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PREFACE

These Design Guidelines, presented in forty-one divisions and sixteen exhibits, have been prepared to assist Architects and Engineers who have been commissioned to design projects for the University by setting guidelines which are in the best interest of the University. Throughout these Guidelines, the term “Architect”, “Engineer”, or “Consultant” is to be interchangeable with the applicable discipline required on the project. These Guidelines, which have been developed over a period of years, will assist all parties to eliminate problems that have developed from the use of substandard products and applications.

These Design Guidelines also affiliate with the North Dakota University System (NDUS) State Board of Higher Education (SBHE) Policy Manual Section 900: Facilities. The NDUS Architect's Manual (NDUS AEM) is included as Exhibits E through M of these Guidelines. We feel this data can be useful and advantageous to the project, Architect/Engineer/Consultant, and the institution. All the information contained in this folder is available in electronic format for Consultants use. Where there is a conflict between the sections of these Design Guidelines and the NDUS AEM, the information of the Design Guidelines shall be followed.

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Bill Brooks  Carpenter/Cabinetmaker

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Fargo, ND  58108-6050
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<td><strong>Closed Interiors (Cabinetry)</strong></td>
<td>Any closed storage unit behind solid door or drawer fronts, sliding solid doors.</td>
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<td><strong>Concealed Surfaces (Cabinetry)</strong></td>
<td>Any surface not visible after installation.</td>
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<td><strong>Exposed Tops (Cabinetry)</strong></td>
<td>Any top of cabinet which is visible from an upper building level or floor such as a mezzanine.</td>
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<tr>
<td><strong>Open Interior (Cabinetry)</strong></td>
<td>Any open storage unit without solid door or drawer fronts and units with full glass insert doors and/or acrylic doors.</td>
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<tr>
<td><strong>Other Exposed Surfaces (Cabinetry)</strong></td>
<td>Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.</td>
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<td><strong>Owner</strong></td>
<td>For the purposes of the Design Guidelines “Owner” shall refer to the Department of Facilities Management and/or the Director of Facilities Management (or designated representative(s)).</td>
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<td><strong>Semi-Exposed Surfaces (Cabinetry)</strong></td>
<td>Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.</td>
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Division 00 Procurement & Contracting

00 10 00 Solicitation/Bid Advertisement
1) All bidding notifications shall be written by the Facilities Management Planning Department prior to advertisement.
   A) These notifications are to be advertised in the “Legal” section within The Forum of Fargo-Moorhead for a period of twenty-one (21) days before the date of the opening of bids.
   B) Additional notifications may be placed in a construction trade publication of general circulation among the contractors, building manufacturers, and dealers in this state, and the Builders Exchange.
   C) Advertisements shall be in compliance with NDCC § 48-01.2-05 and Part 6 of the NDUS Architects Manual.
2) The standard advertisement that shall be followed for bidding is supplied in Exhibit A.

00 31 31 Geophysical Data
1) Contractor is responsible for all utility locates. Contact North Dakota One Call before any work is performed.
2) NDSU will be notified by North Dakota One Call and will locate its private utilities.
3) All repairs required due to disregard of marked locates shall be the contractors responsibility.

00 45 13 Bidder Qualifications
1) Complete “Bidder Questionnaire”, Exhibit B
2) If questionnaire is not submitted within the bid bond envelope the bid will be returned unopened.

00 72 00 General Conditions of the Contract
1) The design and execution of a project shall be in compliance with the Design Guidelines as written on the date of agreement with the Architect/Engineer.
2) The Consultant shall be responsible to comply with all sections of this document, both in the design and execution of a project. The Consultant will be responsible for rectifying any non-compliant items at their cost through the errors and omissions clause of their contract.
3) Consultant shall be responsible for all site survey, geotechnical site evaluation, and construction materials & methods testing.
4) The Consultants are required to consult with the Owner on matters pertaining to basic systems design.
5) Contractor is responsible to pay the sales and use tax on all owner supplied equipment as required. Consultant shall verify with the owner if the owner will be supplying any equipment for a project and what the value of the equipment is. The consultant will provide the value to the bidders prior to the bid opening. If the value is unknown before the bid opening a change order will be written to cover the cost of the tax, bond, and insurance costs.
6) Construction Plans
   A) May not be sized larger than 30”H x 42”W (ARCH E1)
   B) Shall include Building Number, provided by Owner.
   C) Consult with Owner on Project Title.
7) Prior to assigning a room number schedule, consult with the Owner so the schedule on the plans will be the room numbers used after the facility is occupied.
8) Exhibit J outlines the safety requirements and is to be included within the project specifications.
   A) Contractors are required to submit a copy of their written safety program on projects estimated to exceed $100,000.
   B) A “Waiver of Subrogation” is supplied at the end of Exhibit J and shall be included within the specifications of all projects over $100,000.
9) Consultants shall confer with Owner about the Americans with Disabilities Act. North Dakota Century Code § 48-02-19 requires any person preparing plans or specifications for a public building provide a statement, to be filed with the North Dakota Office of Intergovernmental Assistance, that, in their professional judgment, the plans and specifications are in conformance with the American with Disabilities Act Accessibility Guidelines for Buildings and Facilities. Exhibit N contains this Conformance Statement.
10) The Owner may want to salvage items from an existing building and/or site before it is built upon, demolished or remodeled.
11) Contractor shall be responsible for protecting the new and existing irrigation system in the construction site.
Irrigation repair will be back charged to the contractor.

12) Contractor shall be responsible for protecting new and existing plantings pursuant to the protective measures outlined in Section 01 56 39.

13) Prime Contractors shall be responsible for locating and marking buried utilities with paint and flags as needed within the construction site until record documents (drawings), which indicate the location of all buried utilities, are delivered to the Owner.

14) Vice President shall be signatory for all Contract cost change documents and Agreements. FM representative may sign for Proposal Requests or similar preliminary documents.
Division 01 General Requirements

01 00 00 General Project/Design Requirements

1) Stairwells and Stair Treads
   A) Service and emergency exit stairwells shall be of reinforced concrete with an abrasive strip.
   B) Emergency or other exterior stairways will not be allowed in new construction projects or renovation projects. All stairways shall be contained internally within the building design.

2) Service Rooms and Spaces
   A) These service closets shall be provided on every floor, no more than 250 feet apart.
   B) Custodial closets should not be located in or accessed through restrooms. It is advisable, though, to design the custodian's closet between the men's and women's rest rooms, with an access door leading to the common pipe chase.
   C) Custodian rooms shall have a minimum ceiling height of eight feet.
   D) Specify sealed concrete or epoxy flooring and FRP at wet areas and high impact drywall for the remainder.
   E) Supply at least 50 foot candle of lighting in the space.
   F) Implement a self-closing door with a hold open device.
   G) Provide the following fixtures:
      1) A duplex 120 volt outlet with ground fault circuit interrupt protection.
      2) A rack with mop holders for hanging a minimum of three mops and three brooms.
      3) Sixteen (16) inch deep shelves, sixteen (16) inches apart vertically.
      4) Twenty four (24) inches by twenty four (24) inches service floor sink with hot and cold water.
   H) Clear access of thirty six (36) inches by forty eight (48) inches is needed for a custodial cart.
   I) Provide interior space for storage of recycling containers/bins.

01 14 00 Work Restrictions (Site Access, Occupant Coordination, Site Use)

1) Tobacco is not permitted on Campus grounds or in buildings and structures. Anyone caught using tobacco products on campus will be removed from the jobsite.
2) Consuming prepared foods is allowed on the construction site and within the building. If this privilege is abused, food will no longer be allowed within the building and must be consumed in a job trailer or outside the building.
3) Radios, tape players, compact disc players, etc. will not be allowed.
4) Owner reserves the right to halt all work on the construction site if the work is interfering with nearby facilities until that interference is corrected. Owner will provide the contractor with adequate information so this condition could be avoided; however, University activities may not be interrupted.
5) Contractor shall provide a minimum of 48 hour notice of utility or service shutdowns.

01 20 00 Change Order Procedures

1) The allowable markup for overhead and profit shall be as follows below. These markups shall be applied one time to the total of labor and materials included in the change order. Overhead and profit will not be allowed on labor costs if overhead and profit is already included in the hourly billing rate.
   A) Prime contractor shall be limited to an overhead and profit of markup of 10% on their own labor and material.
   B) Prime contractor shall be limited to a markup of 5% on subcontractors work needed in a change order.
   C) Subcontractor shall be limited to an overhead and profit markup of 10% on their own labor and material.
   D) For deduct change orders, provide 5% deduct markup on self-performed work and 2.5% deduct markup on subcontractor work.
   E) Owner reserves the right to negotiate markup on large change orders on a case by case basis.
   F) Change orders shall include all applicable insurance and bond cost.

01 31 00 Coordination

1) Contractor shall coordinate an above ceiling inspection of all rooms by providing a 48 hour notice before ceiling tiles are installed for owner's personnel to view above ceiling areas for locations of valves, VAV boxes, etc.
2) Communication is of the utmost importance and the proper lines of communication often avoid unnecessary delays and misunderstandings.

3) Progress Meetings:
   A) Required Attendance:
      1) Architect and their professional consultants, as needed.
      2) Prime Contractor’s project manager and field superintendents/foremen. Subcontractors and suppliers as appropriate to the agenda.
      3) All Prime Contractors shall have any subcontractor(s), who are within a 2 week window of starting work, present at the progress meetings for the purpose of coordination of their work with all others working on the site.

4) Onsite Coordination Meetings:
   A) The General Contractor’s Superintendent shall conduct a brief daily coordination meeting with site superintendents/foremen of the other Primes, and all subcontractor foremen that are working on site, for the purposes of onsite communication, coordination and dissemination of information.

