. MEDIUM VOLTAGE TERMINATIONS
5. TRANSFORMERS
6. METERS
7. SWITCHES
8. ELECTRICAL VAULTS

1. GENERAL:

- a. Location of the switches, transformers, and temporary services shall be a coordinated effort by UNL Facilities Planning and Construction, UNL Utilities, and the design engineer and design architect, who are responsible for the final description and documentation of the utility services for the contractor.
- b. Only UNL personnel will do switching of electrical circuits.
- c. New duct banks, transformers, and switches installed as part of the project are to be included on updates of the record drawings. The architect or engineer shall include these details on the as-built drawings delivered upon completion of the project.
- d. **Medium voltage Transformers, Switches, Cable will be specified by the design consultant, purchased by UNL, and provided to the contractor for installation. The cost of this equipment will be assessed against the project.**

2. CONDUIT/RACEWAYS:

- a. All wiring should be run in raceway/conduit.

-
- b. Generally, conduit should run concealed. Where conduit is to run exposed, provide guidelines for visual arrangement of system components.
 - c. Pull cords should be provided in all empty conduit.
 - d. Escutcheon plates should be provided where surface raceways penetrate walls or ceilings.
 - e. Require identification of all conduit containing cables rated over 600 volts at not less than every twenty feet with high-visibility labels.
 - f. Heavy Wall Rigid Steel Conduit/Intermediate Metal Conduit: Use in all tunnels, utility plants, and wherever subject to physical damage.
 - g. Rigid Non-Metallic PVC Schedule 40 or Heavier: Should be encased in not less than 2" of concrete on all sides in duct banks. It may also be used in concrete pours.
3. UNDERGROUND CABLE:
- a. 15 KV rated, 133% 220 mil EPR insulation, single conductor copper wire only, shielded with copper tape only. Acceptable manufacturers are Pirelli*, Southwire*, Kerite*, and Okonite*.
 - b. All underground cable shall be installed in PVC conduit encased in reinforced concrete with minimum cover of 3" on all sides. Bends shall be long sweep rigid metal conduit or IMC.
 - c. Cable racks in manholes shall be heavy duty non-metallic cable rack by Underground Devices* or approved equal.
 - d. Color coding:
 - 600 volt and above
 - Neutral: White
 - Phase A: Black
 - Phase B: Red
 - Phase C: Blue

All grounding conductors shall be green or bare.
4. MEDIUM VOLTAGE TERMINATIONS:
- a. Splices on medium voltage cable shall be kept to a minimum.
 - b. All terminations and splices shall be performed by UNL Utilities personnel only.
 - c. All dead break elbows shall be Elistamold* 600A K655LR or approved equal.
 - d. All load break elbows shall be Elistamold* 200A 166LR-B with test point, or approved equal.

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- e. All live front terminations shall be Raychem* HVT series sized for cable. Provide medium voltage rated terminal crimps sized for conductor and crimped with Anderson* hydraulic crimping too. Bolt spacing on terminals shall be coordinated with spacing on equipment to which attached.
 - f. All splices shall be Raychem* 1580 series transition splices sized for cable. Use high voltage rated butt splices with oil block barrier. Splices shall be rated for medium voltage, sized for conductor provided, and crimped with Anderson* hydraulic crimping tool.
 - g. All butt splices between poly and lead cable to be Burndy* brand with oil barrier, or approved equal.
 - h. All **elbow** terminations to have 3M* 8460 cold shrink kit or approved equal.
5. TRANSFORMERS:
- a. Designed in accordance with ASTM C57.12.24 standard for pad mount transformers; copper wound; with temperature and pressure gauges; dead front only; copper 5/8" x 10' grounding rod; taps changer control with five positions (two 2-1/2" above and two 2-1/2" below); in accordance with ASTM C57.12.34.
 - b. Major building renovations should include replacement of building service transformer.
6. METERS:
- Moved to DG 330000 10.**
7. SWITCHES:
- a. 15.5 KV, three phase, SF6 insulated, dead front, pad mound, front access, with 600 amp apparatus bushings and 5/8" by 10' copper grounding rod. Switch to be G&W* or approved equal.
 - b. Line Side: SF6 Linear Puffer Switches, 600 amp continuous and load break.
 - c. Load Side: 600 amp vacuum fault interrupter, Type 1 electronic trip module in a NEMA 4X enclosure with three phase circuit protection and a 30-600 amp trip range.
8. ELECTRICAL VAULTS:
- a. Vaults shall be either cast-in-place or pre-cast concrete with minimum H-20 rating.
 - b. Minimum vault dimensions 6'-6" height, 7' length, and 5' width.
 - c. Vault should include: sump pit, sump pump, and 3'x3' H-20 rated Bilco* Hatch or approved equal.

LOW-VOLTAGE ELECTRICAL DISTRIBUTION
(BELOW 600 VOLTS)

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1. ELECTRICAL SERVICE AND TRANSFORMERS:
 2. SWITCHBOARDS, PANELBOARDS, DISCONNECTS AND STARTERS
 3. CONDUIT/RACEWAYS
 4. WIRING
 5. OUTLETS AND WALL SWITCHES
-
1. ELECTRICAL SERVICE:
 - a. Electrical Service:
 - (1) There should be a single disconnect, allowing the complete elimination of all electric service to the facility
 - (2) Major building renovations should include replacement of main disconnect and distribution panel.
 - b. Service Entrance Switchboards:
 - (1) Provide with solid state metering, such as Westinghouse IQ Data Plus*. KYZ output shall be specified on solid state metering.
 - (2) Label switchboards with CT ratios.
 - (3) Where electric service is provided by the Lincoln Electric System, ascertain their requirements and provide metering accordingly. **A KYZ output electronic meter should still be provided in main gear.**
 2. SWITCHBOARDS, PANELBOARDS, DISCONNECTS AND STARTERS:
 - a. General:

- (1) All switchboard, distribution panel, motor control center, and branch circuit panelboard busses should be copper.
- (2) All cans should be field punched. (Pre-punched knockouts not desired.)
- (3) Metallic tags or labels should not be used inside switchboards, panels or motor control centers.
- (4) Require that panelboards, disconnects and starters be mounted at height which will facilitate testing and maintenance. In no case should any breaker or switch be more than 78" or less than 12" from the floor.
- (5) Require that switchboards and motor control centers be provided with a complete set of engraved labels, designating unit controlled by each switch or device. Label panelboard doors with panel designation and voltage.

b. Panelboards: Conform to the following requirements:

- (1) Provide a minimum of 20% spare space in all panelboards.
- (2) Single door type with locks keyed alike throughout the project.
- (3) Painted with two coats of lacquer over a filler coat.
- (4) Of sufficient size to allow a minimum of 4" wiring gutter around all sides.
- (5) Rough-in boxes shall have a minimum width of 20 inches and a minimum depth of 5 ¾ inches.
- (6) Should be circuit breaker type, with main breakers center mounted, in line with bus when main breaker is used.
- (7) Bolts for fastening cover accessible only when door is open.
- (8) Galvanized steel boxes with blank end walls.
- (9) Ground bus mounted in box.
- (10) Furnished with directory frame for complete list of circuits for each panelboard.
- (11) Size of conduits to be determined by size and type of panel. Spare conduits to be capped above ceiling.
- (12) Should carry suitable NEMA rating for the atmosphere in which it is to be installed.
- (13) Acceptable manufacturers include Siemens*, Cutler Hammer*, GE*, or Square D*.

c. Circuit Breakers:

- (1) Breakers in 120/208 volt panels should be bolt-in type.

- (2) Breakers in 277/408 volt panels should be bolt-in type.
- (3) Two-pole **and** three-pole breakers should be common trip.
- (4) 10,000 AIC Type "NPAB" or "NLAP", "Quik-Lag" or equal, quick-make, quick break.
- (5) Should be of same manufacturer as the panelboards.
- (6) Circuit breakers with adjustable trip settings shall be set by the Electrical Contractor. Such settings shall be calculated by the electrical design engineer and provided to the Electrical Contractor and UNL Building Systems Maintenance.

d. Disconnects and Starters:

- (1) Motors should have disconnecting means furnished and installed by electrical installer.
- (2) Magnetic starters should be installed on motors 1 HP or larger. (Controls to be 120 volt.) Switches should be HD Heavy Duty. General Electric*, Allen-Bradley*, or Square D* are acceptable manufacturers.
- (3) Single phase motors are to be protected with Allen-Bradley* Bulletin 600 or Fusetron*.
- (4) **Disconnect switches to be heavy duty rated.**

3. CONDUIT/RACEWAYS:

a. General:

- (1) All wiring should be run in raceway/conduit.
- (2) Where possible, run branch circuit conduit, communications and special systems conduit overhead.
- (3) Generally, conduit should run concealed. Where conduit is to run exposed, provide guidelines for visual arrangement of system components.
- (4) Minimum conduit size should be 3/4".
- (5) Pull cords should be provided in all empty conduit.
- (6) Require identification of all conduit containing cables rated over 600 volts at not less than every twenty feet with high-visibility labels.

b. Conduit Types:

- (1) Heavy Wall Rigid Steel Conduit/Intermediate Metal Conduit: Use in all tunnels, utility plants, and wherever subject to physical damage. At locations not subject to physical damage, such as ceilings and mechanical rooms, the use of EMT is allowed.

- (2) Electrical Metallic Tubing (EMT): Use in furred spaces, in stud walls, and either exposed or concealed where heavy wall rigid steel conduit is not stipulated.
- (3) Rigid Non-Metallic PVC Schedule 40 or Heavier: Use for area and parking lot lighting and wet locations when heavy wall rigid steel conduit is not stipulated.
- (4) Flexible Steel Conduit: Use for connection to equipment which is moveable for adjustment, mounted on isolation units for elimination of vibration and sound, for connection from a close-by junction box to lay-in type fixtures in suspended T-bar exposed grid ceilings, or where fished in existing stud walls.
- (5) Liquidtight Flexible Steel Conduit: Use where exposed to moisture, weather, and/or for motor hook-ups.
- (6) Metal Surface Raceway (Wiremold*) or Nonmetallic Surface Raceway: Use where exposed raceways are required in finished spaces.
- (7) Conduit Fittings:
 - (a) Approved Manufacturers for Fittings: Crouse-Hinds* or Appleton*.
 - (b) Fittings shall be compression type fittings. Steel is preferred. On telecom conduits greater than 1", set screw fittings may be considered. In situations where the location is indoors and not subject to moisture, steel set screw fillings or steel compression type fittings may be used regardless of conduit size or use.
- (8) Flexible non-metallic tubing may be used for data/communications lines fished in existing stud partitions.

b. Boxes:

- (1) Should be not less than 4" square. For convenience outlets, switch, data, telephone, fire alarm system, or inter-com outlets, use 4" square or larger box with plaster ring.
- (2) Require that pull boxes larger than 4-11/16" square and junction boxes be identified as to which circuit and panel the run feeds from.
- (3) Outlet boxes, junction boxes and switch boxes should be galvanized, code gage steel. Require that conduit body-type cast FD/FS boxes with case lugs be used where exposed to weather and where subject to moisture or mechanical damage. FD/FS covers should be used with these boxes.
- (4) Use gangable boxes only where conduit is to be "fished" into existing partitions.

4. WIRING:

a. General:

- (1) Wire should be copper, soft-drawn, annealed, having a conductivity of not less than 98% pure copper. Except as indicated below, wire should be solid, not less than No. 12 AWG (No. 14 wire size allowable for fire alarm systems). Wire sizes No. 10 and

larger should be stranded. All wiring installed in light poles or other areas subject to vibration should be stranded.

- (2) Require that wiring be color coded throughout its entire length except that feeders should be identified with multiple rings of color coding tape at terminal points and any other accessible points.
- (3) Wire should be dual-rated type THHN/ THWN.
- (4) Require that a green ground wire be provided for all circuits, sized accordingly.

b. Color Coding:

120/208 volt systems:

Neutral: White
Phase A: Black
Phase B: Red
Phase C: Blue

277/480 volt systems:

Neutral: Natural gray or white with gray tracer
Phase A: Brown
Phase B: Orange
Phase C: Purple

All grounding conductors shall be green or bare.

c. Approved Manufacturers for Connectors: Thomas-Betts* or Kearny*.

5. OUTLETS AND WALL SWITCHES:

a. General:

- (1) Push-on type devices are not permitted. Require back- and side-wired outlets with tightening screw. Devices with factory pre-wired blocks that snap into the devices may be used.
- (2) Wiring devices should be 20 amp specification grade.
- (3) Sierraplex*, Despard*, triplex or interchangeable devices should not be permitted.
- (4) Do not locate outlets back-to-back through wall even if associated with same circuits.
- (5) Use lighted toggle switches in all tunnels and equipment rooms.
- (6) All outlets should have ground wire attached to outlet. Do not permit the use of self-grounding receptacles.

b. Receptacles: All plugs and receptacles should have configuration specified by NEMA charts for circuit characteristics where they are being used. Hubbell* numbers are used to establish a standard.

- (1) Duplex: Specification grade, back and side wired, two pole, three wire, grounding type, 20 amp, 125 volt, Hubbel #5362 or approved equal.
- (2) Ground Fault Circuit Interrupter: Two pole, three wire, grounding type, 20 amp, 125 volt, Hubbel #GF5362.
- (3) Surge Suppressor Receptacle: Eagle* IG 1110-Box.

c. Switches: All switches should have body securely locked to bridge by staked screw assembly. Back wiring should be through a hole with clamp-type wiring assembly provided which is suitable for stranded wire.

- (1) Toggle: Specification grade, back- and side-wired, 15 or 20 amp, 120/277 volts, Hubbel* #1221.
- (2) Key Operated: Hubbell* #1221L.
- (3) Momentary Contact: Three position, single pole, double throw, gray color, Hubbel* #1557.
- (4) Lighted Toggle: Clear, Hubbel* #1221-ILC.
- (5) Pilot Toggle: Clear, Hubbel* #1221-PLC.

d. Poke-Thru Floor Boxes: Poke-thru floor boxes shall only be used where cast-in-place boxes are not a viable option, such as in remodel or renovation projects. Where poke-thru boxes are used for data jacks, they shall be compatible with Avaya* data jacks. If metallic carpet rings are available, they are preferred over plastic. Specify models with not more than ½" raised projection. **Poke-thru boxes for data must accept systemax data jacks.**

e. Wall Plates:

- (1) Use stainless steel, Type 302 with satin finish, .035" thick, manufactured by Hubbel* or P & S*. Plates should be used on all openings.
- (2) Plates on control switches should be engraved designating the unit controlled.
- (3) Plates for data and phone outlets should be white plastic.
- (4) Plates on exposed wiring should be rounded to box edge. Do not permit oversized plates.
- (5) Plates for FS/FD conduit bodies should be made specifically for such boxes.
- (6) Plates for devices and switches on emergency power should be engraved "Emergency Power". Devices should be red color.

f. Switch and Device Location:

- (1) Locate wall switches on lock side of doors. If two switches are used to control two-level lighting, the switch nearest door should control the outside lamps. Require that switches be grouped together with other items such as alarm stations and thermostats

located in the same vicinity and arranged in an orderly fashion (i.e. with devices aligned and evenly spaced)

(2) Locate bottom of receptacles 18" above floor or 48" or 40" above floor where table, work benches, or counters occur, except where specific conditions require otherwise. Locate bottom of switches 48" above floor. Locate box heights in remodel areas to match existing boxes in vicinity. Locate telephone and data boxes at heights to match adjoining receptacles unless special height is required for wall phone or other condition. Coordinate location of receptacles and switches with architectural drawings so as not to interfere with casework, marker boards, tack boards, and similar items.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

COMMUNICATIONS

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4. COMMUNICATION PATHWAY REQUIREMENTS
5. QUALITY ASSURANCE
6. COORDINATION
7. SUBMITTALS
8. INTENT OF DRAWINGS AND SPECIFICATIONS
9. MATERIAL SUBSTITUTIONS
10. EXECUTION

1. GENERAL

a. Application: Each new building or addition to an existing building shall include spaces designated for the location of communications equipment. These spaces will be called Telecommunication Rooms (TR). Such spaces must be specifically considered in the Program Statement phase or other planning or planning processes used to define the scope of the project. These spaces shall be designated exclusively for the location of terminal points and equipment associated with the following communication systems:

- Voice systems
- Data network systems
- Wireless network systems
- Closed circuit television (CCTV) systems
- Fire alarm panels
- Card access panels
- Cable television (CATV) systems
- Un-Interruptible Power Supplies (UPS) for these systems
- Telephone company demarcation points

b. Use Restriction: TRs shall not be used as passageways to other equipment rooms, power transformers, custodial equipment, or any other function that would require access for reasons other than communications maintenance.

c. Location: TRs shall be centrally located (both vertically and horizontally) within the building areas served. Every attempt shall be made to maximize the area served from the TR. TRs shall adhere to the following location guidelines:

- (1) TRs shall be accessible from a common hallway.
- (2) Where the TR serves areas on more than one floor, the design process shall incorporate appropriate paths of travel for the raceway systems that will be required to carry the communications wiring between the floors.
- (3) TRs and communications cabling shall be separated from sources of electromagnetic interference (EMI), such as induction devices, transformers, ballasts, power supplies, elevator equipment, generators, motors, X-rays, and similar equipment as much as possible.
- (4) TRs shall be separated from locations containing equipment such as transformers, generators, photo copiers, and microwave ovens by 10 to 15 feet.

d. TR Size Criteria: Using the following two criteria the designer or architect can predetermine the quantity and size of the TRs needed in a building using the assignable square footage as a starting point.

- (1) Criteria #1 – Quantity of TRs to serve the building

The maximum wiring run from the TR to the most distant “Communications Location” (CL) served from the TR shall not exceed 275 feet. NOTE: A CL is a wall plate or termination box with one or more communications cables, usually 2 - 3 cables are installed at each CL. The TR will be the origination point for wiring to all CLs within the area served.

Instructions to Architect: Determine the “TR Service Area” by calculating the area of the building that can be served within a maximum pathway distance of 275 feet. The TR can service multiple floors, with sufficient pathway, as long as the maximum pathway distance remains less than 275 feet.

Once the TR Service Area is determined, calculate the following two TR elements:

- (a) TR Service Area Square Feet = the assignable square footage within the TR Service Area.
- (b) Communication Location (CL) Quantity = the count of CL locations within the TR Service Area. NOTE: If the quantity of CLs is not known, then divide the TR Service Area Square Feet by the number 90 to obtain an estimated CL quantity.

- (2) Criteria #2 – Size of the TRs

A TR sizing matrix is shown in the following table, “Telecommunication Room Sizing Matrix,” based on both the TR Service Area Square Feet and the CL

Quantity. Find the TR Service Area Square Feet for the TR in the table and follow the table row over to the TR Size Needed. Do the same for the CL Quantity. Use the larger TR size for the actual TR that will be planned into the architectural drawings. TR must be a rectangular room as specified in the table below with no obstructions or protrusions (beams, columns, etc.) that decrease the amount of square footage available in the room.

Telecommunication Room Sizing Matrix			
TR Service Area Square Feet	CL Quantity	TR Cabling Racks Needed (Based on 1 Rack per 240 CLs)	TR Size Needed
0 - 21,600	0 - 240	1	10 ft x 12 ft
21,601 - 43,200	241 - 480	2	10 ft x 15 ft
43,201 - 64,800	481 - 720	3	10 ft x 18 ft

- e. **Structured Cabling System:** A certified Structured Cabling System with a 25-year CAT6 link performance compliance warranty is required. See Appendix A “APPROVED COMMUNICATIONS EQUIPMENT VENDORS” for a list of approved systems.

2. ENVIRONMENTAL REQUIREMENTS

- a. **HVAC:** The ambient temperature in TRs shall be maintained in the range of 68⁰ to 75⁰ F., 24 hours per day through an independent HVAC unit. TRs shall be ventilated at the rate of one air change per hour. Separate, wired, thermostatic control shall be provided for each TR.
- b. **Lighting:** Lighting in the TRs shall provide a minimum light level of 50 fc at desktop level on all sides of the rack equipment.

3. ROOM CONSTRUCTION

- a. **Power:** The TR shall be designed to include a dedicated power panel located in the TR. All TRs shall have 2 sources for electrical power:
- (1) **Emergency Power:** Provide 100 amp 120/208 volt 3 phase panel in each TR, connected to the emergency system if available. Receptacles in each TR shall include a minimum of one each L6-30R, one each L6-20R, and one each L14-30R, and one each L5-20R mounted above the communications racks (per Switch).
 - (2) **Building Power:** Provide a dedicated L6-20R and L5-20R mounted above the communication rack (per switch). Also, provide a dedicated 20 amp 120 volt quad receptacle with building power in the following locations: one on each wall.
- b. **Enclosing Walls:** Walls surrounding the TR shall extend to the structural floor above on all sides, both for reasons of physical security and environmental control.
- c. **Conduits and Raceways:** Provide adequate conduit or other raceways through walls to adjoining accessible ceilings and/or accessible locations on other floors, where appropriate.
- d. **Ceiling:** A suspended ceiling shall not be installed. Minimum clear height shall be 10'.
- e. **Floor:** Floor finish shall be smooth, dust-free, and not susceptible to static electricity build-up. Acceptable finishes would be composition tile or sealed concrete.

- f. Clearance: A clear space of 36" shall be provided in front and behind of all terminal boards, panels, or equipment racks.
- g. Door: Provide 3' 0" wide by 7' 0" high door, opening outward, with card reader lock. Door shall be labeled "Telecommunication Room and Room #."
- h. Windows: TRs shall not have windows.
- i. Water Infiltration: Measures must be taken to prevent water intrusion. Water or drain piping shall not be permitted within the TR.
- j. Sprinkler Systems: Where the location of an automatic sprinkler head within the TR is required, it shall be the high heat type and be protected with a wire cage to prevent its accidental discharge. Where possible, do not install sprinklers above the equipment racks.
- k. Plywood Terminal Boards: Provide 3/4" thick Grade A-C plywood terminal boards, securely attached to walls and painted with two coats of light-colored fire-retardant paint. Plywood shall cover three walls of the TR (not the wall with the entrance door) with 4' x 8' sheets of plywood mounted beginning 24" above the finished floor. The designation of the walls to be covered shall be coordinated with the location of the phone, data, and TV entrance equipment and racks.
- l. Equipment Grounding: A ground plate connected to the building main electrical ground system shall be mounted in the room with wiring sized as necessary by the engineer. (See Communication Grounding section)

4. COMMUNICATION PATHWAY REQUIREMENTS

- a. Outside plant pathways
 - (1) A minimum of two 4" entrance conduits will be installed into any building.
 - (2) Outside plant copper, fiber, and coaxial cable shall be installed together in one of the conduits while the other conduit is for future services and disaster mitigation.
 - (3) The conduits will be installed from the building to the nearest UNL utility tunnel if possible.
 - (4) Dual entrances are very desirable where possible, especially for buildings that house emergency services, data core systems, disaster recovery systems, or designated as an essential services building on campus.
- b. Riser pathway (from one TR to another)
 - (1) When more than one TR will be needed in a building, two 4" conduits will be installed from the main TR to the other TRs in the building. These conduits will be used to connect all communication services between the TRs.
- c. Primary horizontal pathways for each floor (conduits and cable tray)
 - (1) Primary pathways are major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas that are likely to be used to support growth in those areas.

- (2) Primary pathways carry cable to secondary pathways.
 - (3) Primary floor to floor pathways shall be vertical sleeve conduits with at least two 4" conduits to each floor.
 - (4) Floor-to-floor conduits will connect the TR to cable trays on the other floors.
- d. Secondary pathways to each CL (conduits to CL backboxes)
- (1) Conduits will be installed from within 3 feet of a cable tray to each CL backbox.
 - (2) Backboxes are defined as the communications metallic box (single gang, double gang, 4 square, handy-box, or device box) with appropriate cover that are mounted in the wall and the conduit is attached for cabling. The Backbox is used to mount the CL and voice/data jacks.
 - (3) Conduits to each CL will be sized depending on the number of cables at the CL, but generally, most CL conduits will be 1" conduits.
 - (4) All cable to each CL will be homerun through the pathway system described. The CL cable will travel through the secondary pathway (conduit), then the primary pathway (cable tray and conduits), then to the serving TR.

5. QUALITY ASSURANCE

- a. **Single Source Responsibility:** Obtain materials for systems from either a single manufacturer or a manufacturer approved by the Structured Cabling System's manufacturer to ensure quality of appearance and performance.
- b. All installations shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of the Architect.
- c. Equipment and materials shall be of the quality and manufacturer indicated. The equipment specified is based on the acceptable manufacturers listed in each section. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval of the Architect based on submittals provided.
- d. **Standards**
- (1) All work done shall comply with applicable ordinances, rules, and regulations.
 - (2) If any portion of this work requires various permits or licenses, the Contractor shall obtain or assist UNL in obtaining all such permits and licenses. All work must comply with and conform to the following codes and standards as applicable to the project:
 - State of Nebraska State Building Code
 - National Electric Code (NEC) and Nebraska Electrical Code
 - National Fire Protection Association (NFPA) 101 Life Safety Code
 - Occupational Safety and Health Act of 1970 (OSHA)
 - American National Standards Institute (ANSI)
 - Institute of Electrical and Electronics Engineers (IEEE)

- Telecommunications Industry Association (TIA/EIA 568-A, A-1, A-2, A-3, A-4, A- 5(e), 569-A, 606, 607, TSB – 67, 72, 75, 95, and other applicable EIA standards)
- National Board of Fire Underwriters (NBFU)
- National Bureau of Standards (NBS)
- Underwriters Laboratories, Inc. (UL), Federal Specifications
- BICSI best practices

(3) The latest editions of these Codes and Standards shall be applicable unless otherwise designated. Where conflicts exist from one code to another, the code to adhere to will be decided by UNL Facilities Project Manager.

6. COORDINATION

- a. Contractor shall coordinate the work specified in the Communication sections with the work of the other trades involved in this project and in particular with the building automation system, electrical, mechanical, and plumbing trades.
- b. Contractor shall coordinate with Division 26 – Electrical for communications pathway, power, grounding and bonding, and space development.
- c. All questions and issues regarding coordination and construction element phasing shall be directed to the General Contractor and UNL Project Manager.
- d. The Contractor shall make every effort to coordinate their work so there shall be a minimum of disruption to any occupants of the UNL campus. There shall be no prolonged disruption of existing service such as telephone, cable television, electrical, and other utilities. Any necessary disruption shall be scheduled with the appropriate staff well in advance.
- e. Contractor will follow all stipulations set forth through the general specification sections with regard to delivery hours, delivery locations, storage, and communications with the Architect and General Contractor.
- f. The Contractor shall coordinate with and follow the requirements of all other applicable specification sections including, but not limited to, the following:
 - Hazardous material
 - Storage
 - Security
 - Safety
 - Logistics

7. SUBMITTALS

- a. All submittals for products and hardware provided under the Communications Specification section shall be made to the Architect and the UNL IS Project Manager for review and approval prior to installation of products and hardware.
- b. Manufacturers' cut sheets shall be submitted for all products to be supplied by Contractor in response to Division 27 Specification sections.

c. The Contractor will provide resumes of supervisors, technicians, and installers indicating their experience in this technology on projects of this magnitude completed within the previous five years.

d. The Contractor will submit all as-built drawings and the manufacturers' 25-year warranty certifications at the completion of the project and before final payment will be made for the project.

8. INTENT OF DRAWINGS AND SPECIFICATIONS

a. These Specifications, together with the Drawings accompanying them, are intended to depict the installation requirements of the infrastructure necessary to support the Structured Cabling Systems included in this Project. Contractor shall furnish materials shown on the drawings or mentioned in the specifications, or both, that are necessary for the complete provisioning and build-out of the Structured Cabling Systems herein depicted. Additionally, Contractor shall provide all incidental equipment, required tools, and incidental materials required for the completion of the Structured Cabling Systems whether or not specified or shown on the drawings.

b. Drawings are diagrammatic; their intent is to depict the on-site conditions accurately, but discrepancies between on-site conditions and drawings do exist. It is the Contractor's responsibility to familiarize itself with the on-site conditions and to immediately point out any discrepancies between drawings and on-site conditions to the Architect.

c. Do not use drawing scale to determine length or location dimension. Scaled drawings are still to be considered diagrammatic. If exact lengths or locations are known, the drawings will show the dimensions or coordinates.

9. MATERIAL SUBSTITUTIONS

a. Submit requests for substitutions within 30 days of contract award, or sooner if required to maintain schedules.

b. Acceptance of substitutions is at the Architect's and UNL IS Project Manager's discretion. Submit sufficient information to show that the proposed substitute is equivalent to the item specified.

c. Make changes needed to accommodate the substitution without impact to the installation schedule or work under other divisions and at no expense to the owner.

d. Substitutions of any components must comply with warranty requirements of the overall system.

e. The Structured Cabling System is intended to provide a level of link performance that exceeds the latest ANSI/TIA/EIA standards for cable installations. Any substitutions of any type proposed by the Contractor must not degrade the performance of the overall system.

10. EXECUTION

a. Examination

(1) Contractor is responsible for examining existing conditions and comparing them with drawings and specifications and notifying the General Contractor of any discrepancies before commencing work.

(2) Contractor is responsible for coordinating with the General Contractor and other associated disciplines to address and adjust for any discrepancies.

b. Installation

(1) Contractor is responsible for all materials, labor, installation, testing, certification, documentation, and approval for acceptance of the Structured Cabling System.

c. Verification

(1) It is incumbent upon the Contractor to verify that the installation and materials used have been inspected before they are enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected. Inspection forms verifying an inspection as complete along with results of the inspection shall be dated and signed by both the General Contractor and the Contractor. If installation methods and materials are approved, and that is so stated on the inspection form, then Contractor may enclose installation and material within building features or other features such as Outside Plant pathway and spaces.

(2) After installation, test and certify all cabling systems per the appropriate standards and manufacturers' requirements.

d. Adjustments

(1) Contractor is responsible for coordinating and documenting with the General Contractor and other associated disciplines to address any approved change orders.