5) Schedule Coordination
   A) The overall construction schedule is managed by the General Contractor. All Prime Contractors are responsible for coordinating their work through the General Contractor and cooperating with all trades to ensure the work progress of others is not impeded.

01 33 00 Submittals
1) Provide the Owner with one copy of Shop Drawings for review when forwarded to Consultant from Contractor. The Owner will review each submittal and reply to appropriate Consultant if modifications need to be made.
2) Shop drawings for review and “For Construction” will be submitted to the Owner in digital format, with hard copies provided in the Operation & Maintenance Manuals only.
3) Schedules:
   A) The overall construction schedule, approved and signed by all of the Prime Contractors, must be submitted within three (3) weeks of the date of the Contract.
   B) The first schedule signed off by all of the Prime Contractors, and approved by the Architect and Owner will be the schedule for the project. Subsequent schedules will show variances to the schedule, accurately indicating tasks that are behind, ahead or on schedule. The schedules will be created in a scheduling program such as Microsoft Project, SureTrack/Primavera or Expedition that is capable of showing the progress and any variations accurately. Electronic copies will be made available to the Architect and/or Owner upon request.
   C) Schedules will be updated by the General Contractor, with the coordination, cooperation and input by the other Prime Contractors. The other Prime Contractors shall supply tasks, accurate dates and timeframes for purpose of completing the schedule expeditiously and accurately. Copies of this updated schedule will bear the signatures of all Prime Contractors acknowledging their acceptance. Signed copies shall be provided to the Architect and Owner one (1) week prior to submission of all Applications for Payment.
   D) If a Prime Contractor falls behind on the schedule due their lack of manpower, equipment, coordination with other Prime Contractors, or their own negligence, the Owner will direct the Prime Contractor to use whatever means necessary to get back on schedule. This may include, but is not limited to, working overtime, increasing manpower, or bringing in additional forces all at the expense of the Prime Contractor. If so directed, the Contractor shall abide by the direction of the Owner or risk being in breach of contract, allowing the Owner to hire additional forces to recover the lost time and deducting the cost from the Prime Contractor’s contract.

01 35 00 Special Project Procedures
1) Storm Water Pollution Prevention Plan
   A) Storm water permitting shall follow NDDH guidelines and the following procedure:
      1) The Consultant shall on behalf of the Owner provide the Contractor with a preliminary Notice of Intent (NOI), Storm Water Pollution Prevention Plan (SWPPP), and Acceptance of Ownership form upon award of the project contract.
      2) The Contractor shall review, amend, complete, and sign all required components of the NOI, SWPPP and Acceptance of Ownership form. Additional sediment and erosion control Best Management
Practices (BMP’s) and other features including a proposed timetable of sediment and erosion control activities shall be added to the SWPPP by the contractor: http://www.ndhealth.gov/WQ/Storm/Construction/ConstructionHome.htm

3) The contractor shall return the completed NOI, SWPPP, and Acceptance of Ownership form to the Consultant and allow for a minimum of two (2) days for review and approval of the NOI and SWPPP by the Owner or its designated representative prior to signature of the NOI by the Owner. The Owner does not sign the SWPPP.

4) The NOI shall be submitted by the Consultant on behalf of the Owner to the NDDH 7 days prior to commencement of construction. The contractor shall not begin Construction activities prior to the seventh (7th) day after submittal of the NOI to the NDDH or until acknowledged in writing by the NDDH, whichever is sooner.

5) If the project involves 50 or more acres, or if the project has a discharge point located within 2,000 feet of, and flows to, a water body listed as impaired under section 303(d) of the Federal CWA due to sediment or parameters associated with sediment transport, the SWPPP shall be submitted with the Notice of Intent to the NDDH. A list of North Dakota’s water quality-limited waters needing total maximum daily loads or TMDLs developed to comply with section 303d of the Federal CWA can be found at: http://www.ndhealth.gov

B) By signing the Contract and completing the NOI, the Contractor is a co-permittee with the Owner to ensure compliance with the terms and conditions of the General Storm Water Permit and is responsible for complying with all provisions of the permit. The contractor is solely responsible for the execution of the SWPPP according to Part II C of the General Storm Water Permit

C) Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
   1) Be located in accessible concealed floor, floor-ceiling or attic spaces
   2) Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition
   3) Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording. "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS" or other wording.
   4) Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

01 51 00 Temporary Utilities

1) Temporary utility services for the construction site will be installed by the appropriate contractor and must be coordinated with the Owner prior to connections being made.

2) Electrical Power Service:
   A) Power will be available to the site from a near-by transformer or building and will be metered with a Contractor-provided meter.
   B) NDSU will read the meter and bill the General Contractor accordingly; Xcel Energy will not meter nor read the meter at the site.
   C) Depending on the job size, power may be supplied without cost at the discretion of the Owner.

3) Water Service:
   A) Water will be available to the site from a near-by University water distribution source with a backflow prevention device and will be metered with a Contractor-provided meter.
   B) NDSU will read the meter and bill the General Contractor accordingly; City of Fargo will not meter nor read the meter at the site.
   C) Depending on the job size, water may be supplied without cost at the discretion of the Owner.

4) Heat and Steam Service:
   A) All Work that requires heat in new construction will be the responsibility of the Contractor.
   B) Through an agreement with the Owner, the Contractor may buy steam from the main Campus steam distribution system.
   C) Usage of the steam will be billed back to the Contractor based on a value per thousand pounds of steam condensate measured through an Owner supplied condensate meter.
5) Telephone, Internet and Fax Service:
   A) Telephone, Internet and fax services may be provided through the NDSU Telecommunications department and billed to each Prime Contractor that requires a connection.
   B) Cellular phone service will be the responsibility of the Contractor.

6) Abuse of the Owner-provided temporary services will result in the Owner billing the contractor for those utilities being abused.
   A) Prior notification will be provided to the Contractor of abuse to cease the abuse.
   B) The Owner will make the final decision on who the abuser was and the amount of wasted services.

01 52 00 Construction Facilities
1) Sanitary Facilities:
   A) Contractors may be allowed to use the facilities for Work that will take place in a building with existing, operating sanitary facilities.
   B) Care must be made to keep these facilities in a clean and sanitary condition.
   C) The General Contractor will be responsible to supply portable toilet facilities at the site for new construction. Nearby buildings will not be allowed unless the General Contractor has received permission from the Owner.

2) Site Storage:
   A) All material and equipment shall be confined to the area allowed by Owner unless prior approval was granted to store material outside the area of work.
   B) Excess black dirt may be reused on the NDSU campus at Owners discretion.
   C) Excess clay or contaminated material will be removed from campus and become the property of the Contractor.

01 55 00 Vehicular Access and Parking
1) Traffic routes will be as directed by the Owner.
2) ON-CALL SERVICES:
   A) Any contractors/vendors performing on-call (non-scheduled) services to NDSU buildings or property may do so WITHOUT purchasing any type Parking Permit from NDSU, but their vehicle(s) shall meet the following criteria to be eligible for parking on NDSU property.
      1) Vehicles shall be easily recognizable as a commercial service vehicle.
      2) Vehicles shall be painted on the exterior with a ‘branded logo’ or have an appropriately sized magnetic or attached sign.
      3) Vehicles shall be parked in legal and/or authorized parking areas or they will be subject to parking citations.

3) LONG-TERM SERVICES:
   A) Any contractors/vendors performing on designated long-term NDSU projects shall also be allowed to park on NDSU property if their vehicle(s) meet the same criteria as stated above.
   B) Contractors/vendors shall be instructed of the work site parking conditions at the pre-performance conference and shall confer with their assigned NDSU Project Manager as to where they shall park their company vehicles while working on NDSU property.

4) UNMARKED CONTRACT/VENDOR VEHICLES
   A) Shall NOT be allowed to park on NDSU property without purchasing an NDSU parking permit. Failure to purchase a parking permit while parked on NDSU property will result in a parking citation.

5) NDSU PARKING PERMIT PURCHASE OPTIONS
   A) One-Year Parking Permit for Contractors/Venders = $185.00 per year
   B) One-Day Parking Permits for Contractors/Venders = $2.00 per day
   C) Temporary Parking Permits for Contractors/Venders = $2.00 per day (Maximum of 6-weeks)
   D) Summer Parking Permits for Contractors/Venders = $25.00 summer only (May 15 to August 15 approximately)
   E) Metered parking at any of the four pay lots on the NDSU campus.

6) NOTES:
   A) Contractors’/vendors’ shall determine which permit or combination of permits works best for their situation.
B) There are no refunds for parking permit purchase fees. All sales are final.
C) All citations received are the responsibility of the vehicles registered owner.
D) CONSULT YOUR NDSU PROJECT MANAGER ABOUT BUYING PARKING PERMITS AND METERED LOTS.

01 56 00 Temporary Barriers and Enclosures
1) The Contractor shall confine apparatus, material storage, and the operation of the workers to limits indicated by the construction site boundaries.
   A) These boundaries are to be fenced-off by use of a chain link fence at minimum height of six feet and maintained in good condition through the completion of the project.
   B) If this confinement is not possible, prior approval must be obtained from the Owner, via the project Consultant, before other University space is utilized by Contractor.
   C) As per state law and city ordinance regarding trespassing, the name of the person posting the premises must appear on each sign in legible characters.
2) Site Traffic:
   A) Contractor may not block traffic or pedestrian use other than designated work area.
   B) Contractor shall supply and maintain all barricades to block-off the work area.