End of section

APPENDIX A

APPROVED COMMUNICATIONS EQUIPMENT VENDORS

1. STRUCTURED CABLING

- a. See sections 270000 and 271119.
- b. Approved cabling manufacturers are as follows (listed in alphabetical order):
 - (1) ADC TrueNet™ Network Cabling System
 - (a) Horizontal cabling: ADC white TN6SP-WTRB for data and ADC gray TN5ESP-GYRB for voice.
 - (2) PANDUIT® PAN-NET™ Network Cabling System
 - (a) Horizontal cabling: Panduit white PUP6004WH-UY for data and Panduit gray PUP5504IG-UY for voice.
 - (3) Systimax Structured Cabling System.
 - (a) Horizontal cabling: Systimax Solutions white 2071E for data and Systimax gray 2061 for voice.
 - (4) Uniprise Structured Cabling System.
 - (a) Horizontal cabling: Uniprise white 6504+ for data and Uniprise gray 5E55 for voice.
- c. Approved component manufacturers are as follows (listed in alphabetical order):
 - (1) Jacks
 - (a) gray Systimax MGS-400 for data
 - (b) ivory Systimax MPS-100 for voice
 - (2) Faceplates
 - (a) ivory Systimax low profile, triplex is typical
 - (3) Patch Panels
 - (a) Systimax 1100GS3-48

2. TELECOMMUNICATION ROOM FITTINGS

- a. See section 271100.
- b. Use Panduit communications equipment room fittings unless previously approved alternate is chosen by the UNL Project Manager.

3. CABINETS AND RACKS

- a. See section 271116.
- b. Approved cabinets and racks are as follows:
 - (1) Panduit 2 post 19” racks.
 - (a) Panduit CMR19X84 - 2 post racks.
 - (b) Panduit PRV8 and PRD8 vertical mangers between racks.
 - (c) Panduit PRV6 and PRD6 vertical managers at rack ends.
 - (d) Panduit LCC6-38DW-L must be attached at the top or bottom of each rack for grounding purposes.
 - (2) Panduit 4 post 19” racks.
 - (a) Panduit CMR4P19X84 - 4 post racks.
 - (b) Panduit PRV8 and PRD8 vertical mangers between racks.
 - (c) Panduit PRV6 and PRD6 vertical managers at rack ends.
 - (d) Panduit LCC6-38DW-L must be attached at the top or bottom of each rack for grounding purposes.

4. BLOCKS AND PANELS

- a. See section 271119
- b. For fiber optic material: Use Corning Pretium distribution housings, fiber optic panels, and wall cabinets.

5. BACKBONE CABLING

- a. See section 271300
- b. Splicing material shall be made by Corning.
- c. Fiber optic cabling shall be OCC or Draka fiber optic cabling.

GROUNDING AND BONDING FOR COMMUNICATIONS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of telecommunications grounding and bonding for the Structured Cabling System as called for in these specifications and related drawings.
 - b. System Description
 - (1) Each TR in a building shall have a Telecommunications Grounding Busbar (TGB) properly connected per ANSI/TIA/EIA-607.
 - (2) Relevant bonding and grounding infrastructure acronyms.
 - (a) EK (Equipment Bonding Conductor): An insulated copper conductor that bonds metallic items and equipment to the TMGB and TGB.
 - (b) IC (Interconnecting Bonding Conductor) (referred to in TIA/EIA-607 as the Bonding Conductor for Telecommunications): The copper conductor that bonds the TMGB to the service equipment (power) ground.
 - (c) TBB (Telecommunications Bonding Backbone): An insulated copper conductor extending from the TMGB to each TGB.
 - (d) TGB (Telecommunications Grounding Busbar): A copper ground reference busbar, typically installed in telecommunication rooms (TR) that is bonded to the TMGB by the TBB. The TGB references metallic entities in the TR space to ground.
 - (e) TMGB (Telecommunications Main Grounding Busbar): A copper ground reference busbar, typically installed in the entrance facility or entrance room that is bonded to the service equipment (power) ground by the IC.

c. Submittals

- (1) Submit product data for the following:
 - (a) TGB busbar.
 - (b) Equipment rack busbars.
 - (c) Two-hole and one-hole (with backstop) lugs.
 - (d) No. 3/0 AWG and No. 6 AWG conductors.
- (2) Submit details of grounding elements for equipment rack applications.

d. Quality Assurance

- (1) Comply with section 270000.
- (2) All work will conform to Article 250-Grounding and Article 800-Communications of the National Electrical Code (NEC) for grounding, bonding, and protecting electrical and communications circuits.
- (3) Materials and work specified herein shall comply with the applicable requirements of ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
- (4) Materials and work specified herein shall comply with the applicable requirements of IEEE-426.
- (5) If there is a conflict between the grounding standards, follow IEEE-426 as the primary standard.

e. Delivery, Storage, and Handling

- (1) Comply with section 270000.

2. PRODUCTS

a. Manufacturers

- (1) All material must be UL listed.
- (2) A single manufacturer will be used for all grounding material.

b. Materials and Fabrication

- (1) Telecommunication Main Grounding Busbar (TMGB) shall be 1/4" x 4" x 20" insulated copper ground bar in size.
- (2) Telecommunication Grounding Busbar (TGB) shall be 1/4" x 4" x 10" insulated copper ground bar in size.
- (3) Equipment Rack Busbars shall be 1/4" x 1" x 19" rack ground bar in size.
- (4) Bonding Conductors

- (a) All bonding conductors shall be insulated copper. The exception is the use of flat, braided, aluminum ground straps utilized for bonding sections of aluminum cable trays.
 - (b) Unless otherwise specified, size the conductors as required by NEC.
 - (c) Unless otherwise specified, the IC (Interconnecting Bonding Conductor) (referred to in TIA/EIA-607 at the Bonding Conductor for Telecommunications) shall be insulated, copper, No. 3/0 AWG.
 - (d) Unless otherwise specified, the TBB (Telecommunications Bonding Backbone) shall be green-colored (or identified as a grounding wire every 10 feet) insulated, copper, No. 3/0 AWG.
 - (e) Unless otherwise specified, the EK (Equipment Bonding Conductor) shall be green-colored insulated, copper, No. 6 AWG.
- (5) Bonding conductor terminations acceptable materials
- (a) Two-hole compression lugs: Color coded to appropriate cable, high conductivity wrought copper, electro tin plated, or approved equal.
 - (b) One-hole compression lugs: Color coded to appropriate cable, high conductivity wrought copper, electro tin plated, or approved equal.

3. EXECUTION

a. Examination

- (1) Comply with section 270000.

b. Installation

- (1) Provide all local bonding as specified on the drawings and in the specifications.
- (2) Bonding conductors shall be continuous and routed in as direct a route as possible to the point of termination.
- (3) All insulated ground bars must be isolated from the structural support by a 2-inch minimum separation, using manufacturer's recommended insulating stand-offs and hardware.
- (4) Clean ground bars prior to terminating conductors.
- (5) Label all telecommunications bonding conductors as close as possible to their termination point.
- (6) Confirm that the electrical contractor bonded the TMGB to the service equipment (power) ground, typically located in the electrical entrance facility, utilizing the most direct route possible to minimize conductor length.
- (7) Bond the following when present.
 - (a) Metallic equipment racks.

- (b) Cable shields.
 - (c) All metal raceways and cable trays.
- c. Adjustments
 - (1) Comply with section 270000.

CONDUITS AND BACKBOXES FOR COMMUNICATIONS

TABLE OF CONTENTS

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

a. Summary

(1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication conduits, backboxes, and hardware as called for in these specifications and related drawings. The communication, conduits, backboxes, and hardware (called technology rough-in) will be installed by the electrical contractor.

(2) Backboxes are defined as the communications metallic box (single gang, double gang, 4 square, handy-box, or device box) with appropriate cover that is mounted in the wall and the conduit is attached for cabling. The backbox is used to mount the Communication Location (CL) and voice/data jacks.

b. System Description

(1) Provide adequate pathways, for the distribution of communication wiring, “homerunning” the cabling from the TR to the CL, without “daisy-chaining” boxes together.

(2) The conduit and backboxes must support the cabling manufacturer’s requirements for conduit fill ratios and cabling bend radiuses.

(3) The pathways shall be sized according to the number of cables served using 40% fill ratio.

(4) Pathways may consist of horizontal conduit, vertical conduit, or cable trays.

(5) Pathways will be designed with cable trays from the TR through major access areas of the building. Then individual conduits will be installed from within 3 feet of the cable tray to each CL backbox.

(6) Conduit sizing for communication cabling is represented in the following table:

CONDUIT SIZING								
No. of Cables	1	5	8	14	18	26	40	60
Conduit Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"

(7) Elevators

- (a) Elevator outlets shall be installed in metal boxes and grounded in accordance with code requirements.
- (b) The elevator CL shall be located inside the elevator equipment room but outside the elevator panel for testing purposes. There will be a conduit installed from the elevator CL to the elevator panel.

(8) Energy management and control systems

- (a) CLs in mechanical rooms for automated building systems shall be run in EMT conduit from the closet cable tray to a CL located next to the automated building system panel.

c. Submittals

- (1) Product Data: Submit manufacturers' product information for backboxes and supports.

d. Quality Assurance

- (1) Comply with section 270000.
- (2) Comply with section 260000 (Electrical).

e. Delivery, Storage, and Handling

- (1) Comply with section 270000.
- (2) Comply with section 260000 (Electrical).

2. PRODUCTS

a. Manufacturers

- (1) Conduits: Comply with Division 26 – Electrical.
- (2) Backboxes: Comply with drawings for size of backboxes.

b. Materials and Fabrication

- (1) Comply with section 260000 (Electrical).

3. EXECUTION

a. Examination

- (1) Comply with section 260000 (Electrical).
- b. Installation
- (1) Comply with section 260000 (Electrical).
 - (2) When installing exposed conduit that is attached to walls or ceilings, ensure that the conduit runs perpendicular to the walls or ceilings. Angular or large conduit sweeping installations will not be acceptable.
 - (3) When installing conduits, terminate the free ends of the conduits with bushings to ensure that communication cabling is not stripped by the sharp edges of the cut conduit.
 - (4) Install no more than the equivalent of two 90-degree bends between CLs and cable trays.
 - (5) Provide pull line in empty conduits and surface raceway.
- c. Adjustments
- (1) Comply with section 260000 (Electrical).

HANGERS AND SUPPORTS FOR COMMUNICATIONS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of equipment supports, cable supports, and fastening hardware as called for in these specifications and related drawings.
 - (2) Ladder rack will not be used; where designed, use cable or basket tray.
 - b. System Description
 - (1) Design Requirements: Support systems shall be adequate for the maximum capacity weight rating of cable. Cable support systems shall have no sharp edges.
 - c. Submittals
 - (1) Product Data: Submit manufacturers' product information for hangers and supports.
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
 2. PRODUCTS
 - a. Manufacturers
 - (1) WBT or Cabofil - Submit product information for approval.

- b. **Materials and Fabrication**
 - (1) Provide all material as needed for complete installation.
 - (2) All hardware shall be corrosion resistant.
 - (3) For technology pathway systems, provide all associated components from a single manufacturer.

- 3. **EXECUTION**
 - a. **Examination**
 - (1) Comply with section 270000.

 - b. **Installation**
 - (1) Fasten hanger rods, conduit clamps, and other applicable supporting hardware to the building structure using expansion anchors, beam clamps, or powder actuated fastening systems. Do not use spring clips and clamps. No sharp edges.
 - (2) Do not fasten supports to piping, ductwork, mechanical equipment, lay-in ceiling support wires, or conduits.
 - (3) Do not drill structural steel and concrete members.
 - (4) In areas where cable tray or conduit is not provided, support the cable with cable hangers. Cable hanger-to-cable hanger center-to-center separation shall be a maximum of 6 feet. Cable bundles shall be at all times at least 6 inches above any lay-in ceiling tiles. Cable support hangers shall be placed in a straight line as much as is possible.

 - c. **Adjustments**
 - (1) Comply with section 270000.

CABLE TRAYS FOR COMMUNICATIONS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communications cable trays, J-hook hardware, and supports as called for in these specifications and related drawings. The communication cable trays will be installed by the electrical contractor.
 - b. System Description
 - (1) Pathway: Cable trays, raceway, J-hooks, D-rings, and all fittings and connectors end-to-end that make up the primary and secondary pathway system.
 - (2) Pathway definitions
 - (a) Primary pathways are major pathways for cable routed floor-to-floor, through corridors, and pathways that carry cables feeding multiple areas that are likely to be used to support growth in those areas. Primary pathways carry cable to secondary pathways.
 - (b) Secondary pathways extend from the primary pathway to the CL.
 - c. Submittals
 - (1) Product Data: Submit manufacturers' product information for cable trays, J-hooks, and supports.
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - (2) Comply with Division 26 – Electrical.

- e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
 - (2) Comply with Division 26 – Electrical.

2. PRODUCTS

a. Manufacturers

- (1) Conduit
 - (a) Comply with Division 26 – Electrical.
- (2) Cable tray
 - (a) The cable trays and all fittings and accessories shall comprise a complete structural system in the form of a rigid mechanical tray of compatible material and design, functional to support all cables.
 - (b) Description: Continuous, rigid, welded steel wire mesh. Tray height as indicated on the drawings. Tray width as indicated on the drawings.
- (3) Fittings and accessories
 - (a) Provide the manufacturer's recommended fittings including splice plates, spacers, wall brackets, ceiling hanger brackets, couplings, junctions, radius bends, radius elbows, radius vertical and horizontal tees, waterfalls, crosses, wall end connectors, angle connectors, offset connectors, wall plate connectors, tray-to-box connectors, fasteners, offsets, and all other components to make the system work.

b. Materials and Fabrication

- (1) Comply with Division 26 – Electrical.
- (2) J-hooks (if used): Plastic, rated for plenum indoor use. J-hooks shall be rated to support Category 6 cable.

3. EXECUTION

a. Examination

- (1) Comply with section 270000.
- (2) Comply with Division 26 – Electrical.

b. Installation

- (1) Comply with Division 26 – Electrical.
- (2) Where physical discontinuity of the cable tray is necessary, cables shall be mechanically supported over the discontinuity by alternate means (including hangers,

clips, brackets, hooks). The ends of the cable tray rack shall be electrically bonded together over each discontinuity.

(3) Bond the cable tray to make electrically continuous. Bond the cable tray to the telecommunications grounding bussbars in the TR, as applicable.

(4) Support cable tray at splices, tees, elbows, bends, intersections, and transitions, and per manufacturer's recommendation. The supporting mechanisms shall be sufficiently spaced to support the weight of the cable trays for their maximum capacity rating.

(5) Install the cable tray, support system, entry, and exit points to be free of all sharp edges, burrs, or projections.

(6) Route cable trays parallel and perpendicular to walls and ceilings.

c. Adjustments

(1) Comply with section 270000.

(2) Comply with Division 26 – Electrical.

FIRESTOPPING FOR COMMUNICATIONS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of firestopping for communications systems as called for in these specifications and related drawings.
 - (2) Contractor must coordinate firestop solution used so that it follows the guidelines or specific solutions determined by UNL FMP for the building.
 - (3) A through-penetration is created when a cable tray, cable, conduit, or sleeve passes through an opening in a fire-rated wall or floor. The opening offers a path for fire and smoke to spread. A firestop is a special seal designed and tested to restore the fire integrity of the barrier.
 - b. System Description
 - (1) Provide firestops for any cable tray system or riser system as required by the latest NEC.
 - (2) Sealing of openings between floors, through rated fire and smoke walls, existing or created by the Contractor for cable pass through shall be the responsibility of the wiring Contractor.
 - (3) Provide penetrations through fire-rated walls and partitions and firestopping of the penetrating items.
 - (4) Sealing material and application of this material shall be in accordance with a submitted and approved UL listed assembly matching the fire rating of the existing fire-rated wall or partition.

c. Submittals

- (1) Submit Product Data: Manufacturers' specifications and technical data for each material including the composition and limitations documentation of UL firestop systems to be used and manufacturer's installation instructions.
- (2) Manufacturers' engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and Contractor's name who will install the firestop system as described in drawing.
- (3) Submit material safety data sheets provided with product delivered to the job-site.
- (4) Product Data: Provide product data for each type of product specified.
- (5) Provide certification from the firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- (6) Provide shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system and each kind of construction condition penetrated and kind of penetrating item.
- (7) Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.
- (8) Where project conditions require modification of the qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit an illustration approved by the firestopping manufacturer's fire protection engineer with modifications marked.

d. Quality Assurance

- (1) Comply with section 270000.
- (2) Firestop system installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated. Fire Stopping 07840-3

e. Delivery, Storage, and Handling

- (1) Comply with section 270000.
- (2) Deliver firestopping products to the project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying project and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to the project; curing time; and mixing instructions for multi-component materials.
- (3) Coordinate delivery of materials with the scheduled installation date to allow minimum storage time at the job site.

- (4) Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- (5) Do not use damaged or expired materials.

2. PRODUCTS

a. Manufacturers

- (1) Coordinate with UNL FMP

b. Materials and Fabrication

- (1) Coordinate with UNL FMP

3. EXECUTION

a. Examination

- (1) Comply with section 270000.
- (2) Verify that openings are ready to receive the work of this section. Sequence work to permit firestopping materials to be installed after adjacent and surrounding work is complete.

b. Installation

- (1) Creation of such openings, as necessary, for cable passage between locations as shown on the drawings shall be the responsibility of the selected wiring Contractor.
- (2) Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.
- (3) Environmental requirements
 - (a) Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
 - (b) Ventilate firestopping per the firestopping manufacturer's instructions by natural means or, where this is inadequate, forced air circulation.
 - (c) During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.
 - (d) Do not use materials that contain flammable solvents.
- (4) Preparation
 - (a) Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of the firestopping manufacturer and the following requirements:

- (b) Remove all foreign materials from surfaces of openings and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - (c) Clean openings and joint substrates and penetrating items to produce clean, sound surfaces capable of developing the optimum bond with firestopping. Remove loose particles remaining from the cleaning operation.
 - (5) Labeling
 - (a) Coordinate with UNL FMP and follow their standard for labeling firestopping locations.
 - (b) For installations that are outside the scope of UNL FMP, label the firestop locations as follows:
 - (c) When the firestop system has been installed, place a label next to the system. The label should contain the following items:
 - UL rating and any other pertinent certification information.
 - The date the firestop was installed.
 - Name of Contractor who installed the firestop.
 - (6) Protection
 - (a) Protect firestopping during and after the curing period from contact with contaminating substances or form damage resulting from construction operations or other causes so that they are without deterioration or damage at the time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.
- c. Adjustments
 - (1) Keep areas of work accessible until inspection by applicable code authorities.
 - (2) Comply with section 270000.

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS

TABLE OF CONTENTS

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

a. Summary

(1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication pull boxes, hand-holds, outside plant conduits, and hardware as called for in these specifications and related drawings. The communication pull boxes, hand-holds, outside plant conduits, and hardware will be installed by the electrical contractor.

b. System Description

(1) Hand-holds shall be below grade communications vaults, minimum 24" x 36" x 36" as a general size unless specified differently.

(2) Hand-holds installed in parking lots or streets must be rated for vehicular traffic. Lids must be concrete rated for traffic.

(3) Lids must be 20,000-pound rated.

(4) Types, sizes, and locations of pull boxes and hand-holds are shown on the drawings. All lids and covers shall be marked "Fiber Optic."

(5) A minimum of two 4" entrance conduits will be installed into any building.

(6) Outside plant copper, fiber, and coaxial cable shall be installed together in one of the conduits while the other conduit is for future services and disaster mitigation.

(7) Type of conduit to be used is high-density polyethylene (HDPE).

(8) Direct buried or aerial service entrances are not allowed unless pre-determined by the UNL IS Project Manager.

(9) The conduits will be installed from the building to the nearest UNL Utility tunnel if possible.

(10) Dual entrances are very desirable if possible, especially for buildings that house emergency services, data core systems, disaster recovery systems, or designated as an essential services building on campus.

(11) Dual entrances should be separated by at least 30 feet.

(12) For outside plant fiber optic entrance cable, install soft sided detectable innerduct in one of the conduits.

c. Submittals

(1) Product Data: Submit manufacturers' product information for conduits, accessories, pull boxes, and hand-holds.

d. Quality Assurance

(1) Comply with section 270000.

(2) Comply with section 260000 (Electrical).

e. Delivery, Storage, and Handling

(1) Comply with section 270000.

(2) Comply with section 260000 (Electrical).

2. PRODUCTS

a. Manufacturers

(1) Conduits: Comply with Division 26 – Electrical.

(2) Pull boxes and hand-holds: Comply with drawings for size and specification.

b. Materials and Fabrication

(1) Comply with section 260000 (Electrical).

3. EXECUTION

a. Examination

(1) Comply with section 270000.

(2) Comply with section 260000 (Electrical).

b. Installation

(1) Comply with section 260000 (Electrical).

(2) Do not include more than two 90-degree bends between pulling points when installing underground conduit. Require that bends be long sweep type, with a radius of not less than six times the internal diameter of the conduit.

- (3) For every 300 feet of outside plant conduit, install an approved hand hole. Design hand holes with the UNL IS Project Manager.
- (4) Securely attach conduit to infrastructure in a manner that will withstand placing and pulling operations.
- (5) Keep area around entrance conduit free of any construction, storage, mechanical apparatus, pipes, or other items that might interfere with installing or maintaining cables.
- (6) Seal the inside-building end of conduit to prevent entrance of water or gases. Reseal conduits after cable is placed.
- (7) Provide mule tape in all entrance conduits.
- (8) Depth of conduit shall be a minimum of 36 inches.
- (9) Warning tape over conduits if installed in trench.
- (10) Refer to NEC code, local, and UNL standards for clearance distance from other utilities.
- (11) Terminate entrance conduit with metallic insulated-throat threaded bushing at terminal board or at cable tray. Secure conduit to cable tray with Gedney* CTC or comparable clamp.
- (12) Ground and bond conduits as they enter the building.

c. Adjustments

- (1) Comply with section 260000 (Electrical).

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication equipment room fittings as called for in these specifications and related drawings.
 - b. System Description
 - (1) Design Requirements: Provide cable management and ladder rack cabling support in each telecommunication room location to transport all communication cabling within the room to the termination racks.
 - c. Submittals
 - (1) Product Data: Submit manufacturers' product information for equipment room fittings.
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
 2. PRODUCTS
 - a. Manufacturers
 - (1) Use Panduit communications equipment room fittings unless previously approved alternate is chosen by the UNL Project Manager.

b. Materials and Fabrication**(1) Ladder rack**

- (a) Provide all required Panduit, or equivalent, Universal Cable Runway.
- (b) Provide color black, but confirm with owner representative and Architect before purchase.
- (c) Provide widths specified in the technology drawings.

(2) Piece parts and accessories

- (a) Provide all piece parts and accessories to complete the drawing illustrated layouts per manufacturer's installation instructions and any installation instructions given in these specifications.
- (b) Examples: Horizontal 90-degree turns, vertical to horizontal, or vice versa 90-degree turns, counter brackets, ladder rack splices, ladder rack supports, etc.
- (c) Provide all ladder rack and associated components from a single manufacturer.

3. EXECUTION**a. Examination**

- (1) Comply with section 270000.

b. Installation

- (1) File a copy of the ladder rack manufacturer's installation instructions with the owner's representative, Architect, and General Contractor before beginning installation of any ladder rack.
- (2) Install all ladder rack components per manufacturer's instructions.
- (3) Use only manufacturer-supplied and/or manufacturer-provided hardware.
- (4) Installation elevations and layout patterns are specified in the drawings.
- (5) Be prepared to make field adjustments and resolve conflicts between drawings, specifications, and field conditions before beginning or continuing ladder rack installation.
- (6) Bond all ladder rack within an equipment room or telecommunication room to the telecommunications grounding buss bar.

c. Adjustments

- (1) Comply with section 270000.

COMMUNICATIONS ENTRANCE PROTECTION

TABLE OF CONTENTS

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

a. Summary

(1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of outside plant cable (OSP) entrance protection and termination for copper cabling as called for in these specifications and related drawings.

b. System Description

(1) If the local telephone company (telco) is installing the outside plant copper cable:

(a) Coordinate the telco design and follow their standards for copper protection.

(2) If the low voltage contractor is installing the outside plant copper cable, then follow the details in this section.

(a) All pairs of both ends of new copper cable shall be protected and shields shall be grounded at both ends.

(b) Both primary and secondary protection shall be provided.

(c) Primary protection shall, as a minimum performance requirement, conform to UL listing 497.

(d) Secondary protection shall, as a minimum performance requirement, conform to UL listing 497A.

(e) Protectors shall be solid-state technology. No air-gap or gas tube protectors are allowed.

(f) Protectors shall be 300V nominal clamping voltage and with 350 mA sneak current protection.

- (g) All pairs of the OSP multi-pair copper cable entering a building shall be spliced or otherwise connected to a fusible-link cable at least two gauges finer than the entrance cable.
 - (h) The fusible-link cable shall be at least 0.6 m (2 ft.) in length but then, after having met this minimum length requirement, kept as short as possible.
 - (i) The fusible-link cable shall be connected to and be an integral part of a Building Entrance Terminal (BET) protection system.
 - c. Submittals
 - (1) Product Data: Submit manufacturer's product information for Building Entrance Terminal assembly
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
- 2. PRODUCTS
 - a. Manufacturers
 - (1) There is no preferred manufacturer.
 - b. Materials and Fabrication
 - (1) BET technology to include fusible link.
 - (2) Protector technology: 5-Pin, 300V, 350 mA.
 - (3) Miscellaneous parts and material required to complete a successful installation of the BET technology, such as splice case and associated hardware
- 3. EXECUTION
 - a. Examination
 - (1) Comply with section 270000.
 - b. Installation
 - (1) Copper outside plant cabling
 - (a) Install a Building Entrance Terminal protector unit for every 100 pairs of OSP entrance cable or entrance tie cable as specified in the drawings.
 - (b) Mount the protector units in columns of not more than three units, with the top surface of the upper-most unit 6 feet A.F.F. Use mounting hardware recommended by the manufacturer.

- (c) Bond all protectors in each BET together using 1/0 AWG (6 AWG allowed) ground wire, in daisy chain style. Connect a segment of ground wire from the top unit to the Telecommunication Grounding Buss Bar in the telecommunications room. Install 100 5-pin protector units for each protector terminal.
 - (d) Splice entrance cable or entrance tie cable to 26 AWG protector terminal fuse cable pigtails. Secure the splice case vertically on the TR wall as shown on the contract drawings.
 - (e) The Contractor shall bond the shield of each OSP cable to the Telecommunication Grounding Buss Bar (TGBB) provided at the entrance facilities using 1/0 AWG copper wire.
 - (f) At the termination end of multi-pair OSP cables, the Contractor shall provide six feet of managed service slack.
 - (g) Label Building Entrance Terminals according standards listed in section 270000.
- (2) Test all terminated pairs of each copper backbone cable segment from the BET output field through the installed protector for the following:
- (a) Continuity to remote end.
 - (b) Shorts between any two or more conductors.
 - (c) Transposed pairs.
 - (d) Reversed pairs.
 - (e) Split pairs.
 - (f) Grounded conductor.
 - (g) Shield continuity.
- c. Adjustments
- (1) Comply with section 270000.

COMMUNICATIONS CABINETS, RACKS, AND ENCLOSURES

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communications cabinets, racks, frames, and enclosures as called for in these specifications and related drawings.
 - b. System Description
 - (1) Design Requirements: Provide communication racks in telecommunication room locations to terminate all communication cabling and networking electronics.
 - c. Submittals
 - (1) Product Data: Submit manufacturers' product information for communications cabinets, racks, frames, and enclosures.
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
 2. PRODUCTS
 - a. Manufacturers
 - (1) See Addendum A: APPROVED COMMUNICATIONS EQUIPMENT VENDORS for approved vendor cabinet and racks.
 - b. Materials and Fabrication

- (1) See Addendum A: APPROVED COMMUNICATIONS EQUIPMENT VENDORS for approved vendor cabinet and rack materials.

3. EXECUTION

a. Examination

- (1) Comply with section 270000.

b. Installation

(2) Assemble relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.

(3) All racks must be attached to the floor using floor mounting anchors recommended by manufacturer's installation instructions as appropriate for floor type.

(4) Each rack shall be bonded to each other and the TGB using hardware approved and/or provided by the equipment rack manufacturer. The bonding will meet local code requirements.

(5) The rack must have seismic bracing as required by local building codes.

(6) Cable support system may be attached to the top of the rack to deliver cables to the rack, Comply with section 270529.

(7) Secure all equipment to the rack with equipment mounting screws specified by or provided by the equipment rack manufacturer.

c. Adjustments

- (1) Comply with section 270000.

COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication blocks and patch panels as called for in these specifications and related drawings.
 - b. System Description
 - (1) Design Requirements: Provide blocks and patch panels required to terminate all communication cabling within the telecommunication rooms.
 - c. Submittals
 - (1) Product Data: Submit manufacturers' product information.
 - (2) Submit manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Shop Drawings and Equipment Brochures.
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - (2) The horizontal cable plant installed shall be link performance warranted by the manufacturer for a period of 25 years.
 - e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
 2. PRODUCTS
 - a. Manufacturers

- (1) A certified Structured Cabling System with a 25-year CAT6 link performance compliance warranty is required. See Appendix A “APPROVED COMMUNICATIONS EQUIPMENT VENDORS” for a list of approved systems.
 - (2) Fiber optic cabling and material: See Appendix A “APPROVED COMMUNICATIONS EQUIPMENT VENDORS” for a list of material.
- b. Materials and Fabrication
- (1) Building entrance terminals and Telco fed TRs
 - (a) Follow section 271113, Entrance Protection.
 - (2) Multipair copper riser cable termination blocks (other than Telco termination)
 - (a) Provide all required 66 blocks and labeling strips. (Confirm block types with UNL Project Manager). Block types are dependent on existing conditions and Telco terminations.
 - (3) Termination block mounting bracket frames/jumper ring bars
 - (a) Provide all required mounting frames.
 - (b) Provide all required wall-mount jumper ring bars.
 - (c) Provide all required rack-mount jumper ring bars.
 - (4) UTP CAT 6 Patch panels
 - (a) Patch Panels: See Appendix A “APPROVED COMMUNICATIONS EQUIPMENT VENDORS” for a list of material.
 - (b) Patch panels are to be 48-port panels unless otherwise specified in the drawings.
 - (5) Fiber optic cable panels
 - (a) Install 19-inch rack mount optical fiber connector housings sized and equipped with connector housing adapter panels. Housing size and adapter panel configurations are provided in the contract drawings.
 - (b) For each optical fiber connector housing, the equipment rack and mounting location within the equipment rack are specified in the contract drawings.
 - (c) For the outside plant (OSP) install a 25-foot to 30-foot service loop in the outside plant (OSP) optical entrance cable and securely fasten the service loop to the wall of the telecommunication room.
 - (d) Service loops are not required for the optical fiber riser cable. Leave 30 feet of slack at both ends of the fiber riser cable.
 - (6) Fiber optic connectors

(a) All fiber optic connectors will be LC terminations.