01 56 39 Temporary Tree and Plant Protection
1) Protect all existing trees and other planting areas that will not be directly affected by the work. Existing trees and other planting areas which are damaged due to work shall be repaired or replaced to original condition.
   A) Fence shall be installed 3'-0" beyond the drip line of trees and plantings.
   B) No equipment or materials shall be placed within the protected fencing.
   C) No chemicals, dirt, or construction debris shall be placed within the protected fencing.
   D) There shall not be cutting or breaking of branches without notifying the Owner’s Landscape/Arboretum Coordinator
   E) No damage shall be done to the tree trunks; this includes bark removal, cutting into the trunk, equipment leaning against the trees, etc.
2) When excavation operations are in proximity to trees, the root system shall be cut by hand at the limits of the excavation prior to any soil removal.

01 57 00 Temporary Controls
1) Erosion and sediment control is required on all construction projects; contractor shall comply with the local authority having jurisdiction and NDPES requirements and procure the appropriate permits.

01 60 00 Product Requirements
1) No Sole Source Specifications allowed.
2) The products and materials listed in this Guideline are those that NDSU has utilized and currently requires.
   A) Any product or material that may be substituted requires prior approval by the Owner.
   B) Within the specifications, require seven working days prior to the date of receipt of bids for review of substitutions by the Owner and the Consultant.
   C) No substitutions will be considered after the project has begun unless provided within the Contract.
3) No products or building materials used as a temporary or permanent element in the construction of a building will be allowed which have any form of asbestos containing or lead containing material.
   A) Contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building, and to remind material suppliers that their products must not contain asbestos or lead.
   B) Contractors shall notify the Architect immediately of any materials which are suspected of containing asbestos, and shall not disturb or attempt to abate any asbestos containing material. The Architect will contact the Owner and inform the Owner of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos or lead removal.
   C) At the completion of construction, during the close-out phase of the project, Contractor shall complete the Contractor Certificate of Non-Asbestos and Non-Lead Materials (See 01 78 00.10.A) (Exhibit O).
4) Use poured concrete foundations, avoiding block wall foundations on exterior walls.
5) Architectural surfaces:
A) All surfaces should be hard surfaced, such as, brick, stone, structural concrete, marble, etc.
B) Exclude plastic or other types of surfacing materials which might require replacing or refinishing in future years.
C) No exterior surfaces should require painting.
D) Other exterior metals should be corrosion free and non-ferrous, for example, stainless steel and/or anodized aluminum.
E) Baked enamel steel is acceptable for roof and downspout applications.

01 73 00 Execution
1) The Consultant is responsible for maintaining accurate AS-BUILT drawings and specs showing any changes to the contract documents.

01 74 00 Cleaning and Waste Management
1) All construction debris shall be removed from the site on a daily basis.
2) Cleaning:
   A) All Contractors will keep the premises free from waste material accumulation, or rubbish created by the construction project. Cleanup shall be conducted every day, with a thorough cleaning by all contractors by end of the work week.
   B) If the project is an interior renovation in an occupied building, the building shall be thoroughly cleaned daily. Consult with the Owner on cleaning requirements.
   C) If the Owner should determine the Contractor to be negligent in this respect, the owner reserves the right to use his own resources for such cleanup. The cost will be charged back against the Contractor.
3) Contractor shall be responsible for performance of any lawn care and weed control measures within the designated construction site to prevent the passive cultivation and seeding of unwanted plants.

01 77 00 Closeout Procedures
1) Upon completion of the project and before final payment is made, the Consultant shall complete the requirements of sections 01 77 00 through 01 78 44.
   A) All documents required in these sections shall be delivered to Owner.
2) Mechanical close-out requirements
   A) Final inspection by the Owner will not be conducted prior to delivery of all air balance and performance data, plus a spare parts list, operating instructions, and equipment descriptive literature that contains complete numbered replacement parts list.
   B) Test data information will be obtained by an independent firm. The firm shall be responsible to Owner.
   C) Air flow, temperature, ampere readings, etc., shall be recorded and become the property of the Owner.
3) Warranty inspection:
   A) The respective consultants shall set up a final warranty inspection on the eleventh month after substantial completion (referred to as “One Year Warranty Inspection”).
   B) The Architect shall arrange for an inspection of the mechanical systems 10 months after date of final acceptance for the purpose of work that should be corrected under the one year guarantee provisions of the contract.

01 78 00 Closeout Submittals
1) Exhibit C of these Guidelines contains the check-off sheet for the items in this section.
2) One copy of field noted, construction drawings (“Red Line Drawings”) shall be delivered to Owner.
3) Record Drawings:
   A) Two (2) complete printed sets of Record Drawings:
      1) May not be sized larger than 30”H x 42”W (ARCH E1)
      2) Drawings must be updated to reflect all change orders, field changes, and revisions. Handwritten notations and field notations are not acceptable.
   B) One (1) set of electronic Record Drawings:
      1) Must be in AutoCAD “.dwg” format.
      2) Final electronic Record Drawings must reflect all field changes & revisions.
4) One (1) updated hardcopy of the specifications with addendum(s) incorporated into the specifications and a
copy of the updated specifications in PDF (or .doc/docx) format.

5) A painting schedule noting all paints and stains used on the project. Designate this information by using the room number.

6) A valve chart for all valves will be provided with valve enumeration, location, and type identified (i.e. Main Shut-Off, Return Valve, etc.).

7) A complete set of shop drawings.

8) The sign-in sheet listing all owner’s employees at the training function provided as part of “Equipment Operating Instruction” (required in 01 79 00.1.B).

9) HVAC system testing and balancing reports (required in 01 77 00.2).

10) The following completed documents:
   A) A Contractor Certificate of Non-Asbestos and Non-Lead Materials (Exhibit O).
   B) AIA G704-2000 Certificate of Substantial Completion; or,
      1) AIA G704CMa-1992 Certificate of Substantial Completion, Construction Manager-Advisor Edition may be substituted if applicable; or,
      2) AIA G704DB-2004 Certificate of Substantial Completion of a Design-Build Project may be substituted if applicable
   C) AIA G705-2001 List of Subcontractors
   D) AIA G706-1994 Contractor’s Affidavit of Payment of Debts and Claims, including AIA G706A-1994 Contractor’s Affidavit of Release of Liens
   E) AIA G707-1994 Consent of Surety to Final Payment
   F) Certificate of Occupancy issued by the local authority

01 78 23 Operation and Maintenance Data

1) Operating and Maintenance Manuals:
   A) Two (2) hardcopy of instructional operating and maintenance manuals and product information on all equipment and finish materials.
      1) Items shall be indexed according to the Construction Specification Institutes indexing system and separated by a tab system (ie: 05 50 00 Metal Fabrications).
   B) One (1) electronic copy in PDF format of instructional operating and maintenance manuals and product information on all equipment and finish materials.
   C) Include part books on every piece of equipment that operates or has moving or electrical parts, for example: elevators, door hardware, alarm systems, etc.
   D) Warranties:
      1) Include all warranty information, cut sheets, and owner’s manual which is to include the operating procedures, product maintenance schedule, and maintenance requirements.

01 78 36 Warranties

1) Warranty items will be repaired within one (1) week. If not repaired, owner will have the item in question repaired and will invoice the responsible party.

2) Roofing Contracts:
   A) A contractor’s “Five Year Roof Guarantee” (Exhibit D) shall be completed by the contractor for all roof projects and submitted to Owner.
   B) Manufacturer’s membrane roofing warranties shall be a minimum of twenty (20) years.
   C) Sheet metal roofing warranties shall be a minimum of 20 years.

3) Casework shall be provided a five (5) year guarantee against defective material and fabrication.

4) Warranties are to be included with Operation and Maintenance Data submittals, see also 01 78 23.D

01 78 44 Extra Stock Materials

1) A complete replacement set of HVAC air filters provided per 23 40 00 must be supplied at the completion of the project.

2) Extra quantities of the products mentioned in 09 05 00.1 shall be made available to the Owner, at five (5) percent of the total use, for future use to replace damaged materials (see also 09 05 00.1.A)
01 79 00 Demonstration and Training
1) Equipment operating instructions:
   A) All consultants shall set up training sessions for their respective products. Contact the Owner’s representative to schedule the meeting times.
   B) A sign-in sheet shall list all Owner’s employees at the training function.

01 80 00 Performance Requirements
1) Architect to perform an eleven (11) month inspection of project and arrange with contractor to remedy any outstanding issues.

01 81 00 Facility Performance Requirements (Alternate)
1) The University fully supports the principles of the LEED (Leadership in Energy and Environmental Design) Building Rating System. All projects shall address sustainability as it relates to site issues, water, energy efficiency, materials and resources and indoor air quality.
   A) The Consultant shall strive to meet or exceed the minimum number of points needed for LEED certification under the rating system appropriate for the project.
   B) The Consultant shall determine the most cost effective means of achieving these points, and shall take full credit for points achieved through compliance with other University standards that address sustainability issues, such as building commissioning.
   C) The Consultant shall submit for the University’s review and approval a LEED Project Checklist, identifying the specific measures proposed to be incorporated into the project to achieve the target number of points.
   D) If the point level for LEED certification may not be affordable within the authorized budget for a given project due to the cost of achieving the total number of LEED points needed for certification, then as many features as can be afforded shall be maintained in the design. This will be addressed on case-by-case basis.
Division 02 Site Construction

02 30 00 Subsurface Investigation

1) The contractor is responsible for the payment of all retesting services of any tests which fail to meet project specifications.

02 40 00 Demolition and Structure Moving

1) Concrete and Asphalt Removal
   A) Where practical, all concrete and asphalt shall be recycled.
   B) All concrete and asphalt surfaces are to be saw cut to the surfaces full depth from the area that is to be kept. Asphalt pavement may be cut with a coultier with the approval of the Owner.
   C) All roots or other vegetation more than one inch in thickness below the finished surface shall be removed to a depth of six inches below the base of the surface.

2) Underground Utility Demolition
   A) All unused or abandoned piping within the limits of the construction site shall be removed and salvaged by the Contractor. Verify pipe insulation and jackets for asbestos containing material before removal.
   B) All unused or abandoned electrical wiring and conduit within the limits of the construction site shall be removed and salvaged by the Contractor.
Division 03 Concrete

03 05 00 Common Work Results for Concrete
1) Concrete Advertising Stamp: Stamps advertising ones company are not acceptable anywhere on campus.

03 10 00 Concrete Forming
1) Forms shall be set upon the compacted sub-grade to the exact grade and alignment.
2) Sidewalk side to side slope is not to exceed one-quarter (1/4) inch per foot of sidewalk width, unless otherwise directed by Owner.
3) Deposit concrete in excess of the required depth, compacted or vibrated with as little handling to fill all voids, and finished smooth and even.
4) Broom the surface transversely across the pavement sufficiently to leave marks, not grooves.

03 15 00 Concrete Accessories
1) Install elasticized sealant in joints with expansion material 48 hours after concrete pour. Clean joints prior to placing sealant.

03 20 00 Concrete Reinforcing
1) Place steel on plastic chairs only.
2) Reinforcement in bike pads, sidewalks and other walking surfaces and garbage dumpster pads shall be #4 rebar placed at 18” O.C.

03 30 00 Cast-In-Place Concrete
1) Materials:
   A) Portland Cement: Type I - ASTM C150; Type III - High Early Strength C150
   B) Aggregates:
      | Fine Aggregates Sieve Designation | Weight Passing Square Mesh Sieve | Course Aggregate: |
      |-----------------------------------|---------------------------------|------------------|
      | 3/8”                              | 100%                           | Shall conform to size No. 57, one inch to No. 4. |
      | No. 4                             | 95 – 100%                      |                  |
      | No. 8                             | 80 – 100%                      |                  |
      | No. 16                            | 50 – 85%                       |                  |
      | No. 30                            | 25 – 60%                       |                  |
      | No. 50                            | 10 – 30%                       |                  |
      | No. 100                           | 2 – 10%                        |                  |
   C) Reinforcing Steel: New steel conforming to ASTM A615, Grade 60, deformed bars
   D) Dowel bars conforming to ASTM A615, Grade 40, non-deformed, plain bars
   E) Joint Expansion Filler: Resin impregnated fiberboard, minimum thickness 1/2 inch.
   F) Joint Sealer: Hot poured elastic type
   G) Curing Compound: White acrylic based curing and sealing compound with 18 percent minimum solids content.
2) Proportions:
   A) 28-day strength to meet the surface specified psi.
      1) If 28-day strength is not met, concrete shall be replaced at contractor’s expense.
   B) Water cement ratio not to exceed 0.45.
   C) Air content of air-entrained concrete shall not be less than five percent, nor more than eight percent (8%) of volume.
   D) Fly-ash maximum percentage will be 30.
   E) Slump shall not exceed four inches; when using slip forming equipment, slump shall not exceed 1 1/2 inches.
3) Properties:
### Concrete type

<table>
<thead>
<tr>
<th>Concrete type</th>
<th>Thickness</th>
<th>Strength</th>
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<tbody>
<tr>
<td>Bike pads</td>
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<tr>
<td>Sidewalks</td>
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<td>Dumpster pads</td>
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<tr>
<td>Streets/ Dumpster Approaches</td>
<td>8”</td>
<td>5000 psi</td>
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</tbody>
</table>

A) Sidewalks to be a minimum of seven (7) feet wide. When two sidewalks join, provide a radius equal to half the sum of the sidewalk widths.

### 03 35 00 Concrete Finishing

1) Tool expansion joints into the wet concrete or “green sawed” within 24 hours after the concrete placement.

   A) Placement of joints to be coordinated with Owner.

### 03 39 00 Concrete Curing

1) Compound shall completely cover the surface, and be applied continuously and uniformly with proper equipment maintained in good condition.

2) Contractor is responsible for taking appropriate measures to regulate the rate of cure for optimum long term viability of the concrete.
Division 04 Masonry

04 05 00 Common Work for Masonry

1) Install caulked expansion joints in the corners of all buildings and along the face of the buildings per the masonry institutes guidelines.
Division 05 Metals

05 40 00  Cold Formed Metal Framing
1) All interior metal C-studs shall be 20 ga (minimum), spaced 16” O.C. and fastened at both sides on bottom and top track.
2) Install bridging in all interior walls using bridging clips per manufacturer’s recommendations.

05 50 00  Metal Fabrications
1) All metal railing members shall not contain sharp edges and welds ground smooth. Consult Owner for finishes.
06 10 00 Rough Carpentry

1) Install metal nailer strips with screws such as Carlisle’s HP Fastener for wood or steel or Rawl’s #14 Deck Screw.

2) Plywood Backing:
   A) 3/4” plywood backing shall be installed at 6’-6” to 7’-6” in all classrooms, labs, and offices for present and future wall shelving, cabinets, etc.
   B) 6” tall 3/4” thick plywood backing shall be installed for base cabinets with the top of the backing 2” above the countertop (backsplash excluded). Verify placement with Owner prior to installation.
   C) Confer with the Owner about providing proper backing for specialty items, such as door stops, signage, grab bars, etc.

3) Wall construction: (See also section 05 40 00: Cold Formed Metal Framing)

06 41 00 Architectural Wood Casework

1) See also section 12 30 00: Manufactured Casework and 12 36 00: Countertops

2) QUALITY ASSURANCE
   A) Manufacturers who wish to supply cabinetry must be approved prior to the bid by submitting a sample that meets the requirements in the casework specifications (Sections 06 41 00 and 12 30 00). Consult the Owner representative prior to specifying this section.
      1) The request for prior approval and the sample casework must be submitted ten (10) calendar days prior to the bid opening date.
      2) Manufacturer shall provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.
      3) At Owners request, manufacturer must submit a sample of their casework which demonstrates compliance with the minimum levels of material and detailing indicated within the specifications.
         a) Product Data: Manufacturer’s catalog with specifications and construction details.
         b) Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
         c) Include section drawings of typical and special casework, work surfaces and accessories.
         d) Indicate locations of plumbing and electrical service field connection by others.
         e) Manufacturer shall submit a base cabinet sample which conforms to specifications, with drawer and door.
         f) Manufacturer shall submit a wall cabinet sample which conforms to specifications, with door.
         g) Cabinet samples shall be complete with specified hardware for doors, drawers and shelves.
         h) Two sets of samples for each of the following components:
            i) Decorative laminate color charts.
            ii) PVC edges.

3) MATERIALS
   A) Acceptable Core Materials based on thickness and application:
      1) Plywood 3/4 inch thick.
   B) Glass:
      1) 1/4” thick laminated or tempered safety glass shall be used when cabinetry has glass sliding doors, glass insert doors, or sliding doors mounted in an aluminum track.
      2) Minimum 1/8” thick tempered safety glass shall be used for swinging doors.
   C) Cabinet Hardware
      1) Hinges:
         a) Concealed Blum, Grass, Salice, or approved equal hinges only with soft close.
         i) Doors 48 inches and over in height have three (3) hinges per door.
      2) Pulls:
         a) Door and drawer front pulls, are epoxy powder coated metal wire style, stainless steel or aluminum; 96mm spacing on screws.
         b) Stainless steel pulls shall be used in lab settings.
      3) Drawer Slides:
a) All slides to be full extension with ball bearings Accuride, KV or approved equal.
b) Regular, knee space and pencil:
   i) 100-pound load rated.
c) Paper storage:
   i) 150-pound load rated.
d) File:
   i) 150-pound load rated.

4) Adjustable Shelf Supports:
   a) Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and
      to prevent accidental rotation of support.
   b) The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip 
      feature for shelving.
   c) Supports may be field fixed if desired.

5) Locks:
   a) Removable core, disc tumbler, cam style lock with strike.
   b) Furnish 2 keys.
   c) Lock for sliding 3/4 inch thick doors is a disc type plunger lock, sliding door type with strike.
   d) Lock for sliding glass/acrylic doors is a ratchet type sliding showcase lock.

6) Sliding Door Track:  Anodized aluminum double channel.

7) Coat Rods:  1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

8) File Suspension System: Extruded molding integral with top of drawer box sides to accept standard 
    hanging file folders.

D) Support Members:
   1) Legs:
      a) Legs shall be furniture grade, epoxy powder coated steel.
      b) Fixed mounted with leveling pad.
   2) Under-counter support brackets:
      a) Furniture grade, epoxy powder coated steel.
      b) Adjustable countertop support brackets.  Fixed and/or flexible rail mounted with integral wire 
         management and leveling pad.

E) Tote Trays:
   1) Heavy-duty vacuum-formed polypropylene plastic with full top rim and pull.
   2) Tote tray/supply cabinets equipped with injection molded polycarbonate; continuous side rail 
      support glide.
   3) Each side rail support glide is adjustable with integral support pins to interface 32mm pre-drilled 
      holes.

F) Articulating Computer Keyboard Tray:
   1) Under counter/desktop mount will be at minimum 27 inch wide flat surface with tilt, and rotation 
      mechanism, black molded polymer with no mouse tray slide or wrist rest.
   2) Provide articulating keyboard tray only per individual request (Not all workstations will require a 
      keyboard tray).