(7) Fiber optic cable connector housings

(a) Provide all required TR connector housings.

(b) Provide all required connector adapter panels.

3. EXECUTION

a. Examination

(1) Comply with section 270000.

b. Installation

(1) Copper backbone terminations

(a) Mount mounting brackets on wall or rack mount bracket frames as shown on the contract drawings.

(b) Backbone cables are to be routed neatly on overhead cable runway to termination block brackets. For cable management from cable runway to termination block brackets and dressing of cable in brackets follow manufacturer's instructions and standard industry practices.

(c) Terminate all riser backbone pairs per manufacturer's specifications and place blocks on brackets.

(d) At the termination end of multi-pair riser cables, the Contractor shall provide 4 to 6 feet of managed service slack.

(e) If removal of the cable jacket is required to facilitate routing of ARMM or plenum backbone cable into the termination blocks, the exposed cable pairs shall be fully covered with black or gray plastic tape, neatly lapped to prevent gaps.

(f) The Contractor shall bond ARMM riser cable to the Telecommunication Grounding Buss Bar (TGBB) using 1/0 AWG 1/0 AWG thermoplastic insulated stranded copper wire.

(g) Label the blocks and associated brackets as specified in this specification.

(2) Horizontal cable terminations

(a) Install one (1) CAT 6 / 48-port patch panel for every 48 horizontal cables.

(b) Mount the 48-port patch panels on rack mount bracket frames.

(c) Horizontal cables are to be routed neatly on overhead cable runway to equipment racks; exit cable runway into vertical rack cabling management and proceed to the patch panels.

(3) Fiber cable termination

- (a) Terminate fiber strands of riser links or OSP links per ANSI/TIA/EIA-568-B.1, sub-clause 10.3.2 inclusive. This means the Contractor shall implement a termination system such as 568SC A-B : B-A orientation or accomplish the same polarity crossing by using reverse pair positioning.
 - (b) Install fiber connectors per the manufacturer's instructions.
 - (c) Install connectors on outside plant single-mode and multimode fiber strands and on single-mode riser fiber strands.
- (4) Fiber optic cable panels
- (a) Install 19-inch rack mount optical fiber connector housings sized and equipped with connector housing adapter panels. Housing size and adapter panel configurations are provided in the contract drawings.
 - (b) For each optical fiber connector housing, the equipment rack and mounting location within the equipment rack are specified in the contract drawings.
 - (c) For the outside plant (OSP) install a 25-foot to 30-foot service loop in the outside plant (OSP) optical entrance cable and securely fasten the service loop to the wall of the telecommunication room.
 - (d) Service loops are not required for the optical fiber riser cable. Leave 6 to 10 feet of slack at both ends of the fiber riser cable.
- c. Adjustments
- (1) Comply with section 270000.

COMMUNICATIONS BACKBONE CABLING

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services labor, materials, tools, and equipment required for the complete and proper installation, splicing, and termination of new backbone cabling as called for in these specifications and related drawings.
 - (2) This section includes minimum requirements and installation methods for the following:
 - (a) Copper backbone cabling
 - (b) Copper splices
 - (c) Fiber optic backbone cabling
 - (d) Fiber splices
 - (e) Fiber connectors
 - b. System Description
 - (1) Outside plant and inside plant copper will be designed and installed by the local telephone company. The outside plant copper cable will terminate in the main telecommunication room (TR) of the building. Confirm that the system design incorporates the pathway and termination requirements for the copper cabling.
 - (2) Outside plant fiber optic cable will be designed to connect new facilities to the campus data networking system in the closest data network core location. The location of the data network core location must be reviewed and approved by the UNL IS Project Manager. The outside plant fiber optic cable will terminate in the main TR of the building.
 - (3) Inside plant riser fiber optic cable for connecting each building main TR to the each other TR within the building.
 - c. Submittals

- (1) **Product Data:** Submit manufacturers' product information.
 - d. **Quality Assurance**
 - (1) Comply with section 270000.
 - (2) Acceptance of cabling installation will not be made unless all cable test results and as-built drawings are submitted and approved by the UNL IS Project Manager.
 - e. **Delivery, Storage, and Handling**
 - (1) Comply with section 270000.
2. **PRODUCTS**
 - a. **Manufacturers**
 - (1) See Appendix A: APPROVED COMMUNICATIONS EQUIPMENT VENDORS for approved vendor cabinet and racks. Must be approved by UNL IS Project Manager.
 - b. **Materials and Fabrication**
 - (1) **Outside plant fiber optic cable**
 - (a) All outside plant fiber optic cable shall be Single-mode 8.3/125 grade.
 - (b) Cable shall be indoor, outdoor, rated and tight buffered.
 - (2) **Inside fiber optic backbone cabling**
 - (a) All inside plant fiber optic cable shall be Single-mode 8.3/125 grade, riser-rated (OFNR).
 - (3) **Fiber splices**
 - (a) Provide all required hardware and kits for field fusion splicing in splice closures and for sealing and mounting the closures.
 - (4) **Fiber connectors**
 - (a) Use single-mode LC connectors.
 - (b) Provide all other consumables and kits as required for field termination of fiber optic cable on connectors
 - (5) **Cable installation materials, equipment, and tools**
 - (a) Furnish all required materials, equipment, and tools necessary to properly complete the backbone cabling system installation including, but not limited to, tools for pulling, splicing, and terminating the cables, mounting hardware, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, communication devices, stands for cable reels, cable wenches, etc.

- (b) Use a pulling ‘mule’ tape for cable installation: Leave a pulling ‘mule’ tape in the conduits for future use after installing the outside plant cable.
- (c) Conduit caulking compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.
- (d) “Caution Fiber” tags shall be installed at all locations where fiber optic cabling is visible entering a room or outside vault. Use 3M Scotchlite 5016-FO (or approved equal).

3. EXECUTION

a. Examination

- (1) Comply with section 270000.
- (2) Verify that field measurements and cable routing and termination conditions are as shown on drawings. Provide notification, in writing, of conditions deviating from drawings.

b. Installation

- (1) Perform all backbone cable installation in conformance with manufacturer’s installation guidelines.
- (2) Ensure that maximum pulling tensions of specified cables are not exceeded and cable bends maintain the proper radius during placement.
- (3) Field verify all cable measurements and install all backbone cables in such a manner as to avoid, if possible, mid-span splices.
- (4) Pull new pulling ‘mule’ tape through all conduits while pulling new backbone cable.
- (5) The Contractor shall be responsible for all damage to the cable during placement.
- (6) Do not roll or store cable reels without an appropriate underlay.
- (7) Clamp all new backbone cables at the entrance facilities for strain relief.
- (8) Backbone telecommunications cabling shall be placed in dedicated pathways separate from horizontal and other cabling.
- (9) Backbone cables and splice cases installed in manholes or pull boxes shall be strapped to the cable racks using stainless steel ties.

- (10) Terminate cables so as not to pull tight on terminating equipment.
- (11) Ensure that all splice closures are properly sealed for protection of the cable and splices.
- (12) Neatly and permanently label all backbone cables with the approved UNL IS standard labeling scheme at both ends and at all splice locations.
- (13) Firestop all sleeves and conduit openings after the cable installation is complete.
- (14) Plug ends of conduit entering buildings with watertight conduit caulking compound after cable installation is complete to ensure foreign matter does not enter the buildings.
- (15) Test and document the final backbone cable installation, including cable footages, on the as-built drawings. (Test using 2 point DB loss.)
- (16) FIBER BACKBONE CABLE
 - (a) Install fiber optic backbone cable through conduit, manholes, and other pathways as shown on the drawings.
 - (b) Install service coils with a length of 20 feet and a diameter of 18 inches, at each end of all new backbone fiber optic cables to control excess cable lengths before terminating fiber strands. Do not leave cable slack on ladder racks.
 - (c) Bind fiber cable service coils in 4 places with separation of 90 degrees and anchor to the wall with cable ties within 4 feet of the cable entrance per the drawings. Do not install cable coils on cable or equipment racks.
 - (d) Install fiber connectors in the TRs as shown on the project drawings.
 - (e) Terminate fiber strands on connectors and in termination equipment (shelves and panels) as specified in the manufacturer's color code sequence.
 - (f) Do not terminate, splice, or cut off "DEAD" cable strands. Neatly coil these un-terminated strands inside the shelves or panels with the proper bend radius to protect them for future termination or splicing.
 - (g) Perform fusion splices for multimode and single-mode fiber strands at each splice location.
 - (h) Perform fusion splices for single-mode fiber strands with splice loss ≤ 0.2 dB at 1310 nm.
 - (i) Perform termination of single-mode fiber strands on LC connectors with loss ≤ 0.2 dB at 1310 nm.
 - (j) Place "Caution Fiber" tags at all coils and every 50 feet along any exposed cable route.

(17) SAFETY

- (a) Guard maintenance hole and pull box openings.
- (b) Test for gas in maintenance holes and unventilated vaults.
- (c) Provision shall be made for adequate continuous supply of air. Note: the term "adequate" includes evaluation of both the quantity and quality of the air.
- (d) Employees shall not smoke in maintenance holes.
- (e) Where open flames must be used in maintenance holes or vaults, extra precautions shall be taken to ensure adequate ventilation.

(18) AS-BUILT DRAWINGS

- (a) Mark the project drawings with notations reflecting actual cable lengths and any variations from the base specifications and drawings including as-built cable routing.

c. Adjustments

- (1) Comply with section 270000.

COMMUNICATIONS HORIZONTAL CABLING

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) Provide all services, labor, materials, tools, and equipment required for the complete and proper installation and termination of new horizontal “station” cabling as called for in these specifications and related drawings.
 - (2) The horizontal portion of the telecommunications cabling system extends from the Communication Location (CL) to the termination in the Telecommunications Room (TR).
 - (3) This section includes minimum requirements and installation methods for the following:
 - (a) Copper horizontal cabling
 - (b) CL faceplates
 - (c) Copper modular jacks
 - (d) Modular patch panels
 - b. System Description
 - (1) Design Requirements: The horizontal cable plant installed shall be link performance warranted by the chosen manufacturer for a period of 25 years.
 - c. Submittals
 - (1) Product Data: Submit manufacturers’ product information.
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - (2) Must discuss labeling with UNL Project Manager before beginning work.

(3) Labeling must follow the established system used by UNL IS group. Any printed labels must have prior approval of UNL Project Manager as well as meet the performance requirements of UL 969 and TIA 606.

e. Delivery, Storage, and Handling

(1) Comply with section 270000.

2. PRODUCTS

a. Manufacturers

(1) Use the chosen 25-year manufacturer cabling and material for all communications horizontal cabling.

b. Materials and Fabrication

(1) Horizontal cable

(a) Install two (2) sheaths of plenum rated, 4-pair unshielded, 23 AWG, twisted copper pair cable for data and one (1) sheath of plenum rated, 4-pair unshielded, 23 AWG, twisted copper pair cable for voice to each CL.

(b) Use white cable for data.

(c) Use gray cable for voice.

(d) Cabling must be rated as Underwriters Laboratories (UL) level V or EIA/TIA and must be stamped with the "UL" approval mark.

(2) CL faceplate

(a) Data cabling shall terminate at the user (CL) end in ivory 3-hole faceplates on keyed eight (8) conductor jacks.

(3) CL data and voice jacks

(a) Used gray jacks for data.

(b) Use ivory jacks for voice.

(c) Use T568B jacks.

(d) Place the two gray data jacks in CL positions one (1) and two (2) with the ivory voice jack in position three (3).

(e) Any specialty CL location including modular furniture, floor plates, or special outlet boxes must have a wiring jack that will allow for the chosen 25-year manufacturer cabling.

(4) Patch panels and blocks

(a) Use 48 port patch panels for data.

- (b) Use 110 Blocks with standoff legs for voice.
- (5) Installation materials, equipment, and tools
 - (a) Furnish all required materials, equipment, and tools necessary to properly complete the horizontal copper cabling system installation including, but not limited to, tools for pulling and terminating the cables, mounting hardware, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, communication devices, stands for cable reels, cable wenchers, etc.
 - (b) Pull-rope to be used shall be polypropylene monofilament line with a minimum pull tensile strength of 200 pounds.

3. EXECUTION

a. Examination

- (1) Comply with section 270000.

b. Installation

- (1) All cable must be installed without any splices or intermediate distribution points.
- (2) Cable installation is “home-run” between the CL and the jack location on the patch panels in the TR.
- (3) Ensure that maximum pulling tensions of specified cables are not exceeded and cable bends maintain the proper radius during placement.
- (4) Ceiling tile shall be removed as necessary for the cable installation and put back in place without damaging or soiling any of the tiles or supporting framework. Ceiling tile shall be handled with clean hands so that no fingerprints or marks are left on the tiles. The Contractor is responsible for the cost of repair or replacement of any damaged or soiled tiles or ceiling hardware.
- (5) All cables in the ceiling space:
 - (a) Shall not be run “wild” (unsupported by conduit or cable tray) for distances greater than 5 feet;
 - (b) Shall not be attached to the suspended ceiling structure or laid directly on the ceiling grids as a means of support and, whenever possible, the bottom of a cable or cable bundle shall remain a minimum of 6 inches above the ceiling grid;
 - (c) Shall not be supported by or attached by any means to fire sprinkler heads or delivery systems, any environmental sensor, or the exterior of any conduit or raceway;
 - (d) Shall be routed at right angles to the electrical power circuits where the cable is not enclosed in conduit or in cable tray.

- (6) Where discontinuity of cable trays or conduit occurs, support all cables over the discontinuity using hangers, brackets, hooks, rings, and other applicable supporting devices installed as specified in section 270529, "Hangers and Supports for Communication Systems."
- (7) All cables in the ceiling space and cable tray shall be bundled with plenum-rated cable ties that are snug but which do not deform the cable geometry.
- (8) The total length of any horizontal station cable from the jack location to the termination block shall not exceed 90 meters.
- (9) Maintain the following clearances from EMI sources:
 - (a) Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: 12 inches.
 - (b) Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: 24 inches.
 - (c) Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: 6 inches.
 - (d) Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: 12 inches.
 - (e) Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: 3 inches.
 - (f) Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: 6 inches.
 - (g) Fluorescent fixtures near cable in open or non-metal pathway: 12 inches.
 - (h) Fluorescent fixtures near cable in grounded metal conduit: 6 inches.
 - (i) Motors or transformers near cable in non-metal pathway: 48 inches.
 - (j) Motors or transformers near cable in grounded metal pathway: 36 inches.
- (10) Manage slack to avoid excess cable or kinking.
- (11) All cables shall be tied and dressed neatly with a minimum bend radius of 10 times the cable diameter. Provide necessary hardware to maintain the proper bend radius at corners.
- (12) All cables shall be firmly held in place. Fastenings and supports shall be adequate to support loads with ample safety factors.
- (13) Cables with jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper (shiners) shall be replaced.
- (14) Do not roll or store cable reels without an appropriate underlay.

- (15) Neatly and permanently label all horizontal cables with the cable number at both ends.
- (16) Firestop all sleeves and conduit openings; after the cable installation is complete.
- (17) Install faceplates and copper jacks at each CL as indicated on the project drawings. Place blank covers in the unused openings on each faceplate.
- (18) Faceplates shall be secured with mechanical fasteners. Adhesive fasteners shall not be allowed.
- (19) Data cable termination shall be EIA/TIA-568 with wiring option T568B.
- (20) Terminate the data cable in the TR on the 48-port patch panels.
- (21) Terminate the voice cable on the 110 blocks with legs for voice.
- (22) Termination must conform to the chosen manufacturers Structured Cabling System installation rules and meet the full performance standards and certification.
- (23) All outlets shall be tested and certified to meet performance standards of the chosen manufacturers Structured Cabling specifications. Testing shall be done regularly as a floor or building is completed and test results provided to the UNL IS Project Manager. UNL IS Project Manger will also conduct random testing.
- (24) All outlets must be labeled at both the work area location and on the patch panels in the Communications Room using the approved UNL IS standard labeling scheme. Labels must be of the printed variety (pencil or ink hand labeling not allowed).

c. Adjustments

- (1) Comply with section 270000.
- (2) Contractor will provide a set of “as built” diagrams to UNL IS Infrastructure at the completion of the project. Additionally, Contractor will provide two sets of specific cable design and installation data in a machine-readable format contained on floppy or hard disk. Both the “as built” drawings and the machine-readable data must comply with UNL’s requirements for permanent documentation of the cable plant. UNL’s documentation scheme will be provided upon contract award.

COMMUNICATIONS CONNECTING CORDS AND ADAPTERS

TABLE OF CONTENTS

1. GENERAL
 2. PRODUCTS
 3. EXECUTION
-
1. GENERAL
 - a. Summary
 - (1) This section describes any cords, cross-connect wire, devices, and adapters required to connect the new OSP, riser, and horizontal “station” cabling as called for in these specifications and related drawings.
 - b. System Description
 - (1) Design Requirements
 - (a) Contractor DOES NOT provide any copper patch cords or fiber optic patch cords.
 - c. Submittals
 - (1) None
 - d. Quality Assurance
 - (1) Comply with section 270000.
 - e. Delivery, Storage, and Handling
 - (1) Comply with section 270000.
 2. PRODUCTS
 - a. Manufacturers
 - (1) None required

- b. **Materials and Fabrication**
 - (1) **CAT 6 copper patch cords**
 - (a) **Contractor does not have to supply patch cords.**
 - (2) **Fiber optic patch cords**
 - (a) **Contractor does not have to supply patch cords.**
3. **EXECUTION**
- a. **Examination**
 - (1) **Comply with section 270000.**
 - b. **Installation**
 - (1) **None.**
 - c. **Adjustments**
 - (1) **Comply with section 270000.**

FIRE DETECTION AND ALARM

TABLE OF CONTENTS

1. REQUIREMENTS
2. CONNECTION TO UNL TELECOMMUNICATIONS
3. ADDITIONAL REQUIREMENTS

1. REQUIREMENTS:

- a. All new buildings shall be provided with fully addressable fire alarm systems.
- b. Additions to existing buildings shall have existing fire alarm systems extended and expanded, if necessary, to include the new construction.
- c. Procurement: Fire alarm systems shall be designed by the project architect/engineer and be fully defined in the contract drawings and specifications. The contract documents shall clearly indicate that the fire alarm system, including cabling, conduit, detectors, pull stations, horns, strobes, panels, and relays will be furnished and installed by the UNL Building Systems Maintenance (UNL BSM). Power wiring will be the responsibility of the Electrical Contractor. **All locations of fire alarm related panels may not be shown on print. Panels shall be connected to emergency power, if available. Coordinate locations with UNL BSM CG.** See table in Article 3 of Design Guideline 230000.10 for additional information regarding the assignment of responsibilities for the procurement and installation of fire alarm system components.
- d. System Description and Capabilities: Fire alarm systems in new buildings or in complete remodel projects should be a combination microprocessor-based fire detection/fire alarm/emergency audio system providing the functions and capabilities described below:
 - (1) Fire Detection/Fire Alarm System: The system should function as follows when an area or duct detector, manual station, or water **flow** switch operates:
 - (a) Sound required audio devices and transmit signal to emergency audio communication system through appropriate interface.
 - (b) Automatically notify the University operator. Notification of the UNL operator shall be via IP connection. All information at enunciator shall be made available to the operator. Provide all **equipment** required for this function.
 - **An additional matching cabinet shall be provided and installed next to the main fire alarm panel for installation of equipment required**

for UNL Telecommunications connections and voice over paging system. Minimum internal dimensions of this cabinet shall be no less than 24" x 30".

- Equipment to be installed shall include:
 - Altronix AL300ULXR listed power supply with two (2) 7.2 AH batteries
 - Bosch C900V2 capture module and corresponding listed enclosure
 - Latest model of Valcom voice over paging device

- (c) Automatically display individual detector and/or zone number on alphanumeric display with user-defined message. Device labels must be submitted and approved by BSM CG.
- (d) Light an indication lamp on the device initiating the alarm.
- (e) Shut down the HVAC system and operate dampers. Approve zoning of HVAC shutdown with UNL BSM CG. A normally closed alarm contact shall be provided and attached to the HVAC monitoring system for alarm status.
- (f) Activate the elevator return sequence.
- (g) Close all magnetically-held fire doors.
- (h) Unlock magnetic electric locks for egress. Coordinate with UNL Card Access group.

(2) Emergency Audio Communication System: The emergency audio communication system should function in combination with the fire alarm system, providing fire alarm tone and voice page to the fire zones. The system should be a single channel. The alarm tone should be cut out or attenuated during voice page originating at the control panel. Any voice page originating from any other location should not function or prohibit the alarm tone to the zones during any active alarm condition. The system should provide, as a minimum, the following functions and features:

- (a) Interface with the fire alarm system, utilizing appropriate and approved interfacing methods.
- (b) Continuous electronic supervision of all components for opens, shorts, grounds, or other faults that would interfere with the distribution of the fire alarm tone or voice page.
- (c) Supervision of the speaker lines for opens, shorts, or grounds that would prevent the proper distribution of the emergency audio communications.
- (d) Failure of any of the components or speaker lines would cause an audible and visual trouble fault indication at the equipment rack and at the fire alarm control panel.
- (e) Upon actuation from the fire alarm panel, the alarm tone should be transmitted over the building speakers continuously throughout the entire facility until the speaker/recorded announcement begins. The tone should be a slow whoop, sweeping from 800 HZ to 1,200 HZ.
- (f) Visual signals should flash upon alarm until the system is reset.

- (g) Provide manual fire alarm tone initiation to selected zone(s).
- (h) Provisions for the system to be used for “alert” paging. Alert paging is ability to access the system from remote locations by either microphones or telephone lines. Provide circuits to cut out “alert” paging when system is activated by fire alarm control panel.
- (i) Provide a separate emergency tone generator for signals other than fire alarm tone.
- (j) The system should have a minimum of two amplifiers not exceeding 60% load on any circuit.
- (k) The Fire Alarm Installer is required to supply a “Valcom” unit for voice over paging.
- (l) Fire Alarm Installer should be required to provide up to four hours of training on the operation and maintenance of the installed system for UNL maintenance personnel.
- (m) The Fire Alarm Installer should be required to provide to the UNL Maintenance Department, at no additional cost, any specialized tools, equipment or software required to service the fire alarm system.

(3) Acceptable Manufacturers:

- (a) Fire Detection/Alarm Systems: Acceptable manufacturers for fire detector/alarm systems include Notifier Division*, Siemens*, and Edwards*. The fire alarm panel should be Notifier* AFP640 Analog Intelligent Fire Panel or equivalent product, pre-approved by UNL Project Representative.
- (b) Emergency Audio Communications System: System should meet or exceed the standards of performance, quality and appearance of equipment manufactured by Notifier*.
- (c) Provide specification-grade devices approved for use with the system being installed.
- (d) Speakers: UL-listed for fire protection service and approved for the system being installed. Ceiling mount speaker strobes shall be used wherever possible.

2. CONNECTION TO UNL TELECOMMUNICATIONS:

- a. The emergency audio communications system will be connected by three communication circuits to the UNL 24 hour operator station. These communication circuits shall be installed in the cabinet referred to in DG 28 31 00 1d(1)(b) in a three port surface mount box. The first circuit will monitor the fire alarm system and report alarms over the secure fire alarm network. The second circuit will be able to capture a backup phone line to transmit alarms in case of a network failure. The final circuit will enable live or recorded messages to be broadcast throughout the building by the campus operator. The cost of installing these circuits will be reimbursed to UNL Telecommunications and should be included in the construction budget. The

building occupants will be responsible for paying the monthly service charge for the two telephone circuits used for the fire alarm/emergency audio communications systems.

- b. Exterior fire alarm system annunciators should be lockable with a standard UNL padlock.
- c. Strobe lights on fire alarm visual alarms should be set at a frequency which minimizes effects to those subject to seizures.
- d. Surface mounted fire alarm break panels should be mounted on back-boxes specifically made for the purpose and red in color.
- e. Fire detection devices which require testing by Code should be self-testing type where such devices are mounted more than 10 feet above the floor. Self-testing devices are preferred for all locations.

3. ADDITIONAL REQUIREMENTS:

- a. Manufacturer's parts are to be interchangeable with any installer's stock.
- b. Fire alarm system installer should be capable of providing emergency service within three hours of notification and have technicians permanently based within a 30-mile radius of the project site.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

CLOSED CIRCUIT TELEVISION (CCTV)

TABLE OF CONTENTS

1. REQUIREMENTS

1. REQUIREMENTS:

- a. Design and coordination of CCTV to be by the Architect/Engineer of record and coordinated with the UNL Project Manager and UNL Police.

**EXCAVATION PROTECTION AND RESTORATION
OF CAMPUS TREES**

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1. GENERAL
2. INSTALLATION OF UNDERGROUND UTILITIES
3. TREE PROTECTION
4. COORDINATION

1. GENERAL:

a. Application: When excavation must occur on campus, consideration should be given to minimizing adverse impact to established trees, especially on valuable large trees which are impossible to replace in a short period of time. The guidelines given herein describe the procedures which should be employed during the completion of excavation work in the vicinity of campus trees. These procedures are applicable to all excavation work, whether completed by UNL personnel or by outside contractors.

2. INSTALLATION OF UNDERGROUND UTILITIES: (Ref. *Journal of Arboriculture, Volume 5, Number 5*)

- a. Consider boring first when placing utility lines under trees larger than 6" in diameter.
- b. When trenching must occur, locate trench beyond the drip line of the tree.
- c. Soil removed during trenching and tunneling should be used as backfill material and should be replaced in the same density of compactness as before removed. Upper 12" of soil replacement should be by UNL Landscape Services.
- h. All arbor work should be done by UNL Landscape Services.

3. TREE PROTECTION:

- a. UNL Landscape Services will provide tree protection appropriate for the site, the value of the tree, and the project scope.
- b. All tree protection measures are to be observed throughout the term of the project. If tree protection inhibits construction of the project, the contractor shall coordinate access around the tree with UNL Landscape Services.

4. COORDINATION:

- a. The implementation of excavation and other work under trees should be coordinated with UNL Landscape Services. Emergency situation coordination during non-business hours is available through the UNL Operator's contact with "on-call" Landscape Services personnel.
- b. The protection and restoration of trees and lawn areas affected by development\ renovation projects should be funded by the accounts allocated for such projects.

DESIGN PROCESS AND GUIDELINES (EXTERIOR IMPROVEMENTS)

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1. GENERAL
2. DESIGN PROCESS AND CONSTRUCTION PHASE PLANNING
3. DESIGN RESPONSIBILITIES
4. MATERIALS SELECTION GUIDELINES
5. RESPONSIBILITY FOR TOPSOIL PLACEMENT
& LAWN INSTALLATION
6. SITE DRAINAGE
7. SITE RETAINING WALLS
8. BRICK PAVERS
9. PROJECT STAGING AREAS

1. GENERAL:

a. Application: The guidelines and recommendations contained herein are applicable to any project which involves temporary or permanent change in any portion of the exterior campus environs. Plans and proposals for site development and landscaping work are subject to review and approval by the UNL Landscape Architect and the UNL Landscape Services Division.

2. DESIGN PROCESS AND CONSTRUCTION PHASE PLANNING:

a. Site Inventory and Analysis: The site design effort shall include a compilation of a complete inventory of outdoor site and landscaping resources located on the project site or otherwise affected by the proposed construction. A list of elements which shall be included in such a site inventory is provided as Attachment "A" to this Design Guideline. The inventory process shall establish quantity, location, and value for each resource item. The site inventory and analysis process must be closely coordinated with the UNL Landscape Services Division and UNL Facilities Management.

b. Planning and Design: The design process shall address the impact of the project on all of the inventoried resources. This process shall include the determination of the appropriate action (i.e. demolition, removal for salvage, relocation, in-place protection) and the party responsible (i.e. UNL Landscape Services, Contractor, UNL **Building Systems** Maintenance) for such action.

c. Construction Phase Planning: During the design and planning phase, specific requirements relating to the disposition of site and landscape resources during the construction period

shall be developed for inclusion in the construction documents. The following areas shall be addressed:

- (1) Disposition and/or protection of such items as irrigation systems, exterior lighting, signs, paving, walls, landscape plants, topsoil, fencing, bicycle racks, or benches.
- (2) Requirements for the installation and location of temporary fencing to protect specific resources and to enclose spaces designated for staging, storage and parking.
- (3) Control of debris and tracked mud from the project site to adjoining streets, walks and yards.
- (4) Control of Weeds and Erosion During Construction: UNL projects that disturb greater than 1 acre are subject to and must conform to the State of Nebraska Title 119, Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System by submitting a Notice of Intent and Storm Water Pollution Prevention Plan for the site. While not subject to the NOI and SWPPP ordinance requirements, sites that disturb less than 1 acre must utilize feasible storm water quality and quantity Best Management Practices.
- (5) Care of plants within the contract limit lines during the construction period.
- (6) Temporary exterior lighting, exterior water, and electrical service during construction.
- (7) Need for temporary paving to serve staging, storage and/or parking.

3. DESIGN RESPONSIBILITIES:

- a. Schematic Design: Show response to site inventory and analysis.
- b. Design Development: Reflect familiarity with and response to these Guidelines.
- c. Final Construction Documents: Coordinate and cross reference documents with those of remainder of design team; confirm that documents of other design team members are similarly coordinated and cross-referenced.