4) FABRICATION
   A) Fabricate casework, countertops and related products to dimensions, profiles, and details shown.
   B) Chemical storage cabinets shall be metal with plastic liner and vented as required.
   C) Cabinet Body Construction:
      1) Cabinet Tops and Bottoms:
         a) Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components 
            such as fixed horizontals, rails and vertical.  Minimum 6 dowels each joint for 24 inch deep 
            cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets.
         b) Tops, bottoms and sides of all cabinets are plywood with plastic laminate where specified.
      2) Cabinet backs:
         a) Cabinet backs shall be 1/2” inch thick prefinished plywood.
         b) Fixed backs:
            i) Exposed back on fixed or movable cabinets: 3/4 inch thick plywood with the exterior surface
Flexible rail mounted cabinet backs: 3/4 inch thick plywood structurally doweled into cabinet sides and top panels.

Removable backs: Provide removable backs for service access where shown on the project drawings.

Fixed base and tall units have an individual factory-applied base, constructed of 3/4 inch thick exterior grade plywood. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the drawings.

Base units, except sink base units:

a) Full sub-top.

Sink base units:

a) Provide with open top, welded steel/epoxy painted sink rail full width at top front edge concealed behind face rail/doors, and a split back removable access panel.

Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers.

Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.

Edging on exposed and semi exposed edges shall be 1mm PVC.

Adjustable shelf:

a) In heavy-duty storage, and laboratory storage, 3/4 inch plywood laminate up to 30 inches wide shall be used; 1 inch thick plywood laminate over 30 inches.
   i) Front edge: 1mm PVC.
   b) In dining service storage, use stainless steel.

Interior finish:

a) Top, sides, horizontal and vertical members, and adjustable shelving shall be plywood with matching prefinished back.
   b) In dining service storage, heavy-duty storage, and laboratory storage, bottom members shall be plywood laminate.
   c) In all other light-duty applications, bottom members shall be plywood with matching prefinished back.

Exposed ends: Faced with VGS high-pressure decorative laminate.

Wall unit bottom: Faced with laminate.

Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), not permitted.

Drawers:

Sides, back and sub front:

a) Minimum 1/2 inch thick plywood doweled and glued into sides.

Drawer bottom: Minimum 1/2 inch thick plywood, sides are rabbeted to accept bottom of drawer box; drawer box bottom shall be glued to drawer box.

Paper storage drawers:

a) Minimum 3/4 inch thick plywood sides, back, and sub front plywood.
   b) Minimum 1/2 inch thick plywood drawer bottoms screwed directly to the bottom edges of the drawer box.
   c) Provide PVC angle retaining bar at the rear of the drawer.

Door/Drawer Fronts:

Use four (4) screws to fasten drawer fronts to drawer boxes.

Core: 3/4 inch thick plywood.

Provide double doors in opening in excess of 24 inches wide.

Faces:

a) Exterior: VGS High-pressure decorative laminate.
   b) Interior: High-pressure cabinet liner.

Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

Shelving:

Core material: 3/4 inch or 1 inch thick plywood.

Exterior: VGS High-pressure decorative laminate.
Design Guidelines

3) Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.
4) Unless noted otherwise, all shelves shall be adjustable.
5) Sloped Shelves:
   a) Shelves which are sloped shall have a gravity tray.
   b) Install sloped shelves with KV #80 standards and KV #179 or approved equal adjustable shelf brackets.
   c) Sloped shelves are 3/4 inch or 1 inch thick plywood with finish matching open interior selection.
   d) Edge shelves with 3mm PVC lip at the front.

G) Heavy Duty Tables
1) Work tops:
   a) 1 inch thick plywood laminated top surface with HGS/HGP laminate, balanced with backer sheeting.
   b) Edges: 3mm PVC
2) Work top support frame: Furniture grade, epoxy powder coated steel.
3) Under table storage units: Manufacturer’s flexible rail mounted under counter units adapted for installation to work top support frame.
4) Adjustable legs:
   a) 1-3/4 inch x 1-3/4 inch x 14 gauge epoxy powder coated tubing fitted inside 2 inch x 2 inch x 14 gauge with height adjustment.
   b) Heavy-duty, non-marking adjustable floor glides.

H) Utility Chase System
1) Flexible rail utility chase frames:
   a) Epoxy powder coated, steel internal frame assembly.
   b) Dimensionally integrated to align with and accommodate fixed modular or flexible rail-mounted casework and countertops.
2) Flexible rail mounted casework support rail and interfacing support keys:
   a) Extruded aluminum 6061-T6 alloy, epoxy powder coated, concealed structural fasteners secured through portion of closure panel one or both sides as required.
3) Chase access panels: 1mm PVC edges on 3/4 inch thick two-sided plywood.
4) Chase assemblies are pre-drilled to accept other system components.
5) Wing walls: 1 inch thick plywood with high-pressure decorative laminate VGS both sides, 3mm PVC edges, two levelers on bottom edge.
6) Reagent ledges and over-chase shelving: 1 inch thick plywood with 3mm PVC edges; provide laminate surfaces as indicated.

I) Laminated Casework
1) Exposed surfaces, exposed ends, exposed tops, open interiors, and face of doors and drawers shall be laminated.

J) Mobile Storage Units:
1) Tall mobile storage units, as indicated on the drawings, are structural steel framed with epoxy powder coated 2 inch x 1 inch tubing.
2) Casters:
   a) 5 inch soft rubber double ball bearing, heavy gauge steel fork, zinc plate finish with 2 brakes per unit.
   b) Load capacity per caster to be a minimum of 200 pounds.
3) Side panels, back, top, drawer fronts, and doors are of 3/4 inch thick plywood, laminated on the exterior with high pressure decorative laminate VGS and on the interior with high pressure cabinet liner. Exposed edges are PVC banding, 1mm or 3mm thickness, to match adjacent casework.
4) Low mobile storage units are mounted to a caster base.

K) Music Specialty/Heavy Duty Storage Units:
1) Instrument and uniform storage unit:
   a) Exposed exterior finished ends are VGS laminate balanced on interior surface with CLS cabinet liner.
   b) Unexposed End panels and vertical dividers are two-sided plywood, with matching 3mm PVC front edging.
c) Cabinet backs are 1/2 inch thick plywood.

2) Instrument shelves:
   a) 3/4 inch thick plywood.
   b) Shelves shall be adjustable.
   c) Top surface is molded flat stock heavy-duty polyethylene with textured abrasion-resistant finish permanently bonded to shelf.
   d) Front edge of shelf is high-impact resistant PVC extrusion full width of shelf.

3) Wire grille doors:
   a) Heavy gauge rod welded to 3/16 inch diameter vertical; 2-3/4 inch, hospital tip, 0.095 inch thick steel, five knuckle hinges welded to door.
   b) Epoxy powder coated spring-loaded locking latch with integral label holder, padlock eye, and rubber bumper.
   c) Latch is covered with a vinyl protection cap.

4) Solid doors:
   a) 3/4 inch thick plywood laminated with VGS laminate on the exposed surface and balanced with cabinet liner on the interior surface.
   b) 3mm PVC edged doors and five knuckle, 2-3/4 inch, hospital tip, 0.095 inch thick steel epoxy powder coated hinges, spring loaded locking latch with integral label holder, padlock eye, and rubber bumper.
   c) Latch is covered with a vinyl protection cap.

5) EXECUTION

A) Product Handling
   1) Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 20 percent to 50 percent.
   2) Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

B) Environmental and Site Conditions:
   1) Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
   2) Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   3) After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.
   4) Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.
   5) The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions.
   6) Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

C) Installation:
   1) Condition casework to average prevailing humidity conditions in installation areas prior to installing.
   2) Erect casework, plumb, level, true and straight with no distortions.
   3) Shim as required.
   4) Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
   5) Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.
   6) Repair minor damage per plastic laminate manufacturer’s recommendations. Replace other damaged cabinets or materials.

D) Cleaning:
   1) Leave cabinets vacuum cleaned inside and out.
   2) Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the General Contractor.
   3) Remove and dispose of all packing materials and related construction debris.
**Division 07 Thermal & Moisture Protection**

### 07 05 00 Common Work Results for Thermal & Moisture Protection

1. All roof levels above one story must have an access by means of hatch, door, or by another roof level.
2. A ships ladder shall be provided for access to roof hatch with a landing at 48” below the hatch; a switched light shall be provided at the top of the landing.
3. Roofing Projects
   - **Roof Drains:** Drains shall be maintained at the current elevations with insulation sump to drain.
   - **Plumbing/HVAC:** All work requiring roof-top units and plumbing fixtures to be modified for the roof work is the responsibility of the roof contractor. All work shall be performed by a licensed contractor that has been approved by the Owner.
   - **Electrical:** All work requiring any electrical and telecommunication line to be modified for the roof work is the responsibility of the roof contractor. All work shall be performed by a licensed contractor that has been approved by the Owner.
   - **There shall be a minimum of one 20-pound fire extinguisher, type ABC, for each open flame, torch, or kettle that is located on the job site.
   - **Re-burners must be utilized with all tar kettles to minimize noxious fumes.
   - **Roof replacement projects that are more than two stories above the ground require the use of chutes to contain the debris removed. The use of cranes, forklifts, and other means that will bucket the material off the roof is acceptable.
   - **Existing surface areas, hard and landscaped surfaces, shall be protected. No additional roofing will be removed without approval from Owner. Existing surfaces damaged by the contractor shall be removed and replaced at contractor’s expense.**

### 07 10 00 Dampproofing and Waterproofing

1. A bituthane membrane system should be used for water-proofing all exposed wall surfaces.

### 07 21 00 Thermal Insulation

1. ASHRAE Standard 90.1-2004 shall be followed.
2. **Roof Insulation:**
   - **A)** The primary insulation shall be polyisocyanurate with a 0.50 inch fiberboard top sheet
   - **B)** Design a 0.25 inch per foot slope in all new construction
   - **C)** Provide on new construction a minimum R-26 insulation value.