4. MATERIALS SELECTION GUIDELINES:

- a. Lighting: Equipment intended for permanent installation shall be heavy-duty with a life expectancy of at least 50 years. Design of lighting plan shall verify that the ratio between minimum and maximum light level shall not exceed 1:10. Area lighting shall provide a minimum illumination level of 1.5 fc where two light distribution diagrams intersect, which results with fixture spacing of approximately 75 feet. Area lighting bases shall be located 2'-0" clear from edge of sidewalks. Street and large area lighting may be most effective when using poles 30 feet tall. The following table reflects the preferred choices for each of the named lighting applications:

<u>Lighting Type</u>	<u>Mfr./Model No.</u>	<u>Comments</u>
Street Lighting		Fully shielded fixtures w/metal halide lamps
Area Lighting		Fully shielded fixtures w/metal halide lamps: Lithonia* KKR 250 M R4 208 ADB with lamp, with Lithonia* RSA 16 4-5C PT ADB pole.
Special Purpose		Uplighting shall be fully shielded; do not use in-grade lighting unless approved by UNL Landscape Services.
b. <u>Site Features:</u>		
<u>Furnishing Type</u>	<u>Mfr./Model No.</u>	<u>Comments:</u>
Benches	Maglin* MLB 400, Black with IPE wood slats	To be located on concrete pad.
Trash Receptacles		Provided by UNL Landscape Services.
Bicycle Loops	Wabash Valley* BL100N, black with Plastisol coating	Locate near main entrances; location and layout to be approved by UNL Landscape Services.
Tree Grates	Neenah*, Deeter* or approved equal	Install with frames.
Drinking Fountains		Shall be wheelchair accessible.
Ash Receptacle (Ash Buttler)	Forms & Surfaces* Model SUB-LGW black cylinder, black end cap; wall or post mounted	To be located a minimum of 10' from building entrance
Picnic Table	Landscape Forms*: Gretchen w/o umbrella hole; IPE wood with black powder coat surface mount support	To be located on concrete pad.
Removable Bollards	UNL standard removable bollard custom manufactured by Sourceone Machine Shop*, phone (402) 474-6603	
Emergency Phone		Concrete pad to be provided around emergency phone to allow ADA access.
Building Sign		Provided by UNL Landscape Services.
Parking Lot Sign		Provided by UNL Landscape Services.

5. RESPONSIBILITY FOR TOPSOIL PLACEMENT AND LAWN INSTALLATION:

- a. Project specifications shall require all topsoil within area affected by building construction to be stripped and stockpiled on the project site. The stockpiled topsoil shall be used as site fill, with any excess to be hauled away by the contractor.
- b. Where haul roads exist on construction sites, require that the road to be removed, the area excavated to a depth of 12" and ripped to achieve acceptable compaction similar to the remainder of the site. UNL Landscape Services shall approve the condition of the rough grade prior to placement of final fill.
- c. Project specifications shall assign responsibility for installing 6" layer of topsoil to UNL Landscape Services. Prior to installation of topsoil by UNL Landscape Services, the contractor is responsible for rough grading the site to 6" below the finish grade in areas designated for turf and 18" below finish grade in defined planting beds. Coordinate these locations with UNL Landscape Services. The condition of the rough grade shall be approved by UNL Landscape Services prior to the placement of topsoil.
- d. Project specifications shall require the contractor to be responsible for cleaning the construction site of all debris and trash prior to final grading.
- e. The installation of seed or sod for the lawn area will be completed by UNL Landscape Services.
- f. Costs associated with the topsoil placement and the lawn installation completed by UNL Landscape Services shall be reflected in the project budget.

6. SITE DRAINAGE:

- a. Site shall be designed for positive drainage away from the building with a minimum of 2% slope and a maximum slope of 8%. Storm water runoff and roof drains shall be collected on site by a site drainage system and carried to a storm sewer system. Storm water management shall conform to the City of Lincoln Drainage Criteria Manual (with current revision).
- b. Drain inlet grates shall be Neenah* or Deeter*. No beehive inlets shall be allowed. Inlets in concrete and turf areas shall be sized appropriately for storm water collection as well as for aesthetics. If drain inlets are in concrete areas where heavy pedestrian traffic will occur, inlet slots shall be no greater than 1/4" wide. Positive drainage to drain inlets shall be a minimum of 2% slope with a maximum slope of 8%.
- c. Where fire sprinkler test and drain outlet is exposed on building façade, a concrete splash guard shall be installed with a minimum width of 2' and extending through the planting bed to the nearest turf area. Coordinate the location and size of such splash guards with UNL Landscape Services.
- d. Stormwater and dewatering discharge from construction sites must comply with EPA and NDEQ regulations.

7. SITE RETAINING WALLS:

a. All site retaining walls shall be constructed of durable material such as cast-in-place concrete, masonry, or other approved material. No segmental retaining walls shall be used without approval of UNL Landscape Services. All retaining walls over 4' high shall meet Building Code requirements.

8. BRICK PAVERS:

a. Brick pavers shall only be utilized in seating areas or other areas with low volumes of pedestrian traffic. Paver color and manufacturer is to be approved by UNL Landscape Services. If pavers are desired in other locations, for example in vehicular applications, concrete pavers can be used instead of brick pavers. Pavers of any kind shall not be used in any area subject to vehicular traffic or fire department access, unless set upon a concrete sub-slab designed to carry projected loads. Color and manufacturer is to be approved by UNL Landscape Services.

9. PROJECT STAGING AREAS:

a. Materials used for temporary staging areas shall be based upon the length of the project and the time of the year. Projects with less than a 6 month construction time may utilize crushed rock staging areas, with a fabric mat beneath the rock. All rock and the mat shall be removed by the contractor. Projects with a construction time greater than 6 months must utilize an asphalt staging area. The asphalt and any subsurface gravel shall be removed by the contractor. If a short term project spans the winter months, an asphalt staging area shall be used to minimize damage to the site due to inclement weather. The size, type, and location of staging area(s) requiring surface treatment shall be established in conjunction with the UNL Project Manager and UNL Landscape Services and shall be defined in the contract documents.

b. When concrete mixers are used on site, all wash off shall occur into a leak proof container and removed from the site. No concrete materials shall be allowed to seep into the ground.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

ATTACHMENT "A"CHECKLIST OF OUTDOOR SITE AND LANDSCAPE RESOURCES
UNL CAMPUSES

1. BOTANICAL, LANDSCAPE AND SOIL RESOURCES

Arboreta	Shrubs
Botanical Collections	Subsoil
Botanical Displays	Topsoil
Botanical Garden	Trees (name, location, size & value)
Botanical Specimen	Turf
Ground Covers	

2. CAMPUS OUTDOOR SITE RESOURCES

Arbors	Hydrants
Athletic Space & Amenities	Wall
Benches	Irrigation Systems
Bicycle Racks	Lighting and Electrical Systems
Bridges	Malls
Footbridges	Parking Surfaces
Bus Shelters	Paths
Creeks	Plaza Areas
Culverts	Playground Space & Amenities
Curbs	Pools & Ponds
Docks	Quick Couplers
Drain Inlets	Recreation Spaces & Amenities
French Drains	Recycling Storage
Foundation Drainage	Retaining Walls
Storm Drain Lines & Manholes	Sculpture & Art
Drives	Shelters
Service Drives & Platforms	Signs
Dumpsters	Building
Surfacing & Storage Areas	Parking
Electrical Service (Outdoor)	Traffic
Fences & Railings	Stabilized Slopes
Flagpoles	Stairs & Ramps (Outdoor)
Fountains	Trails
Garden Furniture	Walks
Gates	Waste Storage
Guard Railings	Water Service
Handicapped	Waterways
Curb Cuts	
Ramps & Covers	

RIGID PAVING

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1. GENERAL
2. WALKS
3. EXTERIOR STAIRS AND RAMPS
4. STOOPS & LANDINGS
5. DRIVEWAYS & PARKING LOTS

1. GENERAL:

- a. Application: Exterior walks and paved areas constructed in conjunction with new building projects shall conform to the requirements of these guidelines.
- b. Snow Removal Considerations: The requirement for snow removal from all paved surfaces shall be recognized in the layout and construction of walks and paving. Areas which can only be cleaned by hand removal should be kept to an absolute minimum. Ramps should be provided between changes of level in paved areas to allow movement of tractor-mounted plows and/or blowers. Walks and steps with snow melt systems shall include provisions to intercept and remove melted water so that it will not refreeze on adjacent paved areas which do not have snow melt systems.

2. WALKS:

- a. Sidewalks shall be 7'-0" wide (narrower walks shall be approved by UNL Landscape Services), 5" thick, with 1/4" per foot transverse slope, be installed on a compacted 2" thick sand base cushion, and reinforced with 6/6 -10/10 welded wire mesh. Walks designated as fire lanes shall be 8" thick.
- b. The sidewalk shall extend above the adjacent finished grade 2".
- c. The concrete for the sidewalk shall be a sand and gravel aggregate mix producing a minimum compressive strength of 3,500 psi at the end of a 28-day curing period.
- d. The sidewalk subgrade shall be compacted and consolidated to 85% of maximum dry density.
- e. The welded wire fabric shall conform to ASTM A185.

- f. Sidewalk curves shall be formed true and smooth. Contractor shall secure UNL representative's approval of formwork prior to placing concrete for each pour.
- g. New sidewalks shall be doweled into existing sidewalks with smooth No. 4 x 12" long dowels, with one end greased and thimble, spaced at 12" o.c., with a 1/2" expansion joint.
- h. Doweled 1/2" expansion joints in the sidewalk shall be located at every 50 feet, between building and sidewalks, at stairs, ramps, structural stoops, where new concrete meets existing concrete (see DG 32 1300 – 2.g.) and between other fixed locations. Expansion joints shall be indicated on the drawings or in the specifications. The dowels shall be a smooth No. 4 x 12" long dowel, spaced at 12" o.c., with one end greased and thimble.
- i. Joint dowel bars for expansion joints shall be Grade 60 plain steel bars, as specified under ASTM A615. Cut bars true to length, with ends square and free of burrs.
- j. The expansion joints for the sidewalks shall be formed as follows:
- (1) The joint filler shall be polyethylene closed-cell Expansion Joint Filler by Sonneborn*, or an approved equal.
 - (2) Install joint filler material to a depth below the sidewalk surface as required for backer rod installation.
 - (3) The backer rod shall be polyethylene backer rod material, Closed-Cell Backer Rod by Sonneborn*, or equal, installed as recommended by the manufacturer over the joint filler material.
 - (4) Prior to applying joint sealant, clean the joint and prime joint with primer. Do not prime backer rod.
 - (5) Apply one-component polyurethane self-leveling sealant, conforming to ASTM C920, Type S, Grade P, Class 25, Use T or M, as recommended by manufacturer, over the backer rod material.
- k. Control (contraction) joints in the sidewalk shall be cut through 1/4 of the slab thickness and have both sides edged and tooled. The layout of the control joints shall have a maximum 1:1.5 proportion and shall be indicated in the drawings or described in the project specifications. The layout of the control joint pattern shall be approved by UNL Landscape Services during the design phase.
- l. All edges and joints shall be rounded to a minimum of 1/4" radius with an approved tool. Horizontal surface of edging tool shall not exceed 2" in width and shall not depress into sidewalk more than 1/16". Walk shall be broomed in such manner as not to remove this tool mark.
- m. All sidewalk surfaces shall have a textured, non-slip broom finish free from trowel marks, except for the edging tool. Specifications shall require the Contractor to secure approval of walk finish from UNL project representative at the completion of no more than the first 300 sq. ft. of walk construction.
- n. All sidewalks shall be cured with liquid-type membrane-forming curing compound complying with ASTM C309, Type I, Class A or B. Curing compound shall be applied in strict accordance with manufacturer's recommendations.

- o. Contractor shall be required to remove excess and waste material, trash, and debris and legally dispose of it off UNL property. Transit ready-mixed concrete trucks shall not be rinsed on UNL or adjacent property.
3. EXTERIOR STAIRS AND RAMPS:
- a. Protection: All stairs and ramps associated with a building shall be covered by the building roof or an overhead canopy.
- b. Stair Proportions: Exterior stairs, including those providing direct access to a building entrance, shall have a treadriser proportion of not more than 6:12.
- c. Exterior Ramps: Exterior ramps shall conform to ADA requirements. Curb cuts shall not be less than 84" wide to allow mechanical snow removal. Smaller curb cuts must be approved by UNL Landscape Services.
4. STOOPS AND LANDINGS:
- a. Provide structurally supported stoops where exit doors swing outward. Anchor stoops to structure in such a manner so as to prevent heaving from frost.
- b. Provide 1/8" to 1/4" per foot slope (1/4" preferred) on stoops and landings outside exit doors for drainage.
5. DRIVEWAYS AND PARKING LOTS:
- a. General:
- (1) Application: Parking lots and driveways connecting parking lots to public streets constructed in conjunction with new building projects or as independent projects shall conform to the requirements of these guidelines.
- (2) Snow Removal Considerations: The requirement for snow removal from all paved surfaces shall be recognized in the layout and construction of the parking lots and drives. Layouts shall be reviewed by UNL Landscape Services and UNL Parking and Transit Services for snow removal considerations.
- (3) Litter Containers: Parking lots shall be designed with space for placement of litter containers.
- (4) Landscaping: Parking lot layout shall allow appropriate landscape enhancement. Curb islands shall be a minimum of 10' with a minimum planting area of 100 sq. ft. The extent of the landscaping and landscape screening to be included within the scope of the project shall be established during the design process in conjunction with the UNL Project Representative and the UNL Landscape Services Department.
- (5) Manholes in Paved Areas: Manhole rims or covers projecting more than 1/4" above the surrounding paved surface create problems for snow plows and blowers. Project details and specifications shall require the correction of this defect when it occurs.

b. Drainage:

- (1) All parking lots shall be designed to develop proper site drainage, directed at the disposal of all storm water accumulated on the site.
- (2) Parking lots constructed on UNL campuses and other facility sites which contain an area of 2,500 square feet or more; and which are located within 150 feet of an existing storm sewer or other drainage way, including an open channel or creek, shall be designed to direct storm water runoff into such storm sewers or drainage ways. The parking lot shall be graded and surfaced such that storm water runoff from the site is collected on the site by a parking lot drainage system and carried to the storm sewer system, and not allowed to discharge through the driveway entrances and exits onto the public way. Proposed finished elevations of the parking lot must be indicated on appropriate plans. The calculations for storm runoff shall be designed in accordance with City of Lincoln Storm Sewer Design Criteria. All storm sewer construction procedures shall conform to the Construction and Material Specifications section of the Standard Specifications of the City of Lincoln, Nebraska.

c. Parking Barriers:

- (1) Approved parking barriers shall be provided around parking lots, to prevent the parking of vehicles overhanging the sidewalk space, public alley, or other public property, and adjacent residential property. Approved barriers are also required as necessary to protect any required landscaping or landscape screen planting and to prevent the parking of vehicles in a minimum front yard setback in which parking is prohibited.
- (2) Approved Barriers: Approved barriers include the following type barriers. Other barriers may be approved, subject to the approval of the UNL Project Representative.
 - (a) Poured concrete curb, nominal 6" x 6" exposed.
 - (b) Prefab barriers, firmly and permanently anchored. The use of prefabricated barriers must be approved by UNL Landscape Services and UNL Parking and Transit Services.
- (3) Location: Barriers shall be located to contain the parking with the approved parking lot. When a concrete curb is used as a barrier for perpendicular or angle parking, it shall be offset at least two (2) feet from the edge of the parking lot to allow for the front overhand of the vehicle. Other type barriers may be located at the edge of the parking lot.
- (4) Curb Islands: The ends of parking rows in lots which exceed 40,000 square feet in area, shall be delineated with minimum 6 inch high curb islands. These islands may serve as planting areas for parking lot trees trimmed to the trunk up to a height of 6.0' or shrubbery below 30 inches in height, measured from the top of the pavement.

d. Parking Layout and Markings:

- (1) Layout: The project design drawings shall include a detailed and accurately scaled parking lot layout clearly showing the location of parking spaces and aisles. The dimensions of the parking spaces, aisles and driveways shall conform to the layout design standards included in this guideline. Parking lot layouts shall be approved by UNL Landscape Services and UNL Parking and Transit Services.

(2) Marking: The construction documents shall require the parking spaces to be marked on the parking lot surface according to layout shown on the project design drawings, using yellow pavement striping paint.

e. Lighting:

(1) The purpose of parking lot lighting is to provide adequate visibility within parking lots and to deter crime. Lighting used to illuminate parking lots shall be arranged so not to cause visual interference on public thoroughfares or encroach on the visual privacy of adjacent building occupants.

(2) Lighting systems shall be designed to conform to the following criteria:

(a) Illumination Level: Not greater than 2.0 horizontal foot-candles, average initial nor less and 0.20 horizontal foot-candles, average maintained.

(b) Illumination Level Beyond Parking Lot Perimeter: Illumination attributable to a parking lot lighting system, beyond the perimeter of the parking lot, shall not exceed 0.50 horizontal foot-candles.

(c) Uniformity Ratio: The illumination uniformity ratio shall not exceed 4:1, average to minimum.

(d) Glare Control: Lighting adjacent to buildings and/or residential districts shall be so arranged so that the luminaires have a sharp cutoff at no greater than 78 degrees vertical angle above nadir, nor more than five (5) percent of the total lamp lumens shall project above 78 degrees vertical; or as an alternative, a luminaire shall emit no more than 500 foot lamberts per unit area above 78 degrees vertical angle from the luminous surface of the luminaire.

(e) Fuse Installation: All ungrounded conductors on area lights and parking lot lights shall have fuses installed. Conductors and fuses feeding the light fixtures shall be accessible through the hand hole opening on the side of the pole.

f. Accessible Parking:

(1) Accessible Parking Space Location: Accessible parking should be conveniently located near a main accessible building entrance, via the shortest accessible route. In buildings with multiple accessible entrances with adjacent parking, accessible parking spaces should be dispersed and located closest to the accessible entrances.

(2) Layout: Accessible parking spaces may be either the traditional accessible space which is 8' wide with a 5' access aisle or a Universal Parking Spaces, which is 11' wide with a 5' access aisle. If the traditional spaces are used, the first space and 1 in every 8 additional spaces shall be van accessible. Van accessible spaces require an 8' wide space with an 8' accessible aisle.

(3) Marking and Signage: Signs displaying the international access symbol shall be provided at each accessible parking space. The signs shall be displayed on fixed mountings in an area where they are not hidden from view. Pavement marking symbols are not necessary but may be used to supplement signs. Spaces intended for van parking shall be marked accordingly. Refer to the Americans with Disabilities Act Accessibility Guidelines (ADAAG) for detailed requirements for marking and signs.

(4) Number of Spaces: Accessible parking stalls shall be provided in each parking lot in accordance with the following table:

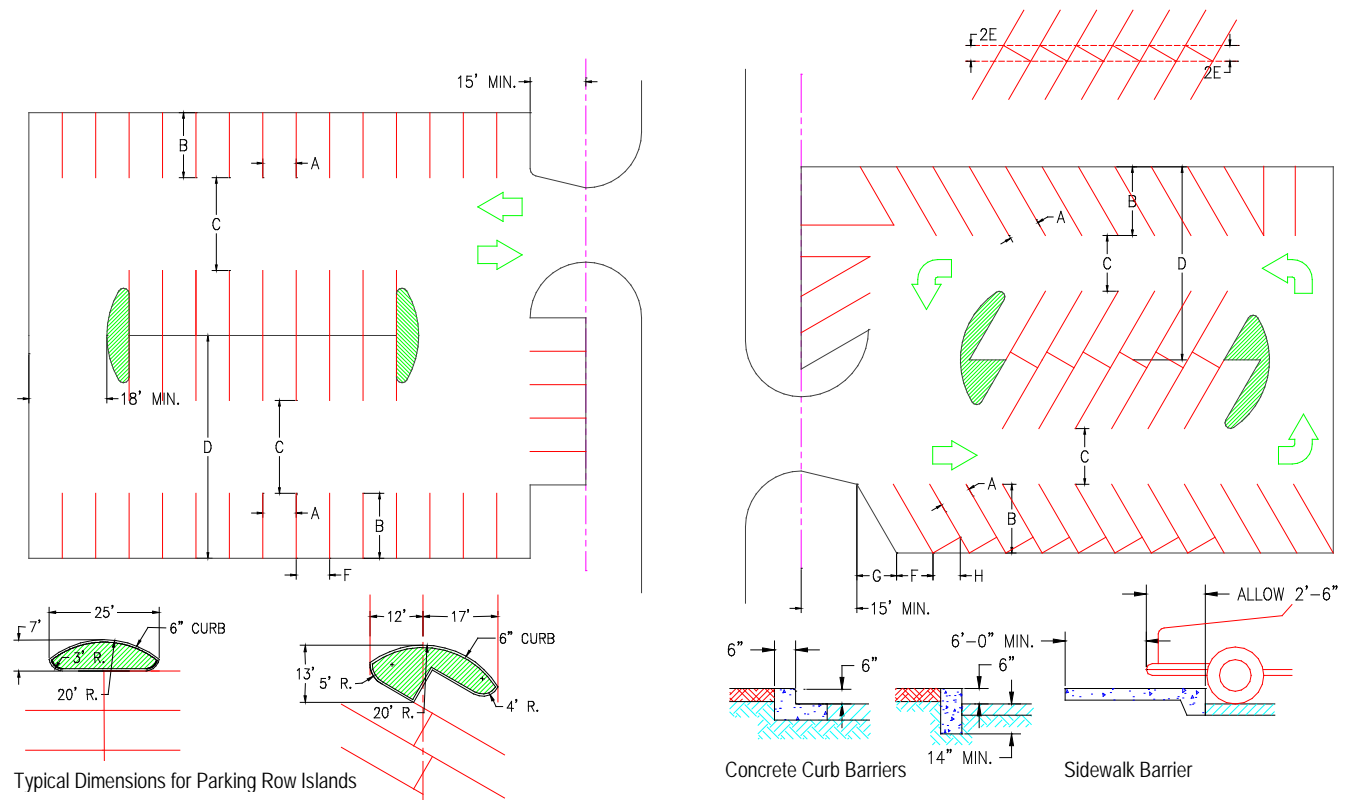
Total Parking In Lot	Number of Accessible Spaces	Required <u>Accessible Spaces</u>
1-25		1
26-50		2
51-75		3
76-100		4
101-150		5
151-200		6
201-300		7
301-400		8
401-500		9
501-1000		10

Parking lots with 1,001 or more spaces shall have 2% of total lot capacity (20), plus 1 for each additional 100 spaces over 1,000.

(5) Access Ramps: Ramps shall be provided at curbs or other raised barriers to provide access to the accessible routes leading from the parking lot.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.

Parking Lot Design Standards



Typical Dimensions for Parking Row Islands

Angle Θ	Stall Width A	Stall Depth B	Aisle Width C		Typical Module D		Interlock Reduction E	Curb Length F	Rear Extension G	Front Extension H
			Long Term	Short Term	Long Term	Short Term				
30°	8.3'	15.0'	11.0'	(1)	41.0'	(1)	2.9'	16.6'	15.2'	4.2'
	8.5'	15.0'	10.0'	11.0'	40.0'	41.0'	2.9'	17.0'	15.2'	4.3'
	9.0'	15.0'	10.0'	10.0'	40.0'	40.0'	2.9'	18.0'	15.2'	4.5'
45°	8.3'	17.0'	12.0'	(1)	46.0'	(1)	2.3'	11.7'	12.4'	5.9'
	8.5'	17.0'	11.0'	12.0'	45.0'	46.0'	2.3'	12.0'	12.4'	6.0'
	9.0'	17.0'	10.0'	11.0'	44.0'	45.0'	2.3'	12.7'	12.4'	6.4'
50°	8.3'	17.7'	13.0'	(1)	48.4'	(1)	2.1'	10.8'	11.3'	6.4'
	8.5'	17.7'	12.0'	13.0'	47.4'	48.4'	2.1'	11.1'	11.3'	6.5'
	9.0'	17.7'	11.0'	12.0'	46.4'	47.4'	2.1'	11.7'	11.3'	6.9'
60°	8.3'	18.5'	15.0'	(1)	52.0'	(1)	1.6'	9.6'	8.8'	7.2'
	8.5'	18.5'	14.0'	15.0'	51.0'	52.0'	1.6'	9.8'	8.8'	7.4'
	9.0'	18.5'	13.0'	14.0'	50.0'	51.0'	1.6'	10.4'	8.8'	7.8'
70°	8.3'	18.8'	20.0'	(1)	57.6'	(1)	1.1'	8.8'	6.0'	7.8'
	8.5'	18.8'	19.0'	20.0'	56.6'	57.6'	1.1'	9.1'	6.0'	8.0'
	9.0'	18.8'	18.0'	19.0'	55.6'	56.6'	1.1'	9.6'	6.0'	8.5'
90°	8.3'	17.5'	24.0'	(1)	59.0'	(1)	-	8.3'	0'	0'
	8.5'	17.5'	23.0'	24.0'	58.0'	59.0'	-	8.5'	0'	0'
	9.0'	17.5'	22.0'	23.0'	57.0'	58.0'	-	9.0'	0'	0'

- (1) The minimum stall width for all lots shall be 8.5'.
- (2) For perpendicular (90°) parking, stall adjacent to the closed end of the aisle shall be a minimum of 8.5' wide.

UNDERGROUND SPRINKLERS

1. GUIDELINES FOR UNDERGROUND SPRINKLERS:

- a. Existing irrigation systems which are to remain should remain fully functional and be protected from damage during construction. Any damage to such systems should be repaired immediately. All repairs shall be coordinated with UNL Landscape Services.
- b. Any irrigation system equipment which must be removed should be salvaged and delivered to the UNL Landscape Services Division.
- c. Contractor to provide PVB (pressure valve backflow) of size, number, and location as determined by UNL Landscape Services.
- d. 110 volt electrical service shall be provided at the exterior of the building to each PVB location.
- e. PVB shall have interior drain system.
- f. PVB shall be installed a minimum of 12" above the highest proposed site elevation.
- g. Irrigation sleeves under pavement should have a minimum depth of 14". Locations and sleeves will be provided by UNL Landscape Services.

UTILITIES

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1. GENERAL: Utility services to new facilities or to substantial additions to existing facilities should be provided as a part of the construction project and should be addressed in the initial programming and budgeting phase. Prior to starting the design of utility extensions, a conference should be held with the UNL Utilities Construction Coordinator to establish such matters as the connection point of each service extension, the routing of the service, the size and/or capacity of the service, the entrance points of the services into the new facility, depths and/or flow line elevations, and the type of service (i.e. tunnel, direct burial, buried conduit). UNL instructions regarding these items will be transmitted in the form of a Site Utilities Map.
2. DESIGN REQUIREMENTS GENERAL:
 - a. Location of the switches and valves, bypasses, and temporary services shall be a coordinated effort by UNL Facilities Planning and Construction, UNL Utilities, and the design engineer and design architect, who are responsible for the final description and documentation of the utility services for the contractor.
 - b. Chilled water and steam shutdowns shall be scheduled only during off-peak seasons.
 - c. Only UNL personnel will do switching of electrical circuits.
 - d. Water and steam valves will be operated only by UNL personnel or by approved contractors under the supervision of the UNL Utilities staff.
 - e. New lines, valves, and switches installed as part of the project are to be included on updates of the record drawings. The architect or engineer shall include these details on the as-built drawings delivered upon completion of the project.

f. Major building renovations should include replacement of building isolation valves on natural gas, chilled water, steam and steam condensate, domestic water and fire sprinkler service.

g. Major building renovations should include replacement or installation of building metering for natural gas, domestic water, chilled water, steam condensate, and electricity. The new metering should be sized according to the redesigned building loads.

3. DESIGN REQUIREMENTS STEAM:

a. Piping Expansion: In areas where loops are not practical or where expansion can be carefully controlled, slip-type expansion joints may be used. Mechanical expansion joints shall be Adisco* RJ slip type or approved equal.

b. Design Pressure: ANSI 150.

c. Design Temperature: 315° near the central utility plant, decreasing radially outward.

d. Steam Piping: Steam line shall be Schedule 40 carbon steel pipe. Piping that is to be direct buried shall be a factory pre-insulated system subject to the approval of UNL Utilities.

e. Insulation System: 3-1/2" high density fiberglass shall be used.

f. Condensate Piping: Condensate lines shall be Schedule 80 carbon steel pipe. Piping that is to be direct buried shall be a factory pre-insulated system subject to the approval of UNL utilities. The piping design should incorporate means to return all steam condensate to the central utility plant.

g. Vaults: Vaults shall be either cast-in-place or pre-cast concrete with minimum H-20 rating, minimum 6'-6" height, sump pit, and sump pump rated for 180° F. water. Hatch shall be Bilco* H-20 rated or approved equal.

4. DESIGN REQUIREMENTS CHILLED WATER:

a. Piping: Direct buried piping shall be cement-lined ductile iron piping that is encased in a polyethylene sleeve.

b. Equipment Drains: Do not pipe any equipment drains directly to the drain. Provide brass hose adaptor, cap, and chain on all vents and drains.

c. Major building renovations should include replacement of building isolation valves and metering.

5. DESIGN REQUIREMENTS ELECTRICAL:

See section DG 26 10 00

6. UTILITIES AVAILABLE ON CITY CAMPUS:

Steam	30 psia	315° F.
Chilled Water	45° F. supply 55° F. return 85 psi supply min. 15 psi differential available year around	
Electricity	4,160 v. or 12,470 v., 3-phase	
Domestic Water	Supplied by City of Lincoln 55 psi at the street Back-flow preventer decreases pressure by 14 psi	
Natural Gas	Supplied by Aquila, Inc.	
Storm Sewer	City of Lincoln system	
Sanitary Sewer	City of Lincoln system	

7. UTILITIES AVAILABLE ON EAST CAMPUS:

Steam	60 psig	310° F.
Chilled Water	45° F. supply 55° F. return 80 psi supply min. 15 psi differential available year around	
Electricity	4,160 v., 3-phase	
Domestic Water	Supplied by the City of Lincoln 40 psi at street Back-flow preventer decreases pressure by 14 psi	
Natural Gas	Supplied by Aquila, Inc.	
Storm Sewer	City of Lincoln system	
Sanitary Sewer	City of Lincoln system	

8. UTILITY TRENCH BACKFILL:

- a. **General:** Do not backfill until all required inspections are made and tests are performed for the specific utility. Backfill with the excavated materials specified for backfilling, consisting of earth, loam, sandy clay, sand and gravel or other materials, free from large clods or earth or stones. Broken concrete shall not be used as backfill material. No backfilling shall take place in freezing weather, and no backfill shall be made with frozen material. Adjust the moisture

content of the backfill material if required for proper compaction. Reopen any trenches improperly backfilled, or where settlement occurs, to the depth required for proper compaction, refill and compact to specified density. Compact all backfill for structures to the specified density.

b. Around Pipe: Deposit suitable backfill material under the haunches of the pipe in 6 inch layers and thoroughly compact. Backfill to at least 90 percent of maximum density at optimum moisture content determined by ASTM D698 until the pipe has a minimum cover of 2 feet. The moisture content of the soil at time of compaction shall be not more than 3 percent above or 3 percent below the optimum. Be careful not to disturb the pipe. Carry backfilling on simultaneously on both sides of the pipe to eliminate the possibility of lateral displacement.

c. Remainder of Trench: Deposit the remainder of the suitable backfill material in layers not exceeding 10 inches in loose depth and thoroughly compact them to at least 90 percent of maximum density at optimum moisture content determined by ASTM D698, except compact the top 12 inches of backfill below the paving base or subgrade in areas to be paved to at least 95 percent of maximum density at optimum moisture content determined by ASTM D698. The moisture content of the soil at the time of compaction shall be not more than 4 percent above or 4 percent below the optimum.

d. Bedding: Where selected bedding material is required by the drawings or by the Architect/Engineer during construction to replace unsuitable foundation material, crushed rock or gravel bedding shall be used. Depth of bedding shall be 4 inches or 1/8 of pipe outside diameter, whichever is greater.

e. Plastic Marking Tape: Warning tape shall be of the type specifically manufactured for marking and locating underground utilities. The tape shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown. The tape shall be acid- and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch and shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise with an elongation factor of 350 percent. Tape color shall be as specified in Table I and shall bear a continuous printed inscription describing the specific utility.

Table 1. Tape Color

Red:	Electric
Blue:	Water Systems
Green:	Sewer Systems

Tape for all non-metallic utility lines shall have integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion.

9. TEMPORARY UTILITIES:

a. Project specifications should require that Contractor(s) be responsible for all utility costs incurred during the construction of the project up to the date of substantial completion. Such costs would include any charges for chilled water, steam, electricity, water, natural gas, or sewer use supplied through the distribution system of the University of Nebraska-Lincoln, the City of Lincoln, Aquila, or any other entity providing utility service to the project site.

b. When utilities are provided by the University of Nebraska-Lincoln, metering devices will be provided by UNL. Specifications should require the appropriate Contractor to install the

meters under the direction of the UNL Utility Division and to remove the meters upon completion of the project.

c. Specifications should direct the Contractors to contact the UNL Facilities Planning & Construction business office for the latest utility rates for utility services provided by UNL.

10. METERING

a. **General Requirement:** Each utility, including electricity, steam, condensate, chilled water, heating water, natural gas and potable water, will be provided with a meter at each building or facility.

b. Meter Location, Number and Type

- (1) **Building with no Auxiliary Enterprise:** There should be a single meter at the service entrance of each utility serving the building. When electricity is provided to the building at several voltages, each voltage is considered a separate utility requiring its own meter.
- (2) **Buildings Housing Auxiliary Enterprises:** A separate meter should be installed for each utility serving each auxiliary enterprise, as well as meters for each utility serving any non-auxiliary enterprise portion of the building. When specifically permitted by the UNL Director of Utilities, the entire building may be metered by master meters for each utility, with individual meters for each auxiliary enterprise serving as deduct meters.
- (3) **Submeters:** The UNL Director of Utilities may direct the designer to submeter certain utilities that serve specific portions of a building or specific purposes within a building. Such direction will be provided at or before the schematic design stage.
- (4) **Accessibility:** Locate and orient each meter so that it can be read by a person standing on the floor. Make sure that all parts of the meter are accessible for connection, adjustment, calibration and repair.

c. **Meter Selection and Provision:** Each meter will be selected by the particular utility provider. When buildings are served directly from a municipal electric, water or natural gas provider, their design guidelines will prevail. In all other cases, UNL is the utility provider and these procedures will be used:

- (1) The designer will provide maximum design flow or demand for each utility to UNL BSM or Utility Services. This should be done no later than the design document stage. For condensate meters, the maximum flow is the total capacity of all condensate pumps that could be running at one time.
- (2) UNL will select the appropriate meter and notify the designer of each selection.
- (3) Designer will incorporate selected meters, along with appropriate piping and wiring, into the 95% review documents.
- (4) UNL will purchase the selected meters and provide them to the contractor for installation.

- (5) The cost of each meter will be assessed against the project.

d. Meter Outputs. Each meter should have a local display showing instantaneous and/or total values in digital or analog form. In addition, each meter will be connected to the UNL Building Automation System (BAS). Meter outputs may be transmitted to the BAS using low-voltage analog signals or switch closures, or digitally. In some cases, low-voltage power to the meter may also be transmitted in the same cables. Provide a continuous conduit path from each meter connection point to the BAS.

e. Electric Meters

- (1) Buildings Served by UNL: Install meter at main electrical distribution panel. Meter type will be Form 9S, 13-terminal, 4-wire Y, Class 20, socket mounted. The meter should have a solid state electronic register with displays of both KWH and instantaneous KW demand. Install appropriately-sized current transformers on conductors prior to terminations. Install appropriately-sized potential transformers when needed. The KYZ output must be scalable and programmable from the meter face.
- (2) Buildings Served by UNL, Meter at Transformer: When the UNL Director of Utilities determines that metering could be best accomplished at the transformer rather than main distribution panel, the socket and meter should be installed on or near the transformer pad. In that case, a continuous conduit path should be provided from the meter to a connection point inside the building.
- (3) Buildings Served by Municipal Electric Utility Provider: UNL will obtain an output signal from the municipal meter. Install a 12"x12" lockable, weatherproof box within 12" of the municipal meter socket panel, and provide a 1" diameter nipple to the municipal meter panel.

f. Natural Gas Meters:

- (1) Buildings Served by UNL: Meter requirements will be based on the meter selected by UNL. Install a 4"x4" electrical box (weatherproof if outside) within 36" of meter.
- (2) Building Served by Municipal Natural Gas Utility Provider: UNL will obtain an output signal from the municipal meter. Install a 4"x4" weatherproof box within 36" of the municipal meter location. A reliable switch closure signal, scaled to a specific gas volume, is required. Generally, this requires a rotary rather than diaphragm-type meter.

g. Thermal (BTU) Meters – Chilled and Heating Water

- (1) Flow Meter: Design for installation in the supply pipe, as near the building service entrance as possible and ahead of any branches. Design for a fluid velocity between 15 and 25 ft/sec at the metering point under full flow conditions.
- (2) Straight Pipe and Bypass Requirement: The meter should be installed in straight pipe of the same diameter as the meter. The straight pipe should extend at least 15 pipe diameters upstream and 5 pipe diameters downstream of the meter, with no valves, elbows, tees, or other devices which could disrupt uniform fluid flow. A bypass should

be provided with manual valves on either end of the straight pipe and in the bypass, so that fluid may be directed either through or around the meter.

- (3) Straight Pipe, Exception: When the required straight pipe would result in an unacceptable loss of pressure, straight pipe larger than the meter diameter may be used, with long-radius concentric reducers installed on both sides of the meter. If this exception is used, the length of straight pipe required will be based on the diameter of the larger pipe rather than the meter diameter.
- (4) Temperature Sensors: Install RTD wells (provided by UNL) for temperature measurement in both the supply and return pipe. The wells should be located as near the building service entrance and exit as possible. A second well should be installed next to each primary well for calibration purposes (total of 4 wells: 2 in supply and 2 in return). RTD wells are 4" long and installed in 3/4" thread-o-lets or tees.
- (5) Pressure Sensors: Install valved taps or tees, located as near the building service entrance and exit as possible, for installation of pressure sensors.
- (6) The conduit path to the BAS must be sized large enough to carry low-voltage output signals from the flow meter, three temperature sensors, pressure sensors, and low-voltage power supply to the flow meter.
- (7) See figure ___ for a schematic diagram of the required components.

h. Steam and Condensate Meters:

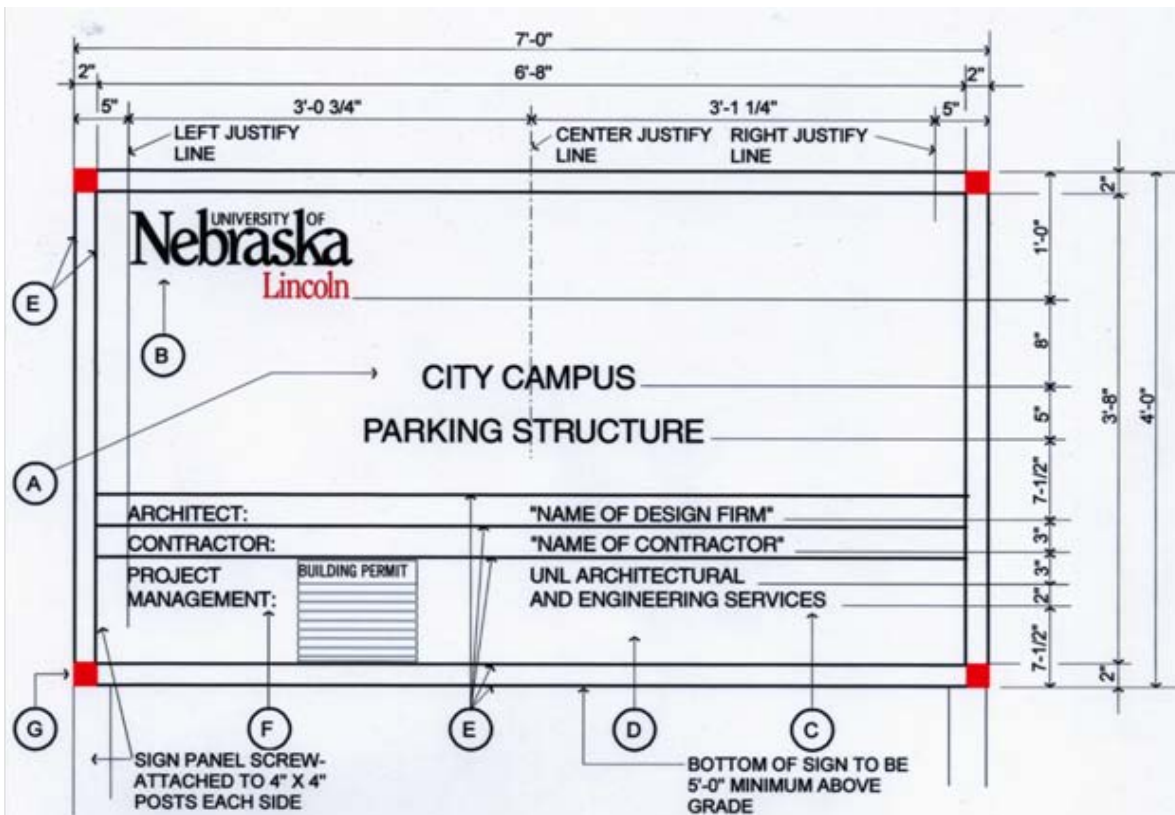
- (1) Steam Meter: Metering of live steam is usually not required except when processes within the building will utilize steam without returning it as condensate. The UNL Director of Utilities will determine, no later than design document stage, if steam metering is required.
- (2) Condensate Meter: Design for installation downstream of all condensate receivers/pumps, and as near the building service exit as possible, after all branches have joined together. Design for the minimum meter size that exceeds the capacity of the condensate pumps. Provide the same straight pipe and bypass requirements as in section g(2), above. In addition, piping must be designed so the meter is always completely flooded. An extra check valve should be provided at the beginning of the straight pipe to prevent backflow. Tees with full-port ball valves (capped) should be provided at both ends of the straight pipe for calibration purposes.
- (3) See figure ___ for a schematic diagram of the required components.

i. Potable Water Meters: Regardless of whether potable water is provided by UNL or by the Municipal Water Provider, a separate water meter shall be installed for connection to the UNL BAS.

- (1) Meter should be installed as near as possible to the building service entrance, and isolation valves should be provided both upstream and downstream.
- (2) Provide straight pipe of the same diameter as the meter, extending at least 5 pipe diameters upstream and 3 pipe diameters downstream of the meter, with no valves, elbows, tees, or other devices which could disrupt uniform fluid flow.

- (3) When there are significant water uses which do not return water to the sanitary sewer system (such as irrigation or process use), additional deduct meters shall be required at the point of service. The UNL Director of Utilities shall determine whether these additional water meters are required no later than design document stage.
- (4) Fire Service: A separate meter is not required.

* Where only one manufacturer is listed, the words "or approved equal prior to the receipt of bids" shall apply.



PROJECT CONSTRUCTION SIGN ELEVATION

NOT TO SCALE



DETAIL OF LOGO

NOTES:

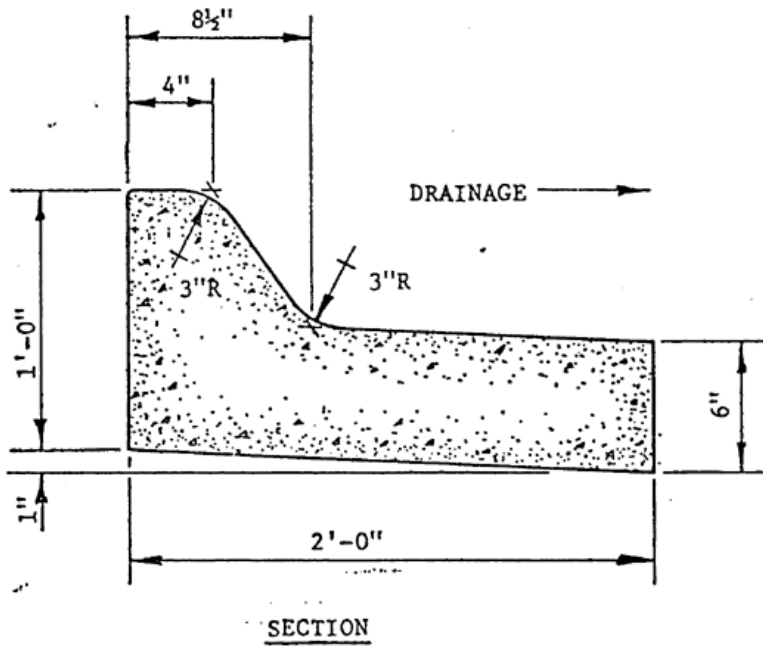
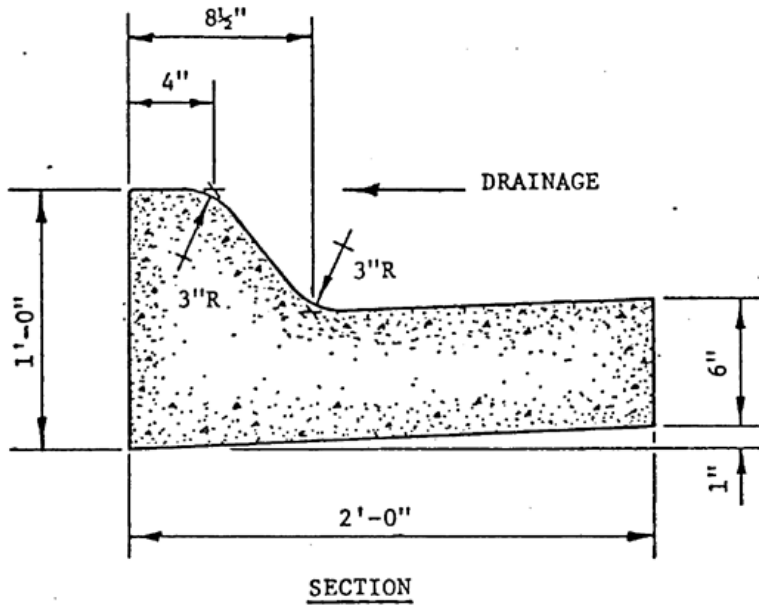
1. Contractor Note: Sign vendor must have copy of this specification in hand prior to starting work. University logo must be accurate.
2. Logo design is available on the web at: <http://www.unl.edu/ucomm/ucomm/toolbox.shtml>

PAINTING & LETTERING SCHEDULE				
MARK	LETTERING STYLE	SIZE	PAINT COLOR	REMARKS
A	HELVETICA MEDIUM	3"	BLACK	AS SHOWN
B	LOGO	-	BLACK & RED	AS SHOWN
C	HELVETICA REGULAR	1-1/2"	BLACK	FIRM NAMES
D	(BACKGROUND)	-	POLAR WHITE	
E	(DIVISION LINES)	1/4"	BLACK	
F	HELVETICA MEDIUM	1-1/2"	BLACK	FIRM ID
G	(BORDER CORNER)	-	BRIGHT RED	

DWG TITLE: PROJECT CONSTRUCTION SIGN
(REFER TO DG010000.18 FOR ADDITIONAL REQUIREMENTS.)

**STANDARD
DETAIL**

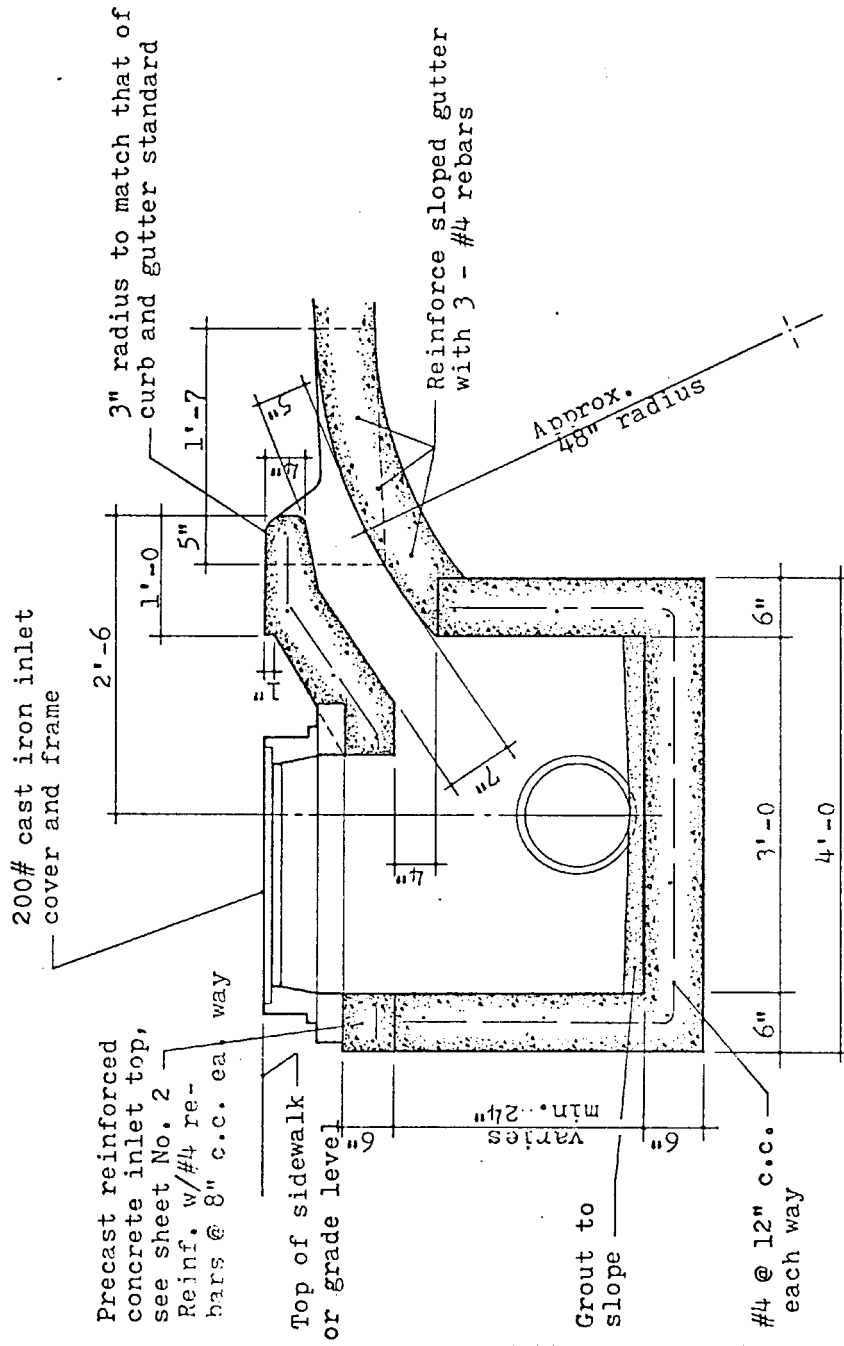
SD1-01



DWG TITLE: INTEGRAL CONCRETE CURB & GUTTER

STANDARD
DETAIL

SD2-01



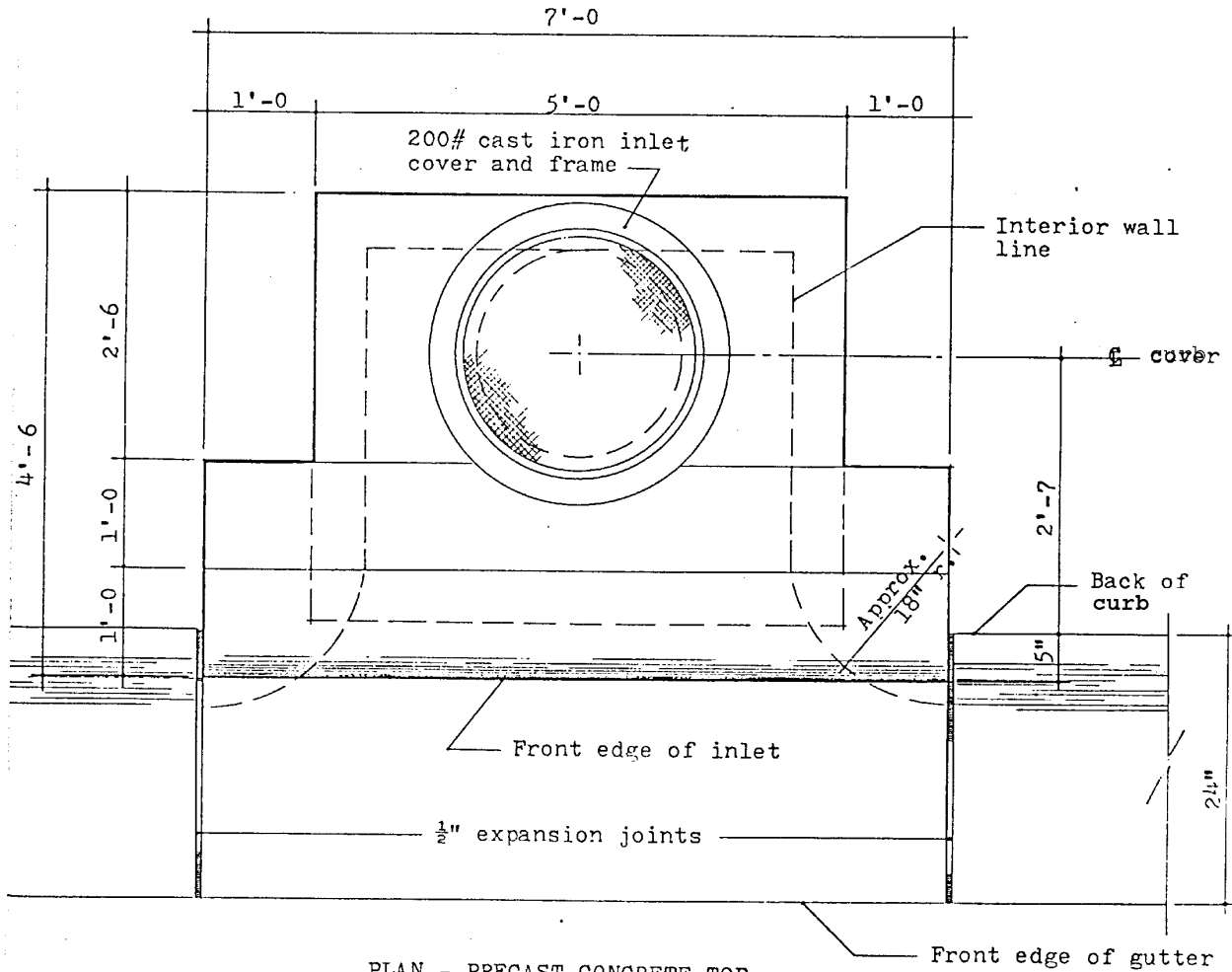
SECTION
Scale: 3/4" = 1'-0"

DWG TITLE: STORM SEWER INLET - SECTION

STANDARD
DETAIL

SD2-02a

) "University of Nebraska"
and name of utility cast
into cover.