### 07 26 00 Vapor Retarders

1. Vapor barriers shall be used where high moisture content areas exist such as pools, showers, residence halls, and food service areas.
2. A minimum six mil. poly vapor barrier shall be used and should be installed to wrap up six inches on blocking and nailed six inches on-center on the blocking.

### 07 50 00 Membrane Roofing

1. No. 1 grade non-reinforced Ethylene, Propylene, Diene, Terpolymer (EPDM), minimum 60-mils thickness.
   - **A)** On roofs with exhaust hoods that emit oils & chemicals that could damage the membrane, provide a slip sheet around the perimeter of the unit with this continuing to the nearest drain.
   - **B)** If the roof has several units that emit oils & chemicals that could damage the membrane, a suitable membrane that is resistant to these materials should be used.
2. All seams shall be fastened using the manufacturer’s three-inch seam tape.
3. Any seams with more than 0.5 inch of tape visible will be covered with manufacturers six-inch cover strip.
4. Perimeter and curb fastening shall use the manufacturers reinforced nailer strip, minimum six-inch wide, fastened every six inches using a one-inch fastening (batten) bar.
5. Perimeter fastening plates are not allowed as means of securing the perimeter strips.
6. Preformed EPDM sleeves and flashing shall be minimum 60 mils thickness with manufacturers stamp.
7. Fully adhered and mechanically fastened roof membranes are preferred for flat surfaces.
   - **A)** Mechanically fastened membranes shall be reviewed upon installation.
B) Ballasted roofs and self-adhering membranes allowed as required.

07 60 00 Flashing and Sheet Metal

1) Sheet Metal Roofing
   A) Flashing trim and standing seam roof panels shall be fabricated of zinc-coated steel conforming to the G90 coating designation, aluminum-zinc alloy coated steel conforming to the AZ50 coating designation, or aluminum-coated steel conforming to Mil. Spec, Typ II.
   B) Minimum thickness of the sheet metal shall be 22 gauge.
   C) Scuppers and downspouts shall be opened faced and match the roof flashing trim color.
      1) For downspouts, utilize a colored liner with horizontal strapping four feet on center for support.
      2) Avoid placing a downspout on the north elevation.
   D) Line all mechanical curbs and roof hatches with sheet metal.
   E) Install 20 gauge aluminum mechanical clips on all paving blocks. Provide 24 gauge galvanized iron, continuous cee-channel edging at perimeter or all corner pavers.

07 70 00 Roof and Wall Specialties and Accessories

1) Unit pavers are not permitted.

07 90 00 Joint Protection

1) Acceptable polyurethane sealants are Tremco and Sika-flex or approved equal in a single or multiple components.
   A) Acceptable silicone sealant to be used where there is glazing installed and not where sealant will be immersed in water continuously.
   B) A closed cell PVC backer rod that is 30 to 50 percent larger than the joint width shall be used at each joint.
2) All exterior surfaces such as louvers, lights, outlets, etc. shall be caulked.
3) All interior tile corners of bathrooms shall be caulked.
Division 08 Openings (Doors & Windows)

08 05 00 Common Work Results for Openings

1) Doors and Frames:
   A) Exterior entrances, doors, and hardware requirements:
      1) Vestibules should be designed at all entrances to control building environment.
      2) Power door operator:
         a) Verify power door operator and push pad locations with the Owner.
      3) Recess exterior entrances three feet (3’-0”) into the building to protect the door from the elements;
         emergency exits and other infrequently used exterior doors need not be recessed.
      4) All exterior doors shall latch when closed.
   B) Service Entrance, loading dock, overhead door:
      1) Consult the Owner concerning potential planning and future development of areas adjoining the
         project site.
      2) Furnish a service entrance to the building for moving equipment to, and from facility.
      3) Provide openings in buildings of sufficient size to permit ingress of the largest piece of equipment or
         machinery which could be needed in the future within reason.
         a) Incorporate a study of trash disposal and/or removal.
         b) The University utilizes a containerized waste disposal pickup system.
   C) Entrances to restrooms shall be designed with consideration to sanitary and line of sight concerns. Provide
      doors with maintenance locking capability.

08 10 00 Doors and Frames

1) Individual doors shall be three feet wide and seven feet tall (3070) unless approved by Owner.
2) Double doors shall be installed with a keyed removable mullion.
3) Doors with fire rated labeling over 20 minutes are to be hollow metal or as approved by Owner.
4) Coordinate with owner requirements for vision panels and/or sidelights.
5) Wood frames are allowed in very limited cases and only with Owner’s approval.

08 11 13 Hollow Metal Doors and Frames

1) All hollow metal frames and doors shall meet National Association of Metal Manufacturer’s specifications.
2) The same manufacturer shall be used for all hollow metal doors and frames throughout the project.
3) Hollow Metal Frames:
   A) Approved manufacturers are Ceco, Curies, and Steelcraft, or approved equal.
   B) Manufacturer shall provide documentation for UL 10C, or other approved testing agency, stating that
      hollow metal applications have passed UL 10C. All necessary instructions and documentation shall be
      supplied to the job site, as required for code official’s approval.
   C) Frame Assembly/Production:
      1) All frames shall be fourteen (14) gauge and comply with ASTM S569 and A568.
      2) Fully back weld inner jamb including stops. A sample section of welded frame corner shall be
         submitted for review at architect’s request. “Knock-down” frames will be allowed in limited cases
         with owner approval.
      3) Reinforce frame hinges with a ten (10) gauge steel bar welded internally.
      4) Reinforce frame head with a seven (7) gauge steel plate welded inside frame for surface mounted
         closures, overhead stops, and hold opens.
      5) Reinforce frame for rim mounted strikes with ten (10) gauge steel sheet welded inside of jamb.
      6) Frames shall be tenon and butt type construction with face corners mitered.
      7) Weld all field splices to match frame.
      8) Frames shall be cold rolled, pickled, and annealed steel, free from scale, pits, and other defects.
      9) Splices must be welded, ground smooth, and puttied if necessary to conceal splice.
     10) After all required preparatory work, the frames shall be coated with a zinc rich primer over the
         grinding area and finished with a matching prime paint.
     11) Bituminous Coating: Frames used in a wet environment are to receive a supplier applied asphalt
         emulsion or other high-build, water-resistant resilient coating.
12) Provide a minimum of 3 anchors per side of a standard height frame or 2’-6” on center. Provide additional anchors per manufacturer’s recommendations for frames 7’-6” and higher and fire rated frames.

13) Provide all necessary sleeves or clips for frame splices.

14) Frames shall have three (3) rubber silencers per single door and two (2) per double door.

D) Frames for Exterior Doors
1) Exterior sidelight frames to be glazed with 1” tempered insulated low-E glazing wherever possible to reduce energy loss.
2) Brush-type weather stripping is to be installed where exterior door meets frame.

E) Frames for Interior Door Frames
1) Interior sidelight frames to be glazed with 1/4” laminated glazing or tempered glazing.

F) Frames for electronic access-controlled doors:
1) Frames for electronic access-controlled doors shall be prepared with an electrical junction box located behind the middle hinge with three-quarter inch (3/4") EMT conduit extended to 6” above the top of the frame.
   a) Middle hinge location shall be prepped, with no field work required, to accept an electronic power transfer hinge with monitor as manufactured by Stanley Security Solutions or approved equal.

G) Strikes for cylindrical locks shall be 4 7/8” and conform to ANSI A115.1 and A115.2 specifications.

4) Hollow Metal Doors
   A) Approved manufacturers are Ceco, Curies, or Steelcraft, or approved equal.
   B) Manufacturers shall provide documentation for UL 10C, ANSI A250.4, ANSI A250.5, or other approved testing agency stating that hollow metal applications have passed testing. All necessary instructions and documentation shall be supplied to the job site as required for code official’s approval.

C) Door Assembly/Production:
1) All doors shall be sixteen (16) gauge cold rolled steel with vertically stiffening reinforcements. Reinforce top and bottom of the door with eighteen (18) gauge steel channel welded to face skins.
2) All seams and exposed fasteners shall be continuously welded and ground smooth, completely sealed, and watertight.
3) Putty or fillers on door edges will not be allowed.
4) Reinforcement for rim exit devices shall be fourteen (14) gauge continuous steel channels projection welded or bonded to the door edge at lock and hinge side of door.
5) Reinforcement for cylindrical locksets shall be fourteen (14) gauge steel projection welded to the edge of the door. The reinforcement should include tabs to center the latch both horizontally and vertically.
6) Reinforcement for surface mounted vertical latches shall be fourteen (14) gauge steel plate at top and bottom of doors.
7) Reinforcement for flush bolts shall be sixteen (16) gauge steel angle projection welded to the edge of the door or a fourteen (14) gauge steel astragal with tabs drilled and tapped to receive flush bolts.
8) Reinforcement for surface mounted door closers and overhead stops / hold opens shall be fourteen (14) gauge steel channel 14”deep x 20” long.
9) Doors for electronic access-controlled openings shall be prepared with three-quarter inch (3/4”) EMT conduit extended from middle hinge to lockset.

D) Exterior Doors:
1) Exterior and vestibule locations shall be hot dipped galvanized steel having A60 zinc-iron alloy coating per ASTM 924.
2) Tops of exterior doors are to be flush. Flush top cap can be welded or applied with screws to secure top cap into top channel of door.
3) Exterior doors are to be insulated.
4) Exterior door edges shall be continuously welded and ground smooth.
5) Brush-type weather stripping is to be installed at the base of exterior doors.
6) Provide a minimum six inch (6”) center stile for panic device between glazing on exterior doors. Provide an eight inch (8”) minimum rail on doors with panic devices. Other doors match horizontal
stiles on the door with the frame.

7) Avoid dark color finish paints on exterior applications. Dark colors may absorb heat from the sun and swell the door causing the door to bind with the frame.

8) Light kits on exterior door must have removable stops on the inside only. Glazing is to be one inch, tempered, low-E insulated wherever possible to reduce energy loss.

9) Doors for electronic access-controlled openings shall be prepared with three-quarter inch (3/4”) EMT conduit extended from middle hinge to lockset.

E) Interior Doors:
1) Light kits on interior doors may be two-piece with exposed fasteners using 1/4” laminated glazing.

F) Doors being prepped for electric locks:
1) Middle hinge plate will be prepped to accept an electronic power transfer hinge with monitor manufactured by Stanley Security Solutions, or approved equal.
2) Three-quarter inch (3/4”) EMT conduit will be installed between the middle hinge plate and the lockset.

08 11 16 Aluminum Doors and Frames
1) All frames and doors shall meet the Aluminum Association, Incorporated specifications.
2) The same manufacturer shall be used for all aluminum doors and frames throughout the project.
   A) Acceptable suppliers are Fargo Glass, Davtech, Red River Glazing or approved equal.
3) Aluminum Frames
   A) Frame Assembly/Production:
      1) Frames shall be 1-3/4” x 6” with a minimum wall thickness of 0.125 inches extruded aluminum. The corner brackets shall be extruded aluminum with fully welded corners and fastened with stainless steel screws.
      2) Hinge side of the frame shall be reinforced with a full length 1-1/2” by 1-1/2” by 3/16” steel angle; the butts are to be tapped directly into the steel.
      3) Frame finishes shall be clear anodized, dark bronze anodized, black anodized or custom color with approval by Owner.
      4) Brush-type weather stripping is to be installed where door meets frame.
      5) Exterior sidelight frames are to be glazed with 1” tempered insulated low-E glazing wherever possible to reduce energy loss.
      6) Interior sidelight frames are to be glazed with 1/4” laminated glazing.
   B) Frames for Electronically Access-Controlled Doors:
      1) Frame assemblies for electronic access-controlled doors shall be prepared with a three-quarter inch (3/4”) EMT conduit between an electrical junction box located behind middle hinge and the top of the frame assembly.
      2) Middle hinge location will be prepped to accept an electronic power transfer hinge with monitor manufactured by Stanley Security Solutions.
4) Aluminum Doors
   A) Aluminum door material shall be extruded aluminum with a minimum thickness of 0.125 inches. The corner brackets shall be extruded aluminum with fully welded corners and fastened with stainless steel screws.
   B) Door Assembly/Production:
      1) Hinge style of door shall be reinforced with a full length 3/16 inch by 1.5 inch flat steel bar; the butts are to be tapped directly into the steel bar.
      2) Doors are to have a minimum eight inch (8”) top rail, a six inch (6”) mid rail, a ten inch (10”) bottom rail, and four and one half inch (4 1/2”) stile. Provide an eight inch (8”) minimum stile on doors with panic devices.
      3) Door finishes shall be clear anodized, dark bronze anodized, black anodized or custom color with approval by Owner.
   C) Exterior Doors:
      1) Exterior door light kit glazing is to be one inch, tempered, low-E insulated wherever possible to reduce energy loss.
      2) Brush-type weather stripping is to be installed at the base of exterior doors.
3) Provide all exterior doors with a channel for wiring of electrified panic devices or locksets from the electrified hinge location.

D) Interior Doors:
   1) Interior door light kit glazing is to be 1/4" laminated glazing or tempered glazing.

E) Electronically Access-Controlled Doors:
   1) Doors being prepped for an electrified lock and/or a door monitor switch:
      a) Middle hinge plate shall be prepped to accept an electronic power transfer hinge with monitor switch by Stanley Security Solutions.

08 31 00 Access Doors and Panels
   1) Provide access door of sufficient size in hard surface walls and ceilings as required. Lockable access door shall accept Best core.

08 50 00 Windows
   1) In air-conditioned buildings, provide fixed windows unless approved by Owner. Where installed, movable sash units shall be lockable.
   2) Specify windows that have integral weather-stripping and thermal break. Provide testing as an option at the Owner’s request.
   3) Windows with an internal core of wood is to be used in historical renovation only.
   4) A dark anodized aluminum clad window is preferred.
08 70 00  Hardware

1) All door hardware shall be installed per manufacturer’s instructions with manufacturer supplied fasteners. Hardware and doors installed with any other fasteners will be replaced at contractor’s expense.

2) Finishes and base materials

   A) Except where indicated otherwise, hardware finishes shall be applied over base metals as specified in the following finish schedule:

<table>
<thead>
<tr>
<th>Hardware Item</th>
<th>Finish &amp; Base Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Hinges</td>
<td>US32D (BHMA#630)</td>
</tr>
<tr>
<td>Interior Hinges</td>
<td>US26D (626 or 652)</td>
</tr>
<tr>
<td>Flush Bolts</td>
<td>US26D</td>
</tr>
<tr>
<td>Exit Devices</td>
<td>Extruded aluminum with US32D touch pad</td>
</tr>
<tr>
<td>Locks and Latches</td>
<td>US26D</td>
</tr>
<tr>
<td>Pulls and Push Plates/Bars</td>
<td>US32D</td>
</tr>
<tr>
<td>Coordinators</td>
<td>Prime painted or mill aluminum</td>
</tr>
<tr>
<td>Closers</td>
<td>Powder coat aluminum</td>
</tr>
<tr>
<td>Protective Plates</td>
<td>US32D</td>
</tr>
<tr>
<td>Overhead Stops</td>
<td>US32D</td>
</tr>
<tr>
<td>Wall Stops and Holders</td>
<td>US26D or US32D</td>
</tr>
<tr>
<td>Thresholds</td>
<td>Mill Aluminum</td>
</tr>
<tr>
<td>Weather-strip, Sweeps Drip Caps</td>
<td>Aluminum Anodized</td>
</tr>
<tr>
<td>Magnetic Holders</td>
<td>US2CD (603)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>US26D on brass or bronze</td>
</tr>
</tbody>
</table>

3) Door hinges

   A) All doors sized 3070 and smaller shall be prepped for a minimum of one and a half (1-1/2) pair of butts (4-1/2" x 4-1/2"). All doors sized larger than 3070 shall be prepped for a minimum of two (2) pair of heavy-duty butts (4-1/2" x 4-1/2").

   B) Aluminum store front entrance doors shall be prepped for a minimum of two (2) pair of heavy-duty butts (4-1/2" x 4-1/2").

   C) Acceptable manufacturers are Hager, Ives, PBB, Stanley, McKinney or approved equal.

   D) Door hinges on interior doors shall be ANSI A8112 hinges.

   E) Door hinges on exterior doors shall be ANSI 5111 hinges.

   F) Hinges shall be only ball bearing (BB) throughout the project.

   G) All frames and doors shall be tapped for manufacturer’s fasteners.

   H) Fasteners, exposed either when the door is open or closed, shall have Phillips-heads.

   I) Electrified hinges:

      1) Stanley Security Solutions Incorporated or approved equal will be supplier of electrified power transfer hinges.

      2) Electrified hinges will be monitor magnetic type

      3) Electrified hinges will be ten through wire type

4) Flush Bolts

   A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers:

<table>
<thead>
<tr>
<th>Door Control Int.</th>
<th>Ives</th>
<th>Sargent</th>
</tr>
</thead>
<tbody>
<tr>
<td>780</td>
<td>FB458</td>
<td></td>
</tr>
<tr>
<td>842</td>
<td>FB32</td>
<td></td>
</tr>
<tr>
<td>942</td>
<td>FB42</td>
<td></td>
</tr>
<tr>
<td>845</td>
<td>FB52</td>
<td></td>
</tr>
<tr>
<td>945</td>
<td>FB62</td>
<td></td>
</tr>
</tbody>
</table>

5) Removable Mullions

   A) When the size of an opening requires a pair of doors a keyed, removable mullion shall be used.

      1) In locations where a mullion cannot be used, surface mounted flush bolts, automatic flush bolts, or
vertical rods with less bottom rod may be used with the approval of the Owner.

B) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Duprin</td>
<td>KR4954, KR9954</td>
</tr>
</tbody>
</table>

Exit Devices

6) Exit Devices

A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Duprin</td>
<td>98 Series, QEL 98, 996-17, 990, XP, RX, LX</td>
</tr>
</tbody>
</table>

B) The entire project shall have exit devices supplied by one manufacturer only.

C) Exit Devices shall be surface mounted per manufacturer’s template to ensure proper distance between the strike and the latch.

D) All security devices and fire rated devices must have deadlocking latchbolts.

E) In situations where vertical rods are used on fire rated non-secure openings, use vertical rods with less bottom rod.

F) All exit devices are to have cylinders for Best Access Systems Core Max 7-pin small format interchangeable cores.

G) When intruder devices are warranted, use “-2” (double cylinder) function so the inside cylinder locks and unlocks the outside trim and the outside cylinder retracts the latchbolt.

H) The dogging on non-labeled doors shall be by cylinder dogging.