PLAN - PRECAST CONCRETE TOP
Scale: 3/4" = 1'-0

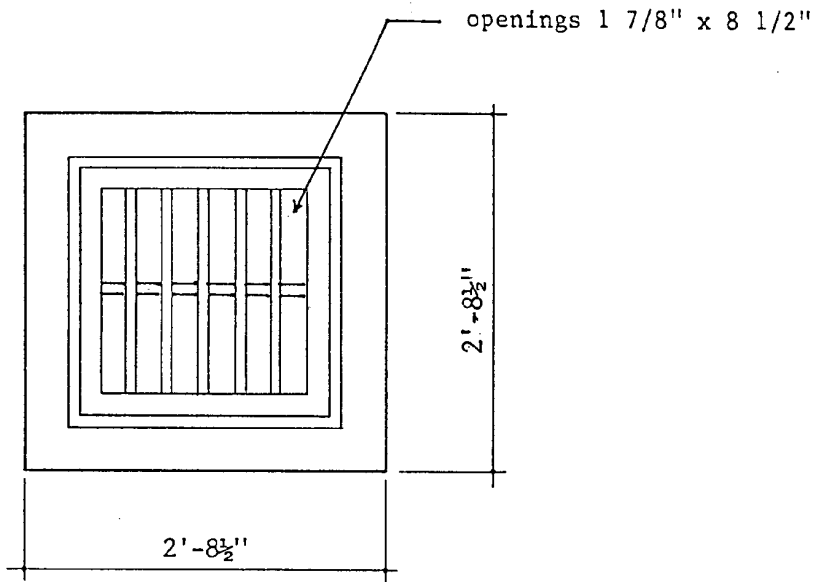
DWG TITLE: STORM SEWER INLET - PRECAST CONCRETE TOP

STANDARD
DETAIL

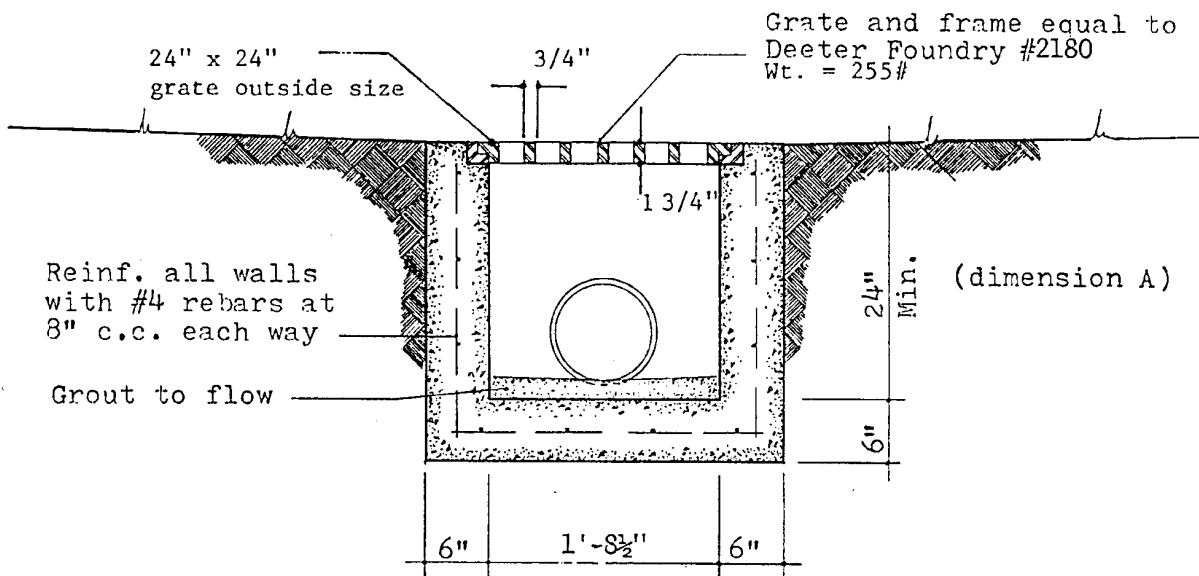
SD2-02b

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JANUARY 2011

UNIVERSITY OF NEBRASKA - LINCOLN



PLAN



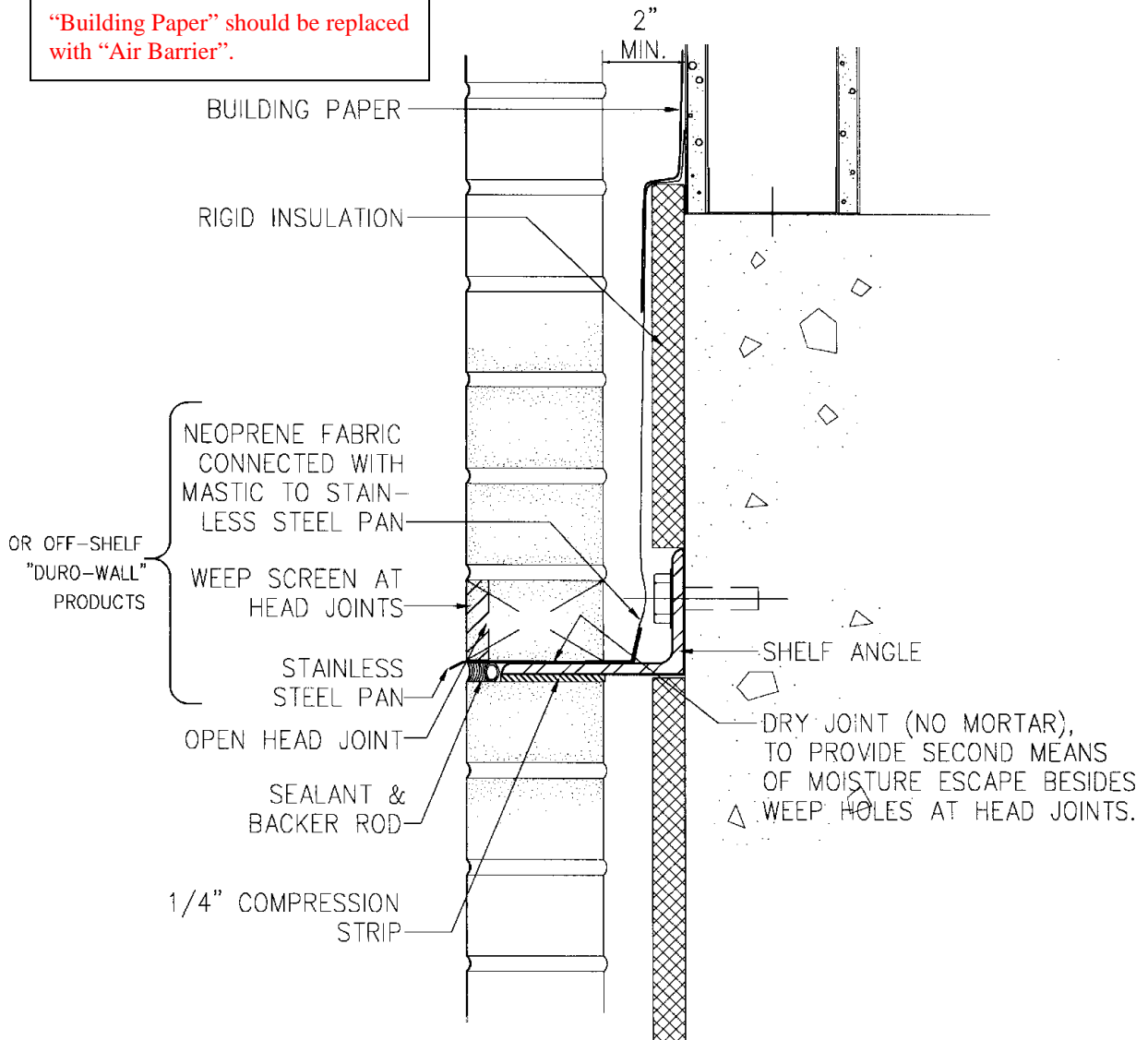
SECTION
Scale: 3/4" = 1'-0

DWG TITLE: CATCH BASIN

STANDARD
DETAIL

SD2-03

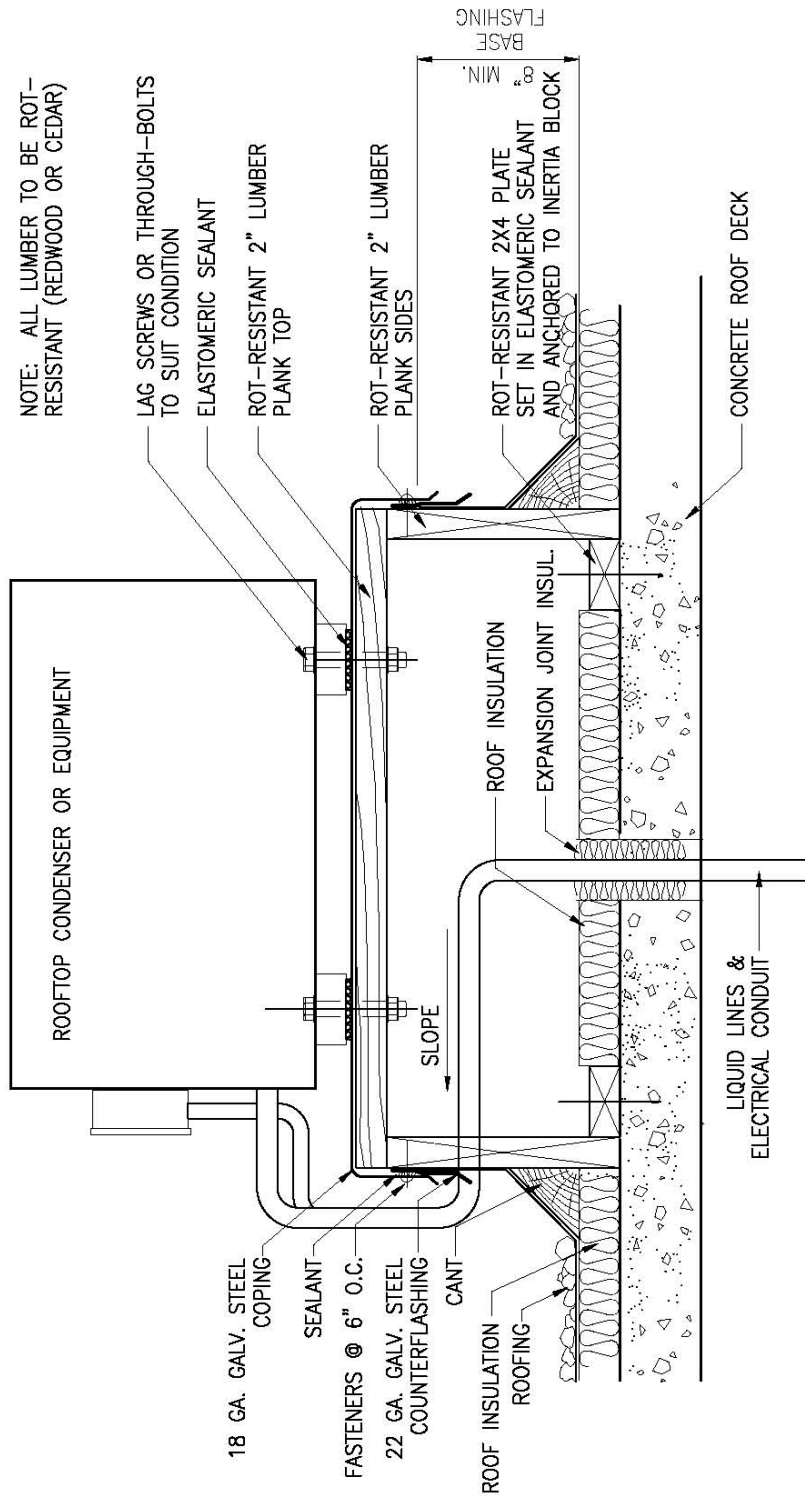
“Building Paper” should be replaced with “Air Barrier”.



DWG TITLE: BRICK VENEER/SHELF ANGLE DETAIL

**STANDARD
DETAIL**

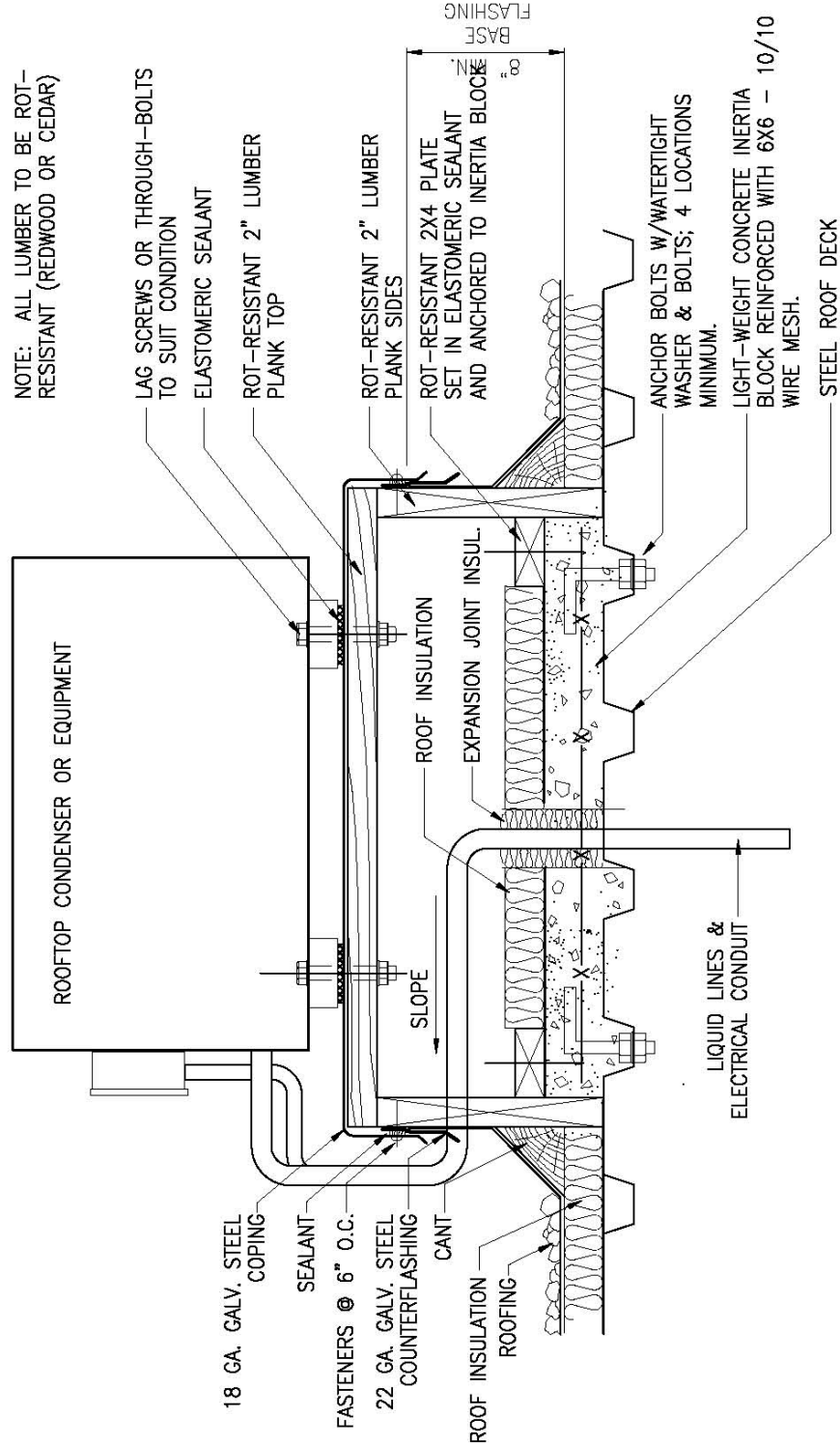
SD4-01



DWG TITLE: EQUIPMENT CURB & FLASHING
(Concrete Roof Deck)

**STANDARD
DETAIL**

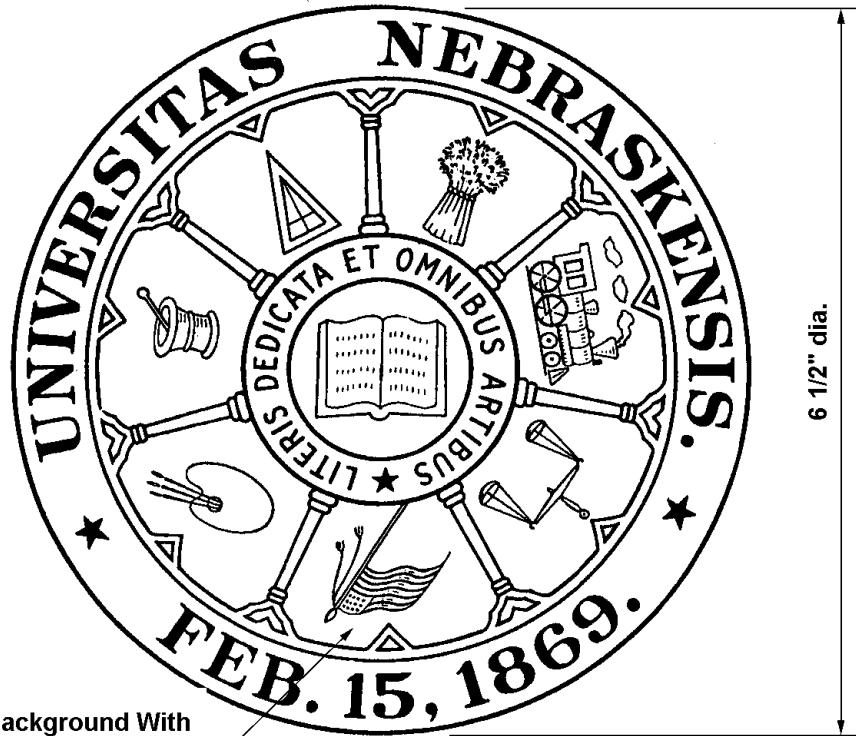
SD7-01



DWG TITLE: EQUIPMENT CURB & FLASHING
(Metal Roof Deck)

**STANDARD
DETAIL**

SD7-02



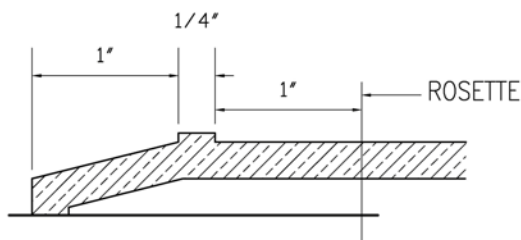
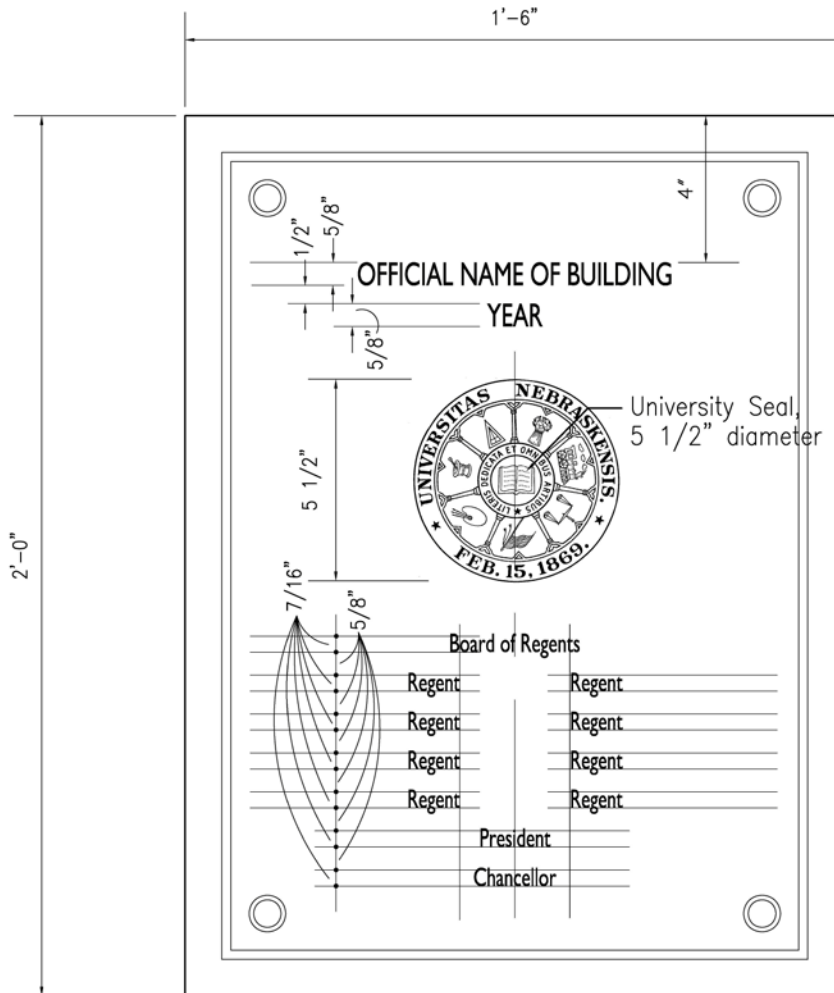
Scarlet Background With
Cream Object Lines and
Lettering

UNIVERSITY OF Nebraska Lincoln

DWG TITLE: SIGN GRAPHICS

STANDARD
DETAIL

SD10-01



EDGE DETAIL

NOTES:

1. LETTERING TO BE RAISED
2. LIST BOARD OF REGENTS MEMBERS ALPHABETICALLY.

DWG TITLE: BUILDING PLAQUE DETAIL

**STANDARD
DETAIL**

SD10-02a

TEXT STYLE FOR UNL SIGNS AND PLAQUES

A B C D E F G H I
J K L M N O P Q R
S T U V W X Y Z 1
2 3 4 5 6 7 8 9 0

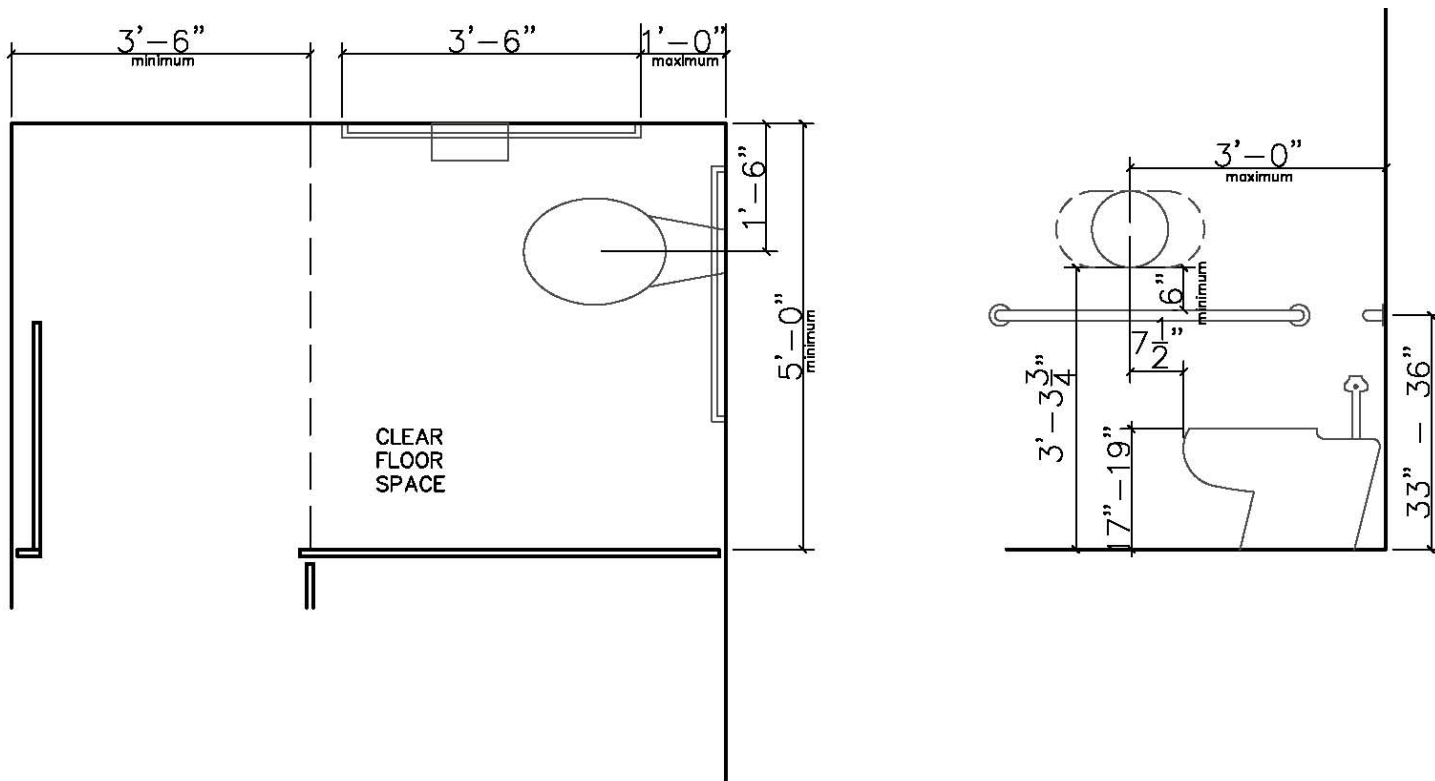
a b c d e f g h i
j k l m n o p q r
s t u v w x w z

HELVETICA MEDIUM

DWG TITLE: BUILDING PLAQUE LETTERING STYLE

**STANDARD
DETAIL**

SD10-02b



56" min	w. wall mounted w.c.
59" min	w. floor mounted w.c.

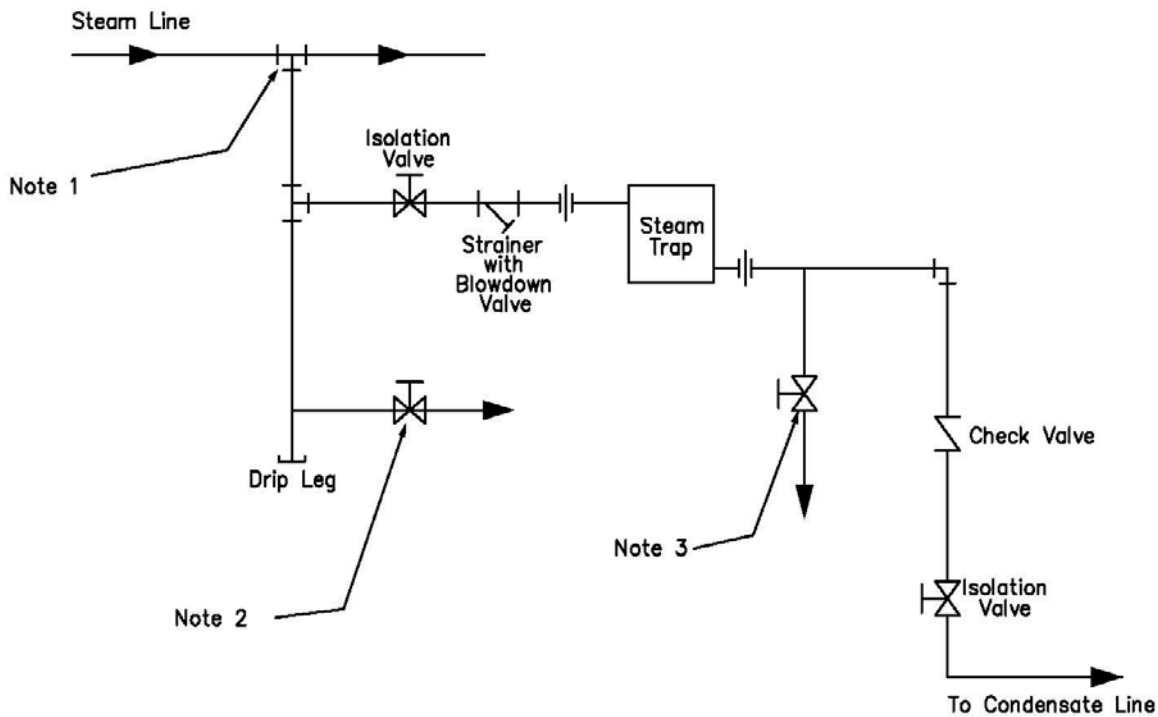
NOTE:

FOR ADA APPLICATIONS, USE A SINGLE ROLL TOILET TISSUE DISPENSER.
 FOR NON ADA APPLICATIONS, USE A DOUBLE ROLL TOILET TISSUE
 DISPENSER (SHOWN BY DASHED LINES) MOUNTED AT SAME LOCATION.

DWG TITLE: ADA ACCESSIBLE RESTROOM
 N.T.S.

**STANDARD
 DETAIL**

SD10-03



STEAM TRAP DETAIL

Notes:

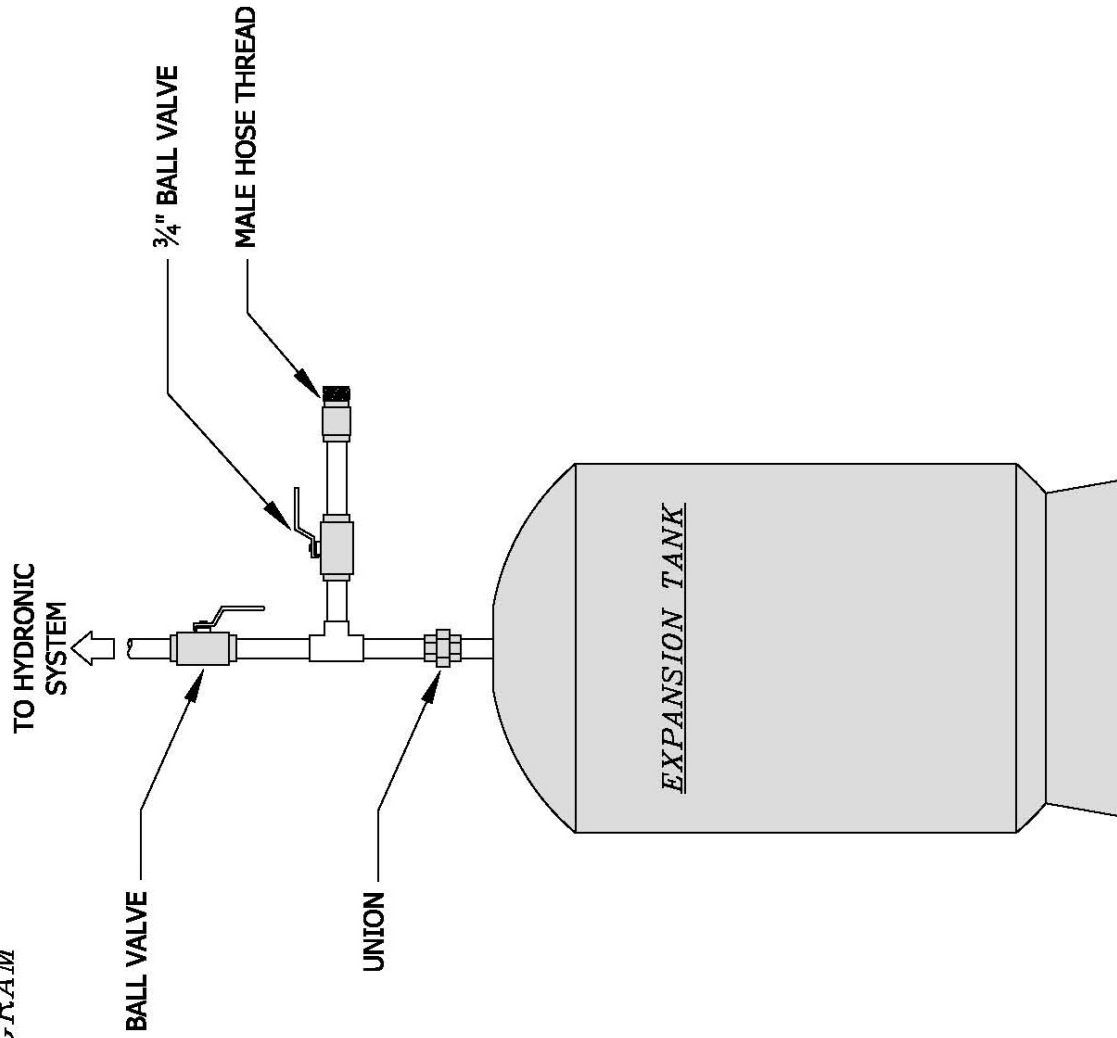
1. TEE SHALL BE FULL SIZE FOR 4" AND SMALLER MAINS, 4" FOR 5" AND 6" MAINS AND 1/2 OF MAIN DIAMETER FOR LARGER MAINS.
2. INSTALL 1" BLOW DOWN VALVE ON DRIP LEG
3. INSTALL A 1/2" BLACK PIPE AND GATE VALVE ON THE CONDENSATE LINE OF ALL TYPICAL STEAM TRAP INSTALLATIONS FOR THE PURPOSE OF CHECKING TO SEE IF THE TRAP IS FUNCTIONING PROPERLY. (MAY SUBSTITUTE BALL VALVE WITH PROPER APPROVAL)
4. DRIP AND DIRT LEGS SHALL BE AT LEAST TWICE THE DIAMETER OF THE TRAP INLET.
5. INSTALL LEGS OF STRAINERS IN HORIZONTAL POSITION TO MINIMIZE CONDENSATE HOLDING.
6. LOCATE DRIP TRAPS AT 300 FOOT MAXIMUM INTERVALS AND UPSTREAM OF ALL EXPANSION JOINTS, BRANCH CONNECTIONS, ELEVATION CHANGES OR CONTROL VALVES.

DWG TITLE: GATE VALVE INSTALLATION ON CONDENSATE LINE FOR CHECKING STEAM TRAPS

**STANDARD
DETAIL**

SD23-01

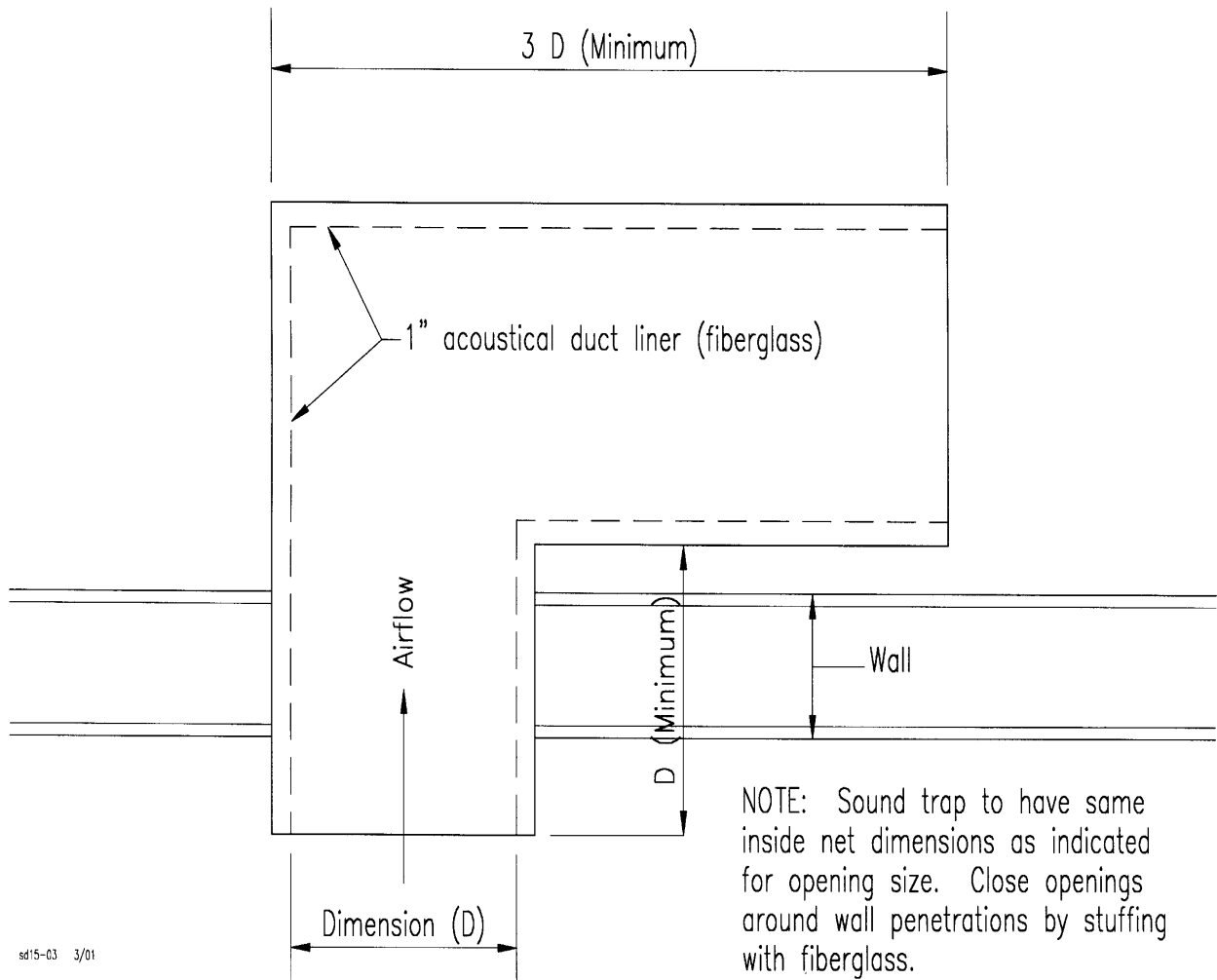
EXPANSION TANK
PIPING CONNECTIONS DIAGRAM



DWG TITLE: EXPANSION TANK PIPING CONNECTIONS DETAIL

STANDARD
DETAIL

SD23-02

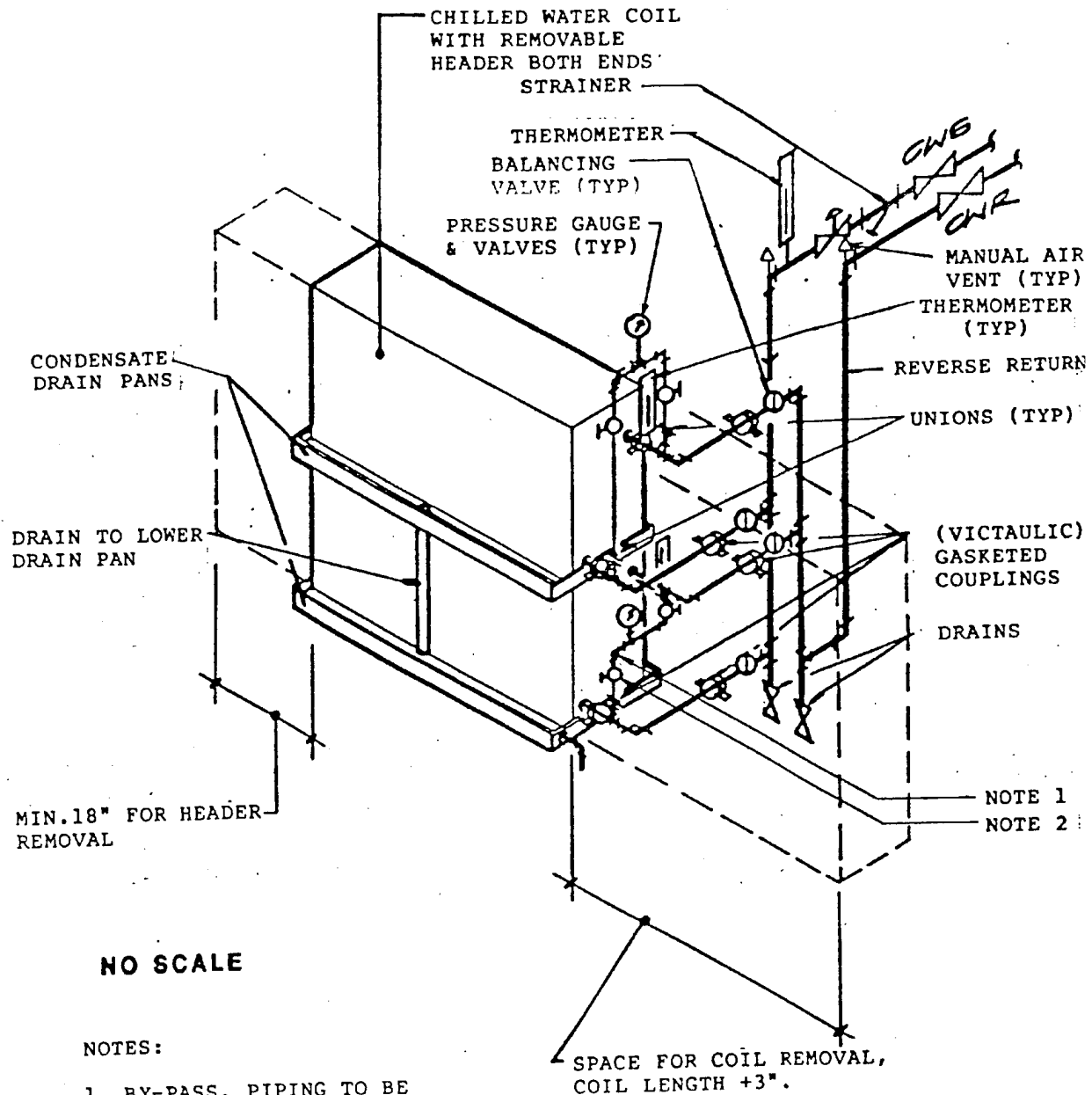


sd15-03 3/01

DWG TITLE: DUCTWORK – SOUND TRAP

**STANDARD
DETAIL**

SD23-03



NO SCALE

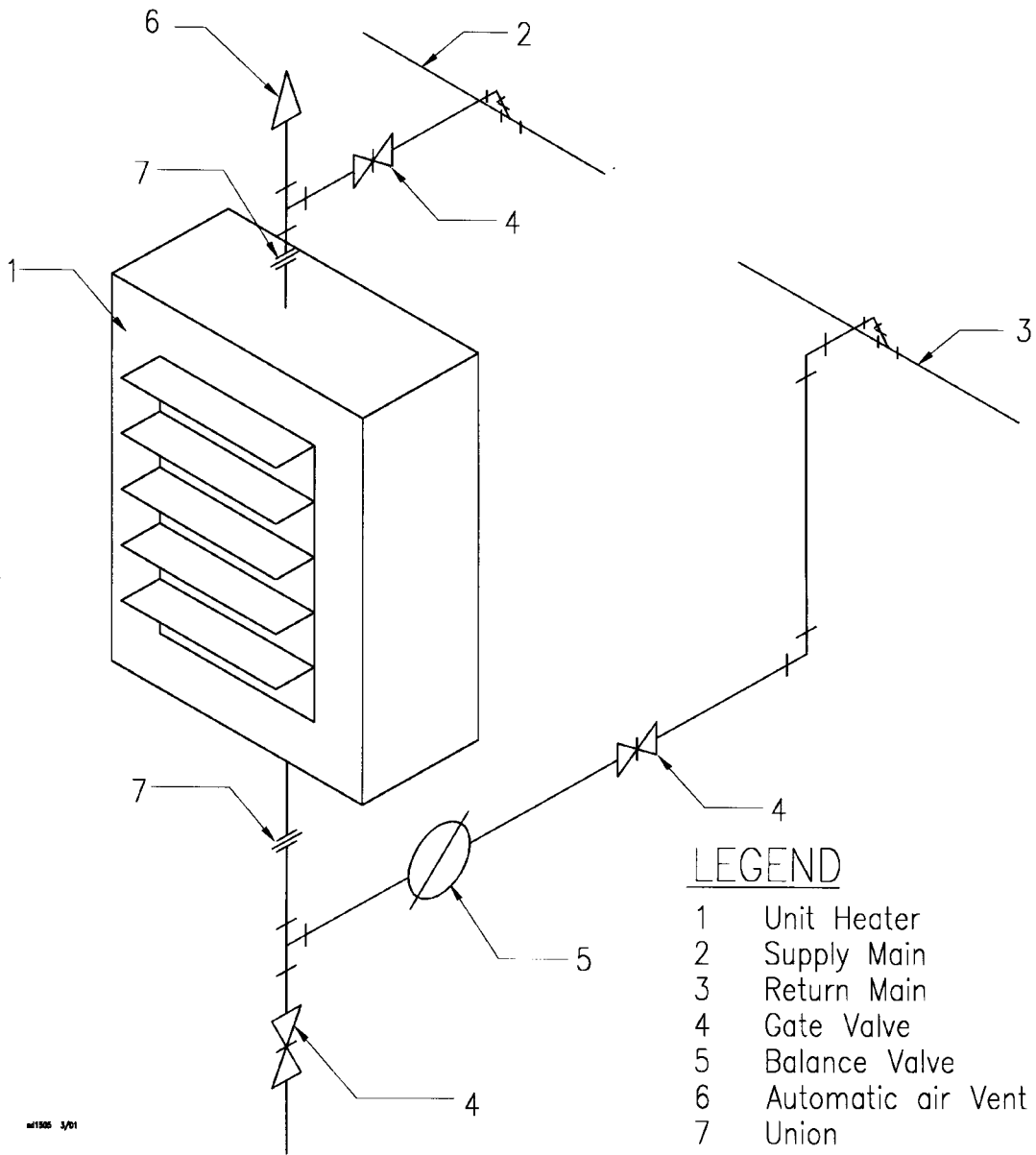
NOTES:

1. BY-PASS. PIPING TO BE 1/4" BLK. SCHED. 40.
2. POWELL 680 1/4" NEEDLE VALVE. (TYPICAL)

DWG TITLE: CHILLED WATER COIL PIPING

**STANDARD
DETAIL**

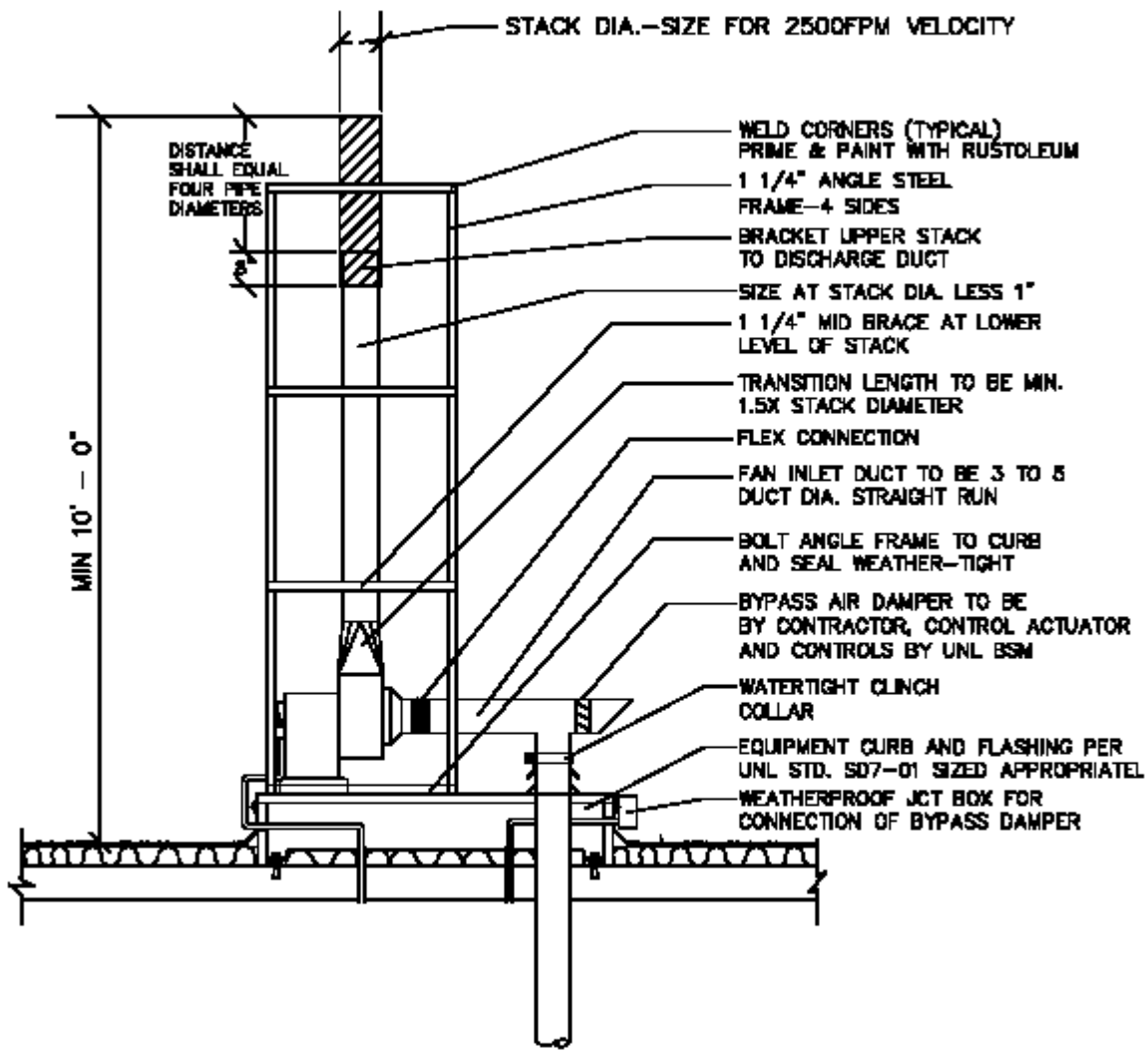
SD23-04



DWG TITLE: TYPICAL CONNECTIONS TO HORIZONTAL
HOT WATER UNIT HEATER

**STANDARD
DETAIL**

SD23-05



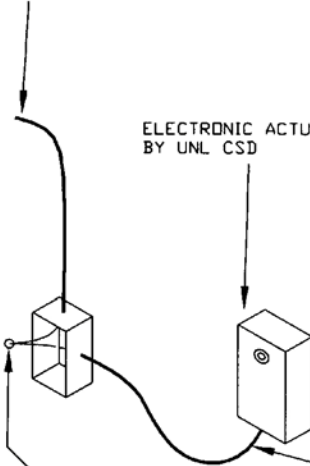
DWG TITLE: CURB AND EXHAUST FAN INSTALLATION FOR
GENERAL PURPOSE FUME HOOD

**STANDARD
DETAIL**

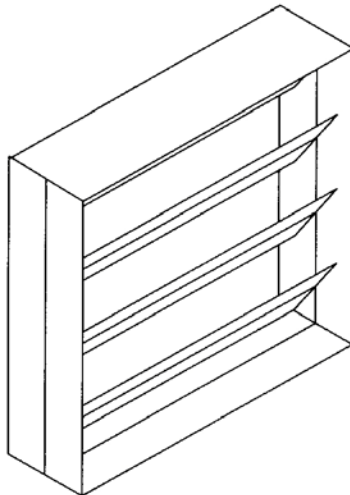
SD23-06

CABLES TO BE RUN BACK TO
PMC PANEL GUTTER IN EMT.
CABLE TO BE BELDEN #8445.
SEPARATE CABLE TO BE RUN BACK
TO PANEL GUTTER FOR EACH ACTUATOR.

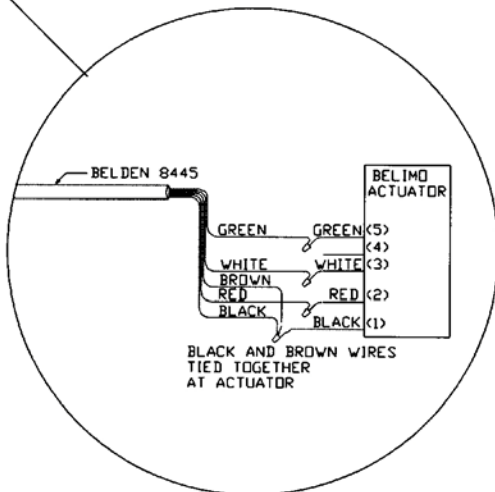
ELECTRONIC ACTUATOR
BY UNL CSD



ACTUATOR CABLE TO BE RUN IN FLEX CONDUIT
TO JUNCTION BOX. MAXIMUM 24' LENGTH.



DAMPER SECTIONS TO BE MOUNTED SO
AS TO PROVIDE ACCESS TO PLACE
ACTUATOR ON DRIVE BLADE END
SHAFT. ALLOW 12" BETWEEN
SECTIONS. DAMPER SECTIONS MAY NOT
BE INTERCONNECTED.



NOTE: SEE CONTROL SCHEMATICS FOR EXACT QUANTITIES

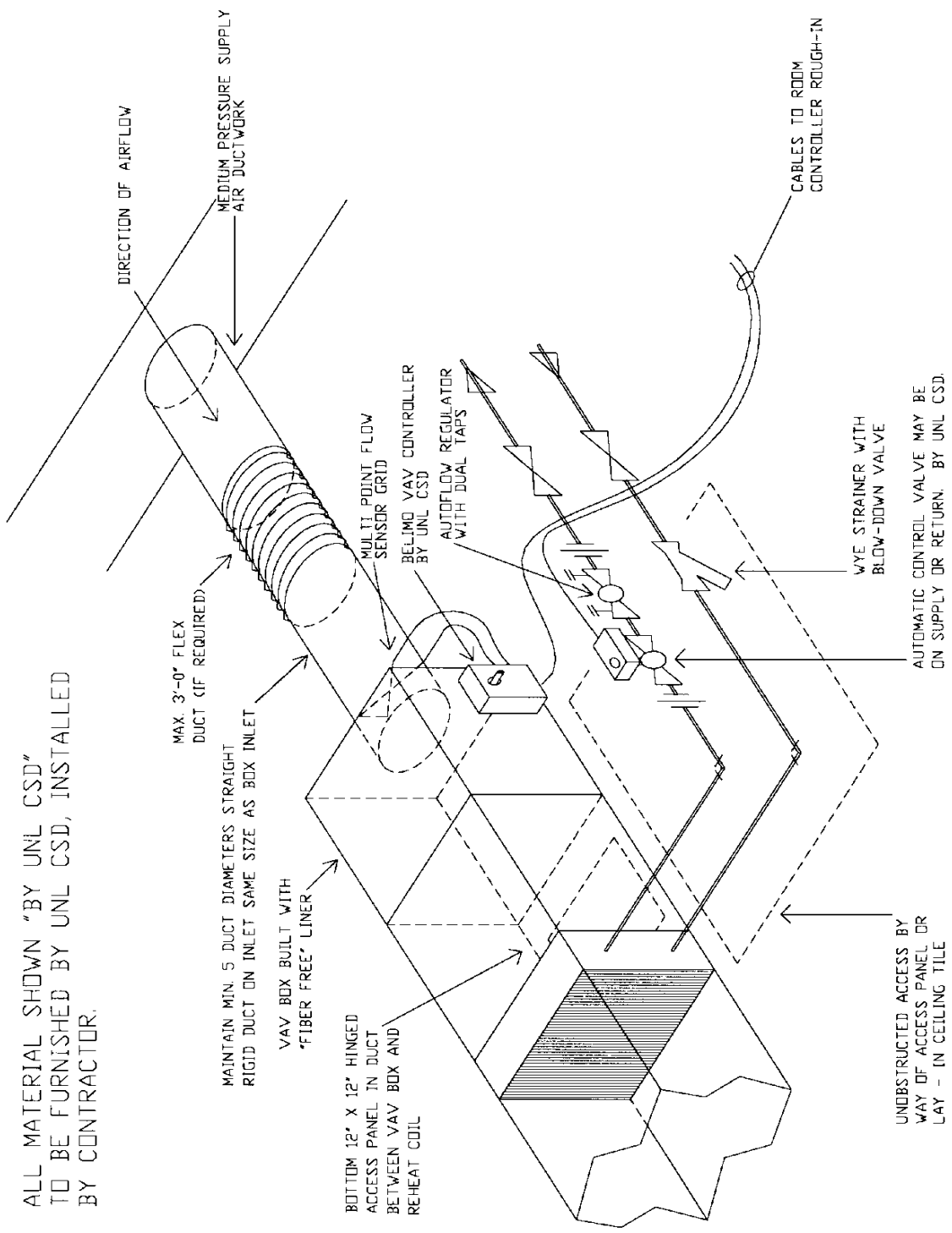
NOTES:

SINGLE SECTION DAMPER TO HAVE ACTUATOR
BROUGHT THRU ACCESSIBLE SIDE OF DUCT. DAMPER
FRAME TO BE MINIMUM 16 GA. WELDED SEAMS OR
FITTED EXTRUDED ALUMINUM TO PREVENT RACKING.
DAMPER TO BE OF LOW LEAKAGE DESIGN AND
PARALLEL TYPE BLADE DESIGN WITH SILICONE
BLADE END SEALS AND SILICONE BLADE EDGE
SEALS. DAMPER BLADE ORIENTATION TO BE
HORIZONTAL UNLESS SPECIFIC CONDITIONS
REQUIRE OTHERWISE. IF VERTICAL BLADE DAMPER
IS USED, IT MUST BE FACTORY FITTED FOR THAT
SERVICE. MAXIMUM DAMPER SECTION TO BE
DETERMINED BY UNL CSD, DAMPER BLADES TO BE
EXTRUDED AIRFOIL ALUMINUM CONSTRUCTION.
DAMPER SHAFTS TO BE WELDED OR KEYS TO
DAMPER BLADE. DAMPER SHAFT BEARINGS TO BE
OILITE BRONZE TYPE OR APPROVED EQUAL.
DAMPER BLADES TO BE DRIVEN BY SHAFT GEARING
OR INTERNAL LINKAGE CONCEALED WITHIN THE
DAMPER FRAME. DAMPER BLADES MUST NOT HAVE
EXTENSIONS ATTACHED TO ACHIEVE ODD SIZE
SECTIONS.

DWG TITLE: MOTORIZED DAMPER CONTROL DETAILS

STANDARD
DETAIL

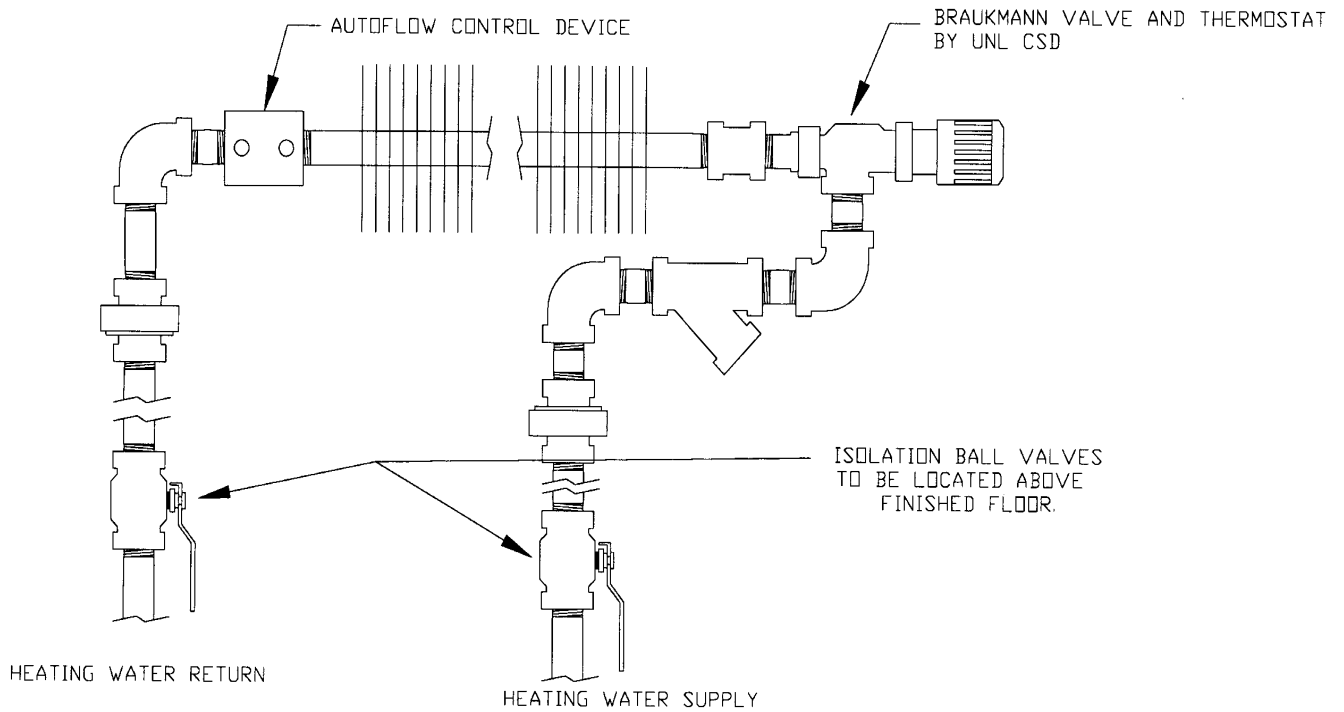
SD23-07



ALL MATERIAL SHOWN "BY UNL CSD" TO BE FURNISHED BY UNL CSD, INSTALLED BY CONTRACTOR.

DWG TITLE: VAV BOX INSTALLATION DETAIL

STANDARD
DETAIL
SD23-08



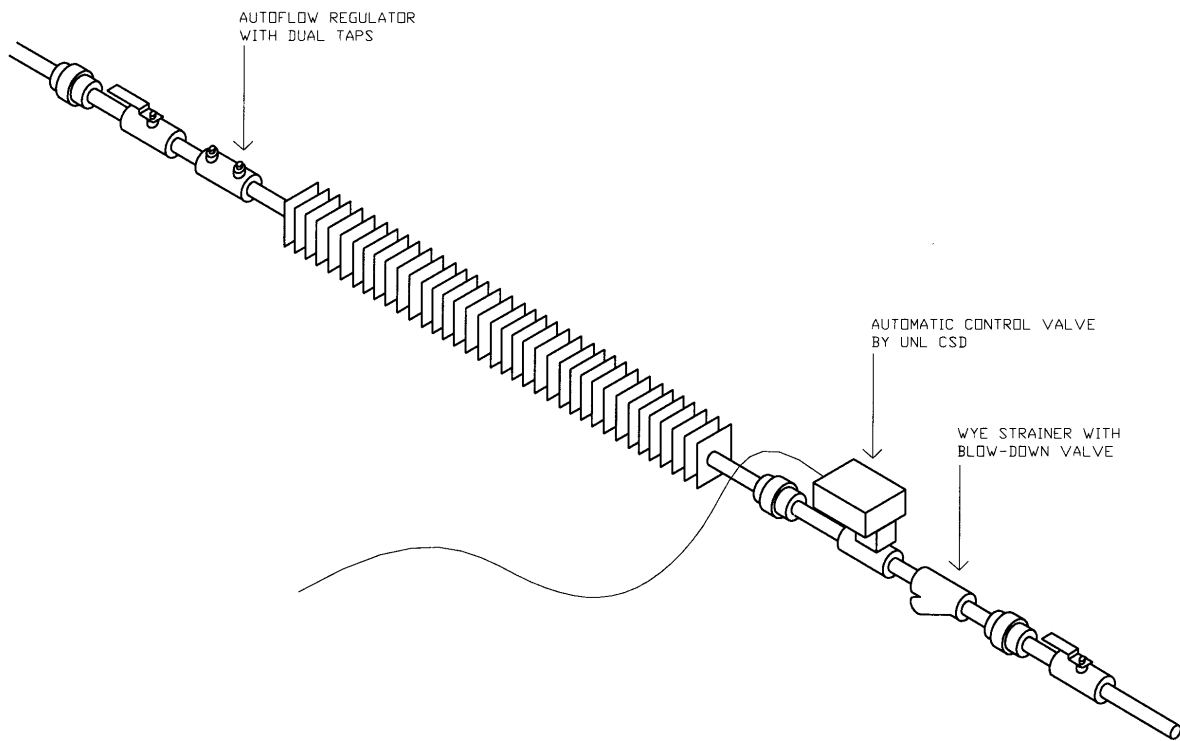
NOTE:

BRAUKMANN CONTROL VALVES TO BE FURNISHED BY UNL CSD. TO BE INSTALLED WITHIN FIN TUBE HOUSING. ORIENTATION MAY BE ALTERED, BASED ON INSTALLATION REQUIREMENTS. HAND VALVES AND UNIONS TO BE PROVIDED WITHIN SPACE CONTROLLED TO ALLOW FOR REPAIR OF BRAUKMANN VALVE. AUTOFLOW DEVICE TO BE INSTALLED ADJACENT TO BRAUKMANN VALVE.

DWG TITLE: FIN TUBE RADIATION CONTROL DETAIL

**STANDARD
DETAIL**

SD23-09



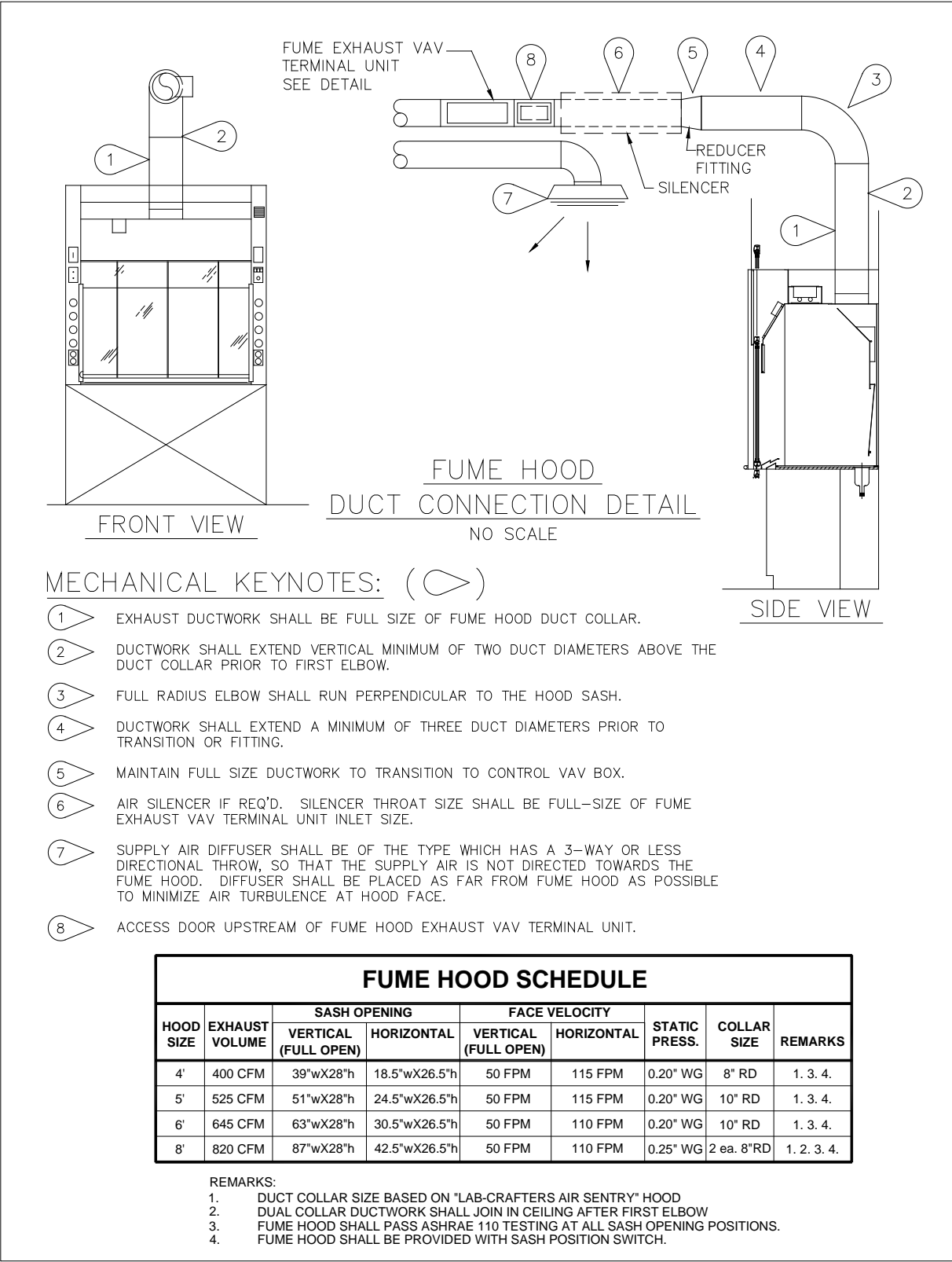
DWG TITLE: FIN TUBE RADIATION CONTROL DETAIL

**STANDARD
DETAIL**

SD23-10

FACILITIES PLANNING & CONSTRUCTION
JANUARY 2011

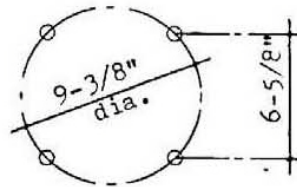
UNIVERSITY OF NEBRASKA-LINCOLN



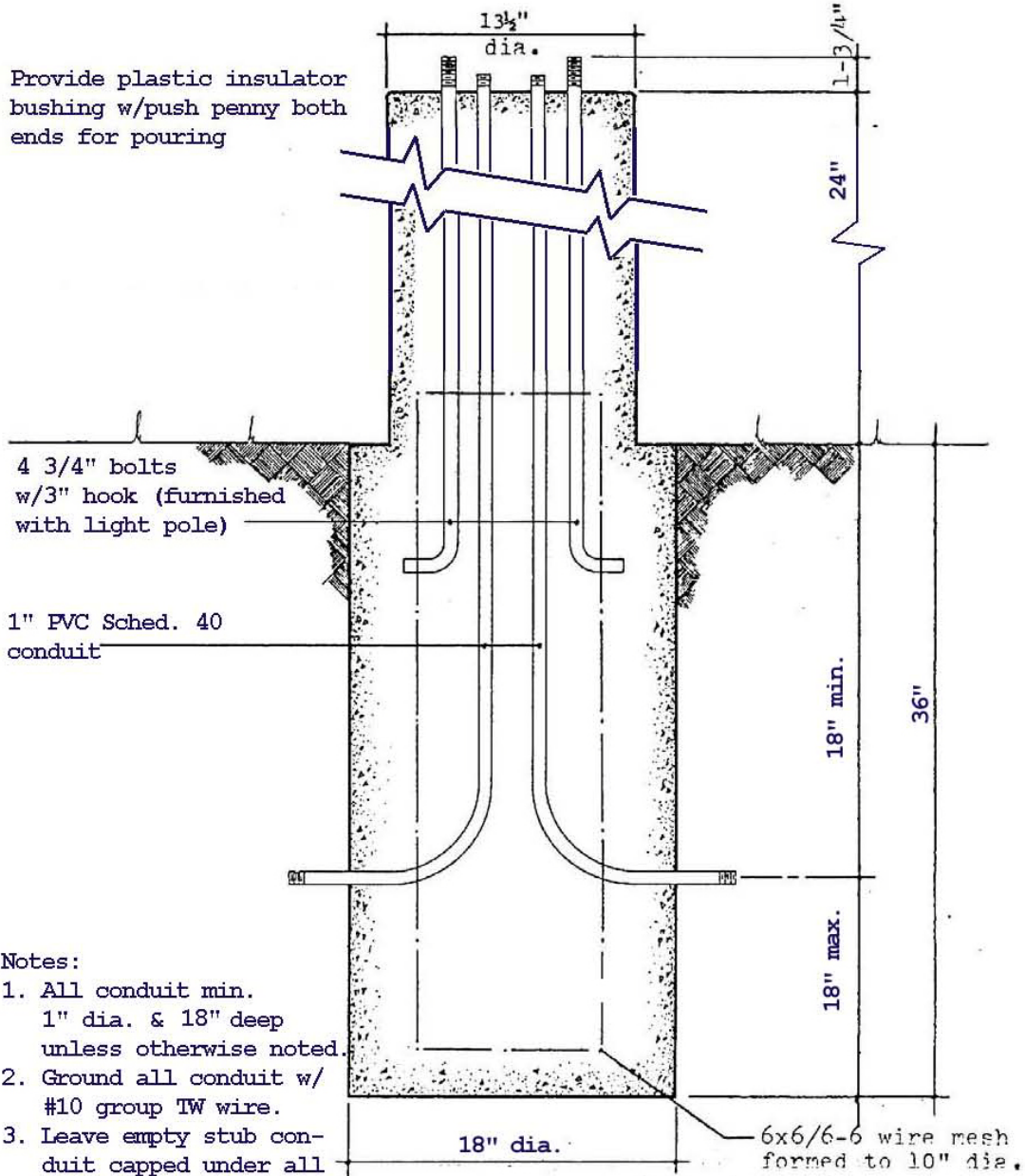
DWG TITLE: FUME HOOD CONFIGURATION AND DUCT CONNECTION DETAIL

**STANDARD
DETAIL**

SD23-12



PLAN - BOLT LOCATIONS



Notes:

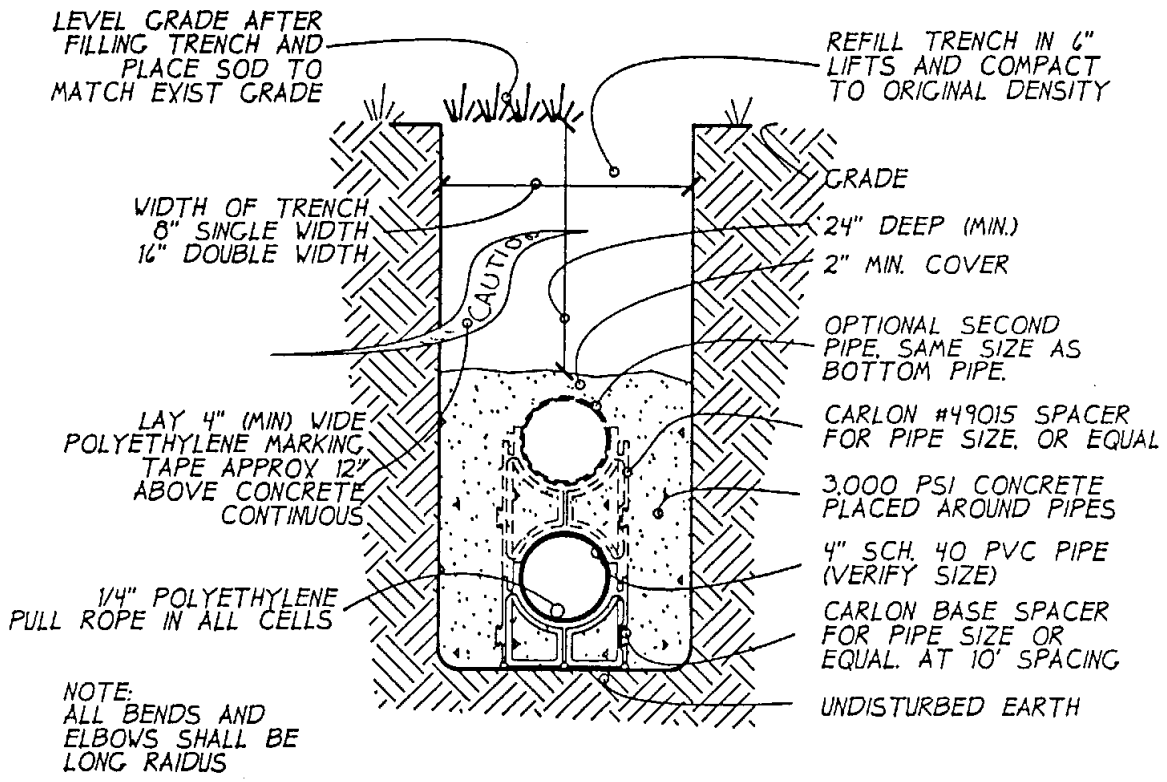
1. All conduit min. 1" dia. & 18" deep unless otherwise noted.
2. Ground all conduit w/ #10 group TW wire.
3. Leave empty stub conduit capped under all dead end lights for future.

SECTION

DWG TITLE: LIGHT POLE BASE

STANDARD
DETAIL

SD26-01



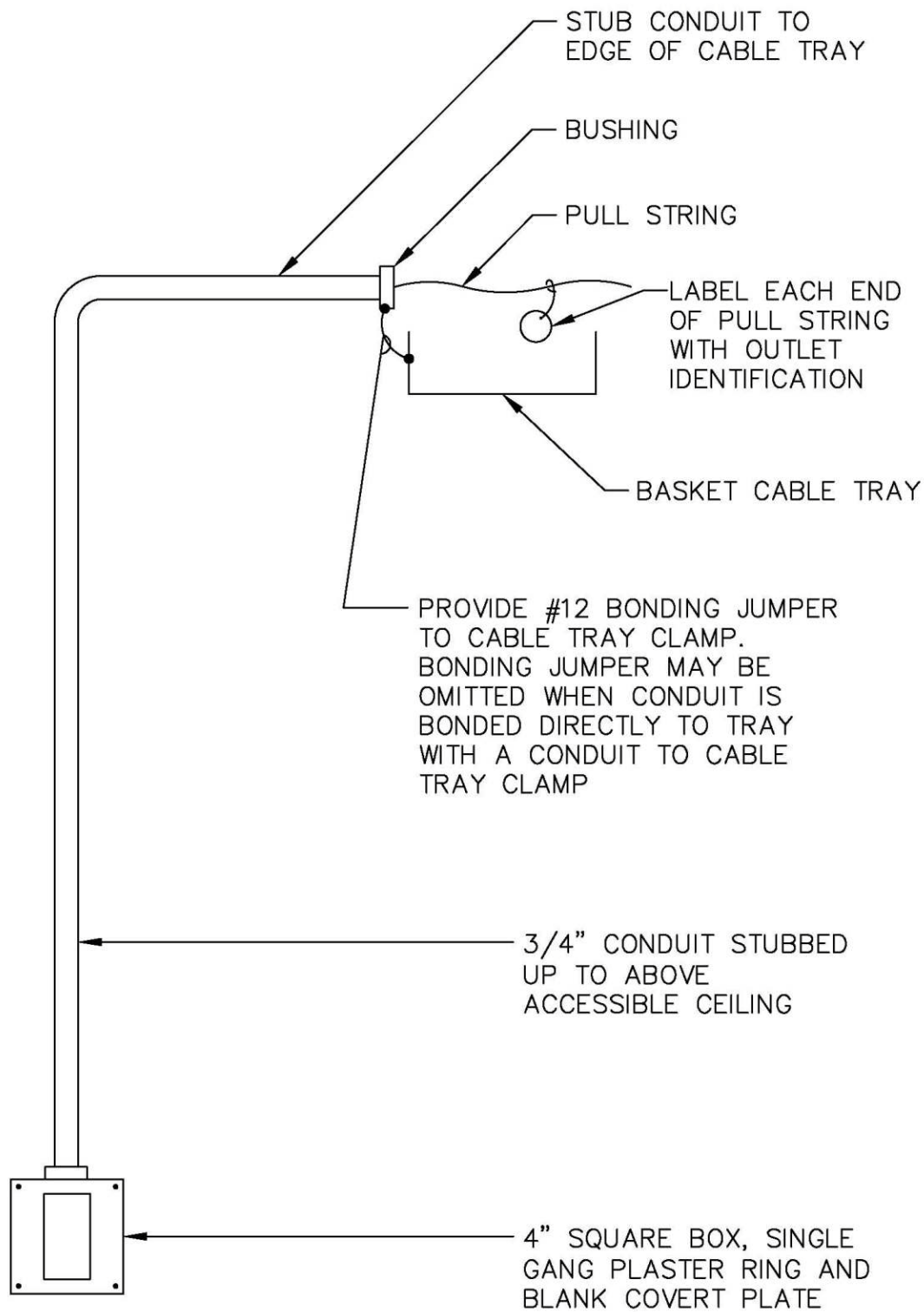
TYPICAL SECTION OF NEW DUCT ELECTRICAL/COMMUNICATIONS

SCALE 1/2" = 1'-0"

DWG TITLE: ELECTRICAL/COMMUNICATIONS DUCT BANK

STANDARD
DETAIL

SD26-02



DWG TITLE: COMMUNICATION ROUGH-IN DETAIL N.T.S.

STANDARD
DETAIL

SD26-04

DIRECT BURIED STEAM/CONDENSATE LINE INSULATION REPAIR

Proper Installation of Gilsulate 500

After the repairs are made and you are ready to backfill the trench, do the following:

1. Make sure the trench is free from any foreign matter.
2. Check the distance from the bottom of the trench and the underside of the pipe. Add and TAMP enough dirt (use sand in a wet hole) to bring the dirt to the proper distance under the pipe. (See Chart on SD15-02b)/ As you can see, the amount of Gilsulate needed will depend on the size and temperature of the pipe. Note that any time you are using Gilsulate under a street, parking lot, or railroad, you must add 2" to the amount used on the top of the pipe. Also, if you have "hot" and "cold" lines in the same trench, use 2" more between the pipes. (In most cases the lines are already in place, and the distance between the pipes cannot be adjusted.)
3. Cut the corrugated metal to the proper length (4" to 6" into the dirt to "x" number of inches higher than the pipe (x=the amount of Gilsulate needed on top of the pipe, taken from the chart). (See Drawing SD15-02c.) Note that the corrugated metal MUST be installed with the corrugation running vertically.
4. Backfill and TAMP dirt about 2/3 of the way up on the outside of the corrugated metal BEFORE putting in the Gilsulate. This will help to keep the corrugated metal from bowing. TAMP the Gilsulate while it is being put in to insure proper protection against moisture. Note how the Gilsulate is slightly rounded on the top.
5. After all the Gilsulate is in place and properly tamped, cover the Gilsulate with fiberglass and mastic, being careful to cover all the fiberglass with a thin coat of mastic. Use GAF Mineralshield. In putting the fiberglass on, be sure to cover the sharp edge of the corrugated metal with a 2" to 3" wide strip first, then overlap the sheets of fiberglass over all the Gilsulate.
6. Backfill and ALWAYS TAMP the dirt as you backfill the trench. In grass areas, put rich, black dirt on the top 6" of the hole. You MUST have at least 12" of tamped dirt above the Gilsulate.

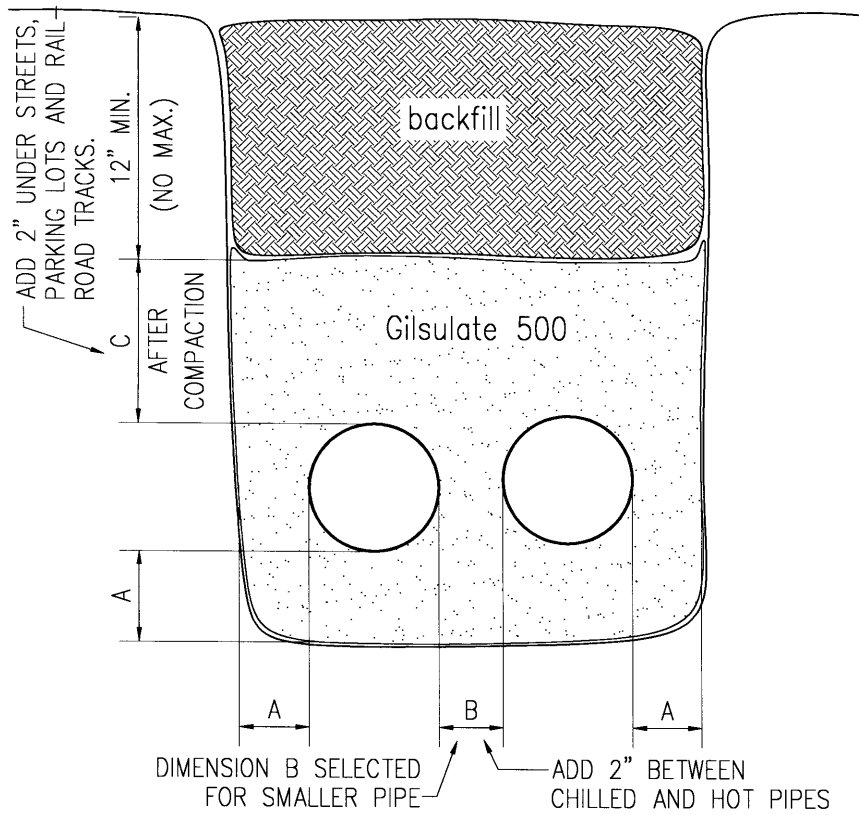
DWG TITLE: INSULATION REPAIR - DIRECT BURIAL STEAM OR
CONDENSATE LINE

**STANDARD
DETAIL**

SD33-02a

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JANUARY 2011

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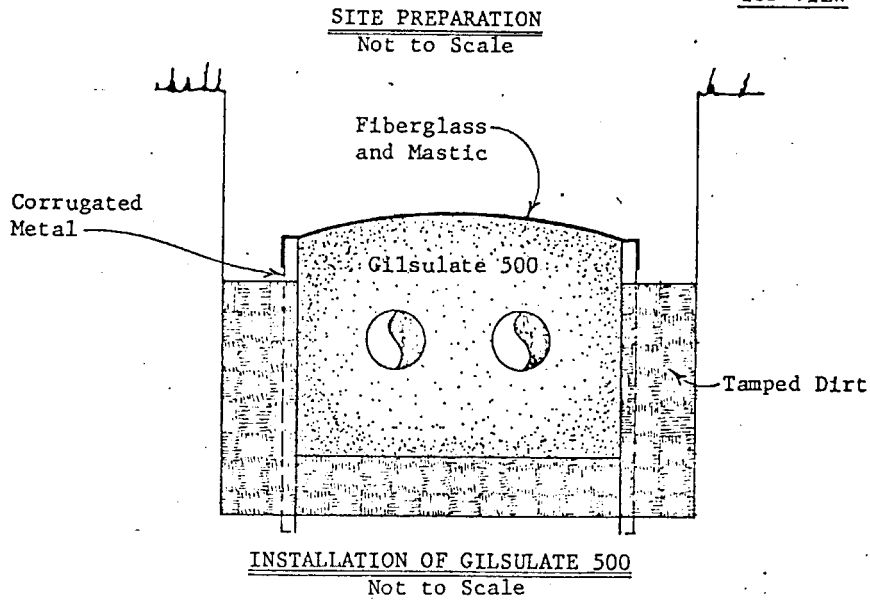
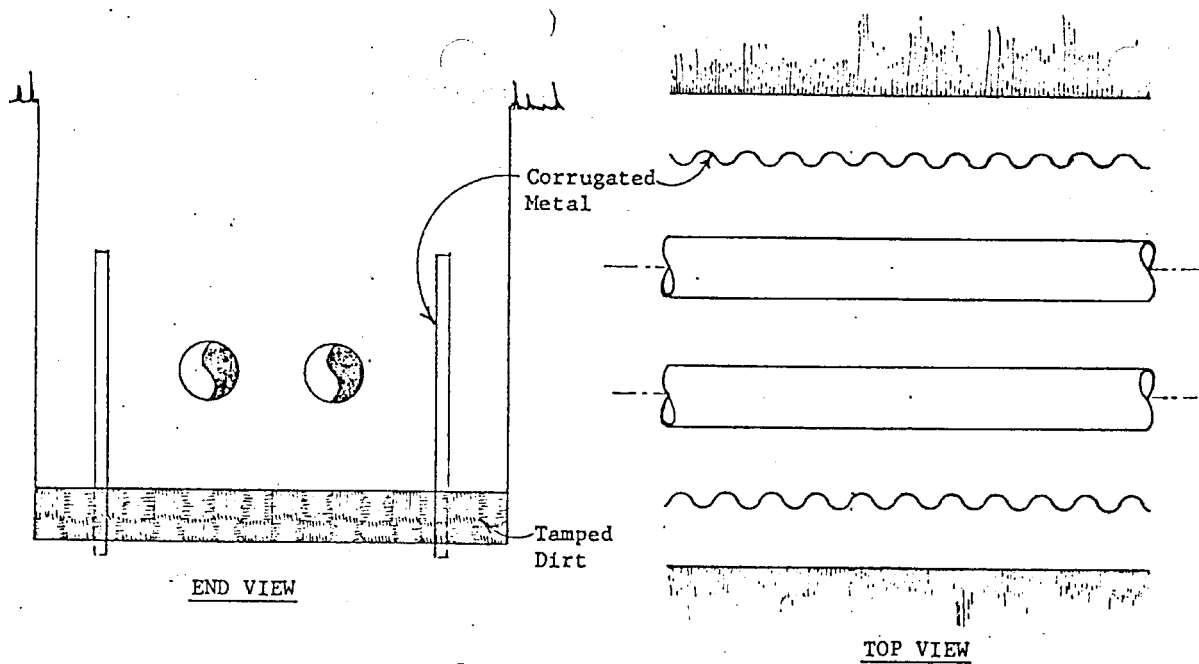
EXAMPLE: STEAM LINE 3" IN DIAMETER WITH CONDENSATE LINE 2" IN DIAMETER, 300 TO 399 DEG. F. USE 4" ON THE OUTSIDE AND BOTTOM OF THE PIPE, 2" BETWEEN THE PIPES, AND 6" ABOVE THE PIPES.

DIMENSIONS IN INCHES												
NOM. PIPE DIAM.	35° F. to 199° F.			200° F. to 299° F			300° F. to 399° F			400° F. to 499° F		
	A	B	C	A	B	C	A	B	C	A	B	C
1	3	2	5	3	2	5	3	2	5	4	2	6
2	3	2	5	3	2	5	3	2	5	4	2	6
3	3	2	5	4	2	6	4	2	6	5	2	7
4	3	2	5	4	2	6	5	2	7	5	2	7
5	3	3	5	4	3	6	5	3	7	6	3	8
6	3	3	5	4	3	6	5	3	7	6	3	8
8	3	3	5	5	3	7	6	3	8	7	3	9
10	3	3	5	5	3	7	6	3	8	7	3	9
12	3	3	5	5	3	7	6	3	8	7	3	9
14	4	4	6	5	4	7	6	4	8	7	4	9
16	4	4	6	6	4	8	6	4	8	8	4	10
18	4	4	6	6	4	8	7	4	9	9	4	11
20	4	4	6	6	4	8	7	4	9	9	4	11

Add additional 2" between hot and chilled pipes.

DWG TITLE: INSULATION REPAIR – DIRECT BURIAL STEAM OR CONDENSATE LINE

**STANDARD
DETAIL
SD33-02b**



DWG TITLE: INSULATION REPAIR – DIRECT BURIAL STEAM OR CONDENSATE LINE

**STANDARD
DETAIL**

SD33-02c

UNL DESIGN GUIDELINE APPENDIX
Sustainable Design Policy - LEED-NC Project Checklist

Implementation Process

Attached is a standard LEED-NC 2009 project checklist as provided by the USGBC. This checklist is preferred as it is available online and remains updated as the LEED-NC program is revised. Each credit has been separated into three categories; Yes, Maybe, or No. The “Yes” category is equivalent to the aforementioned “Recommended” category. The “Maybe” category is equivalent to the aforementioned “Optional” category. The “No” category encompasses the aforementioned “Conditional” and “Advanced” categories. Refer to the LEED-NC reference guide for credit requirements and strategies. All credits categorized as “Yes” shall be implemented in design and construction unless the University of Nebraska-Lincoln deems otherwise. All credits categorized as “Maybe” shall be implemented in design and construction upon suggestion of the University of Nebraska-Lincoln or at the desire and ability of the design team. All credits categorized as “No” shall be implemented in design and construction only at the request of the University of Nebraska-Lincoln.



LEED 2009 for New Construction and Major Renovations

Project Checklist

7 5 2 Sustainable Sites		Possible Points: 26	
Y	? N		
Y		Prereq 1 Construction Activity Pollution Prevention	
1		Credit 1 Site Selection	1
1		Credit 2 Development Density and Community Connectivity	5
1		Credit 3 Brownfield Redevelopment	1
1		Credit 4.1 Alternative Transportation—Public Transportation Access	6
1		Credit 4.2 Alternative Transportation—Bicycle Storage and Changing Rooms	1
1		Credit 4.3 Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
1		Credit 4.4 Alternative Transportation—Parking Capacity	2
1		Credit 5.1 Site Development—Protect or Restore Habitat	1
1		Credit 5.2 Site Development—Maximize Open Space	1
1		Credit 6.1 Stormwater Design—Quantity Control	1
1		Credit 6.2 Stormwater Design—Quality Control	1
1		Credit 7.1 Heat Island Effect—Non-roof	1
1		Credit 7.2 Heat Island Effect—Roof	1
1		Credit 8 Light Pollution Reduction	1

4 3 3 Water Efficiency		Possible Points: 10	
Y	? N		
Y		Prereq 1 Water Use Reduction—20% Reduction	
2		Credit 1 Water Efficient Landscaping	2 to 4
2		Credit 2 Innovative Wastewater Technologies	2
2		Credit 3 Water Use Reduction	2 to 4

14 8 13 Energy and Atmosphere		Possible Points: 35	
Y	? N		
Y		Prereq 1 Fundamental Commissioning of Building Energy Systems	
Y		Prereq 2 Minimum Energy Performance	
Y		Prereq 3 Fundamental Refrigerant Management	
9	6 4	Credit 1 Optimize Energy Performance	1 to 19
7		Credit 2 On-Site Renewable Energy	1 to 7
2		Credit 3 Enhanced Commissioning	2
2		Credit 4 Enhanced Refrigerant Management	2
3		Credit 5 Measurement and Verification	3
2		Credit 6 Green Power	2

5 6 3 Materials and Resources		Possible Points: 14	
Y	? N		
Y		Prereq 1 Storage and Collection of Recyclables	
2	1	Credit 1.1 Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
1		Credit 1.2 Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2		Credit 2 Construction Waste Management	1 to 2
2		Credit 3 Materials Reuse	1 to 2

Materials and Resources, Continued		Possible Points: 15	
Y	? N		
1	1	Credit 4 Recycled Content	1 to 2
1	1	Credit 5 Regional Materials	1 to 2
1		Credit 6 Rapidly Renewable Materials	1
1		Credit 7 Certified Wood	1

12 3 Indoor Environmental Quality		Possible Points: 15	
Y	? N		
Y		Prereq 1 Minimum Indoor Air Quality Performance	
Y		Prereq 2 Environmental Tobacco Smoke (ETS) Control	
1		Credit 1 Outdoor Air Delivery Monitoring	1
1		Credit 2 Increased Ventilation	1
1		Credit 3.1 Construction IAQ Management Plan—During Construction	1
1		Credit 3.2 Construction IAQ Management Plan—Before Occupancy	1
1		Credit 4.1 Low-Emitting Materials—Adhesives and Sealants	1
1		Credit 4.2 Low-Emitting Materials—Paints and Coatings	1
1		Credit 4.3 Low-Emitting Materials—Flooring Systems	1
1		Credit 4.4 Low-Emitting Materials—Composite Wood and Agrifiber Products	1
1		Credit 5 Indoor Chemical and Pollutant Source Control	1
1		Credit 6.1 Controllability of Systems—Lighting	1
1		Credit 6.2 Controllability of Systems—Thermal Comfort	1
1		Credit 7.1 Thermal Comfort—Design	1
1		Credit 7.2 Thermal Comfort—Verification	1
1		Credit 8.1 Daylight and Views—Daylight	1
1		Credit 8.2 Daylight and Views—Views	1

3 2 1 Innovation and Design Process		Possible Points: 6	
Y	? N		
1		Credit 1.1 Innovation in Design: Specific Title	1
1		Credit 1.2 Innovation in Design: Specific Title	1
1		Credit 1.3 Innovation in Design: Specific Title	1
1		Credit 1.4 Innovation in Design: Specific Title	1
1		Credit 1.5 Innovation in Design: Specific Title	1
1		Credit 2 LEED Accredited Professional	1

2 1 1 Regional Priority Credits		Possible Points: 4	
Y	? N		
Y		Credit 1.1 Regional Priority: Specific Credit	1
Y		Credit 1.2 Regional Priority: Specific Credit	1
1		Credit 1.3 Regional Priority: Specific Credit	1
1		Credit 1.4 Regional Priority: Specific Credit	1

47 28 23 Total		Possible Points: 110	
47	28	23	

Date:

TO: Richard Firebaugh, Building Code Official
Facilities Planning & Construction
University of Nebraska-Lincoln
1901 Y Street
Lincoln, NE 68588-0605

PART A:

Suggestion for Revising or Expanding Current Design Guidelines or Standard Detail:

Number of Current Design Guideline or Standard Detail: _____

Example: DG 23 00 00.20, 3b(4) or SD 23-4

Name of Current Design Guideline or Standard Detail:

Description of Suggested Revision: (Attach additional material if necessary.)

Reason for Request:

PART B:

Suggestion for New Design Guideline or Standard Detail:

Nature and Scope of Subject Matter to be included in New Guideline or Illustrated in New Standard Detail: (Attach additional material if necessary.)

Reason for Request:

Submitted by: _____