I) Where exit device is used for electronic access:
   1) A night latch function on the panic device is required.
   2) Do not use dogging of any kind.
   3) Do not use “-2” or any other double cylinder function.
   4) Latch retraction is the standard (electrified trims may be used in some situations). Electric strikes will not be used.
   5) Provide the power supply recommended by the device’s manufacturer.

J) Provide point to point wiring diagrams from hardware supplier.

Locks and Latches

7) Locks and Latches

A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best</td>
<td>93K LM 14D</td>
</tr>
<tr>
<td>Schlage</td>
<td>D Series Vandlguard / Sparta</td>
</tr>
</tbody>
</table>

B) Locksets shall be cylindrical type with lever handle and the product of one manufacturer throughout the project.

C) Cores shall be Best Access Systems 7-pin small format interchangeable cores. Contractor is responsible to purchase final keyed combined cores for final keying.

D) Backsets are limited to 2-3/4" or 3-3/4" on all locksets, deadlocks, and latch sets.

E) Latch or dead bolt throw on pairs of doors shall be not less than 5/8 inch.

F) When a situation calls for an intruder lockset, use ANSI #F88 for cylindrical.

Keying

8) Keying

A) Contractor shall provide the lock cores as determined by Owner’s keyway requirement. Owner will provide the building master key codes and install the final lock cores.

B) Cores shall be Best Access Systems 7-pin small format interchangeable cores in the keyway as specified by Owner. Provide two blank keys for each core.

C) Best cores shall be supplied for garage doors, roll-up gates, rolling shutters (aka Roll-up doors), elevator key switches, and padlocks.
D) Keys for specialty items such as directory boards, cabinets, napkins dispensers, towel and fire cabinets, etc., shall be properly identified and turned over to the Owner upon completion of the project. All directory boards should be keyed alike, however, a different key is used for towel dispensers, but all towel dispensers should be keyed alike.

9) Pulls, Push Plated, and Push Bars
   A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers.

<table>
<thead>
<tr>
<th>Item</th>
<th>Hiawatha</th>
<th>Burns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1” dia. Pull</td>
<td>HG111</td>
<td>M26D</td>
</tr>
<tr>
<td>1” dia. Push Bar</td>
<td>HG114</td>
<td>M422</td>
</tr>
<tr>
<td>Push/Pull Plate</td>
<td>200F</td>
<td>54</td>
</tr>
<tr>
<td>1” Pull</td>
<td>523A</td>
<td>25B</td>
</tr>
</tbody>
</table>

10) Coordinators
    A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers.

    | Item | Hiawatha |
    |------|----------|
    | Ives | COR      |

11) Door Closers
    A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers.

    | Item | Hiawatha |
    |------|----------|
    | LCN  | 4040 XP  |

    B) EDA arm when mounted parallel arm.
    C) When reveal is less than 3” use 4040XP-30 bracket.
    D) When cushion arm is used, use 4040XP-3077SCNS.
    E) Always use 4040XP for exterior and vestibule doors.
    F) Door closers shall be surface mounted.
    G) Thru-bolts are required when fastening to wood fire doors.

12) Low Energy Automatic Operators
    A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers.

    | Item     | Hiawatha |
    |----------|----------|
    | Besam    | PowerSwing |

    B) Power swing with on/off switch
    C) Door decals
    D) 6” press wall activation pads
    E) Since all exterior doors are to close and latch, the power door operator will need to activate panic device when activation pad is touched.
    F) All operators on electronic access system shall have relay so operator and access system work together. Provide relays for interface to access control system electrified door hardware.

13) Kick Plates and Mop Plates
    A) Kick plates shall be installed on doors where applicable.
    B) Acceptable manufacturers are Hiawatha, Burns, Ives or approved equal.
    C) All kick plates shall be ten (10) inches high and two (2) inches less door width.
    D) Thickness to be sixteen (16) gauge (0.05 inches).
    E) Plates shall have countersunk holes and all edges should be beveled.
14) Overhead Stops
   A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers.

<table>
<thead>
<tr>
<th>Ives</th>
<th>Burns</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS407CVX</td>
<td>570</td>
</tr>
<tr>
<td>WS407CCv</td>
<td>575</td>
</tr>
<tr>
<td>WS11X</td>
<td>530</td>
</tr>
<tr>
<td>WS20X</td>
<td></td>
</tr>
</tbody>
</table>

15) Magnetic Hold Opens
   A) LCN, Ives or approved equal.
   B) General Contractor to provide backing.
   C) Magnetic door holds shall be used when individual doors are held open and are required to close due to code requirements.
   D) Connect devices to centralized fire alarm system. Do not use a fusible link door closures.

16) Threshold, Gasketing, and Weather-strip
   A) Acceptable manufacturers or approved equal and respective manufacturers’ part/model numbers.

<table>
<thead>
<tr>
<th>Item</th>
<th>National Guard</th>
<th>Reese</th>
<th>Pemko</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thresholds</td>
<td>425E</td>
<td>5205A</td>
<td>171A</td>
</tr>
<tr>
<td>Gasketing</td>
<td>5050</td>
<td>797B</td>
<td>588D</td>
</tr>
<tr>
<td>Weather-strip</td>
<td>700NA</td>
<td>755A</td>
<td>2891APK</td>
</tr>
<tr>
<td>Drip Strip</td>
<td>16A</td>
<td>R201A</td>
<td>346A</td>
</tr>
<tr>
<td>Sweeps</td>
<td>B606A</td>
<td>964A</td>
<td>18061CP</td>
</tr>
<tr>
<td>Astragel</td>
<td>600A</td>
<td>964A</td>
<td>18061CP</td>
</tr>
</tbody>
</table>

17) Electronic Access System
   A) Every exterior entrance frame shall have an internal one half inch (1/2") EMT installed from an electrical box located behind the center-most hinge to a junction box located above the ceiling.
   B) All exterior doors shall be prepared for power door operators and electronic access systems.
   C) No electric strikes
   D) Interior frames that are being prepared for electronic access shall have an internal one half inch (1/2") EMT installed from an electrical box located behind the center-most hinge to a junction box located above the ceiling.
   E) If magnetic monitoring is used, an internal one half inch (1/2") EMT should be installed from the head (latch side) to a junction box located above the ceiling.
   F) The card access hardware will be installed by owner.
   G) Egress sensors in handle/crash bar where possible.
   H) Door contact sensor in hinge or door strike where possible.
   I) Latch contact sensor in lockset where possible.
   J) At double doors, the non-reader door will have powered hardware and door contacts.
   K) Wire size/type
L) Electronic Access Systems Hardware

1) Cylindrical Electrified Lockset

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer</th>
<th>Part/Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lockset</td>
<td>Best</td>
<td>93KW7DEU – 14D – LM – RQE</td>
</tr>
<tr>
<td>Power Supply (Single Lock)</td>
<td>Best</td>
<td>8WCON</td>
</tr>
<tr>
<td>Power Supply (Multiple Locks)</td>
<td>Altronics</td>
<td>Supervised power supply/charger</td>
</tr>
<tr>
<td></td>
<td></td>
<td>115 VAC 60Hz input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 VDC output @ 10A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 fused outputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 sealed lead-acid batteries, 12AH</td>
</tr>
</tbody>
</table>

Power Transfer: Stanley Security Solutions, CECS 5 knuckle, 8 wire

a) Stanley Security Solutions will be supplier of electronic hinges.
b) Verify power supply locations with architect & electrical engineer.

2) Exit Device or approved equal with Latch Retraction

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer</th>
<th>Part/Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Device</td>
<td>Von Duprin</td>
<td>QEL-LX-RX-XP98L-996L-17</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Von Duprin</td>
<td>PS914-BB-2RS</td>
</tr>
<tr>
<td>Power Transfer</td>
<td>Stanley Security Solutions</td>
<td>CECS 5 knuckle, 8 wire</td>
</tr>
</tbody>
</table>

a) Verify power supply locations with architect & electrical engineer.
b) Where there is more than one door and only one door is electronic access controlled with a card reader, the other doors must have request to exits (RX), latch monitoring (LX) and monitored hinges.
c) If a power door operator is required, verify requirements for the Besam Operator with power door opener vendor.

3) Exit Device or approved equal with Electrified Trim

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer</th>
<th>Part/Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Device</td>
<td>Von Duprin</td>
<td>LX-XP98L-E996L-17</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Von Duprin</td>
<td>PS914-BB-2RS</td>
</tr>
<tr>
<td>Power Transfer</td>
<td>Stanley Security Solutions</td>
<td>CECS 5 knuckle, 8 wire</td>
</tr>
</tbody>
</table>

a) Stanley Security Solutions will be supplier of electronic hinges; verify weight of the hinge (see 08 70 00.5).
b) Verify power supply locations with architect & electrical engineer.
c) Where there is more than one door and only one door is electronic access controlled with a card reader, the other doors must have request to exits (RX), latch monitoring (LX) and monitored hinges.
d) If a power door operator is required, verify requirements for the Besam Operator with power door opener vendor. A second power transfer hinge may be required.
**Division 09 Finishes**

**09 05 00 Common Work Results for Finishes**
1) Ceiling and floor tile, carpet, paint, wood floors, ceramic tile, etc., must have the same batch number when ordering each product in bulk.
   A) Extra quantities of the aforementioned products shall be made available to the Owner, at five (5) percent of the facilities total use, for future use to replace damaged materials (required in 01 78 44).
   B) Discontinued batches or materials will not be accepted.
2) All interior hollow metal frames shall be caulked to drywall after finish coat of paint. Caulk shall match paint color of the door frame.

**09 20 00 Plaster and Gypsum Board**
1) Plastered surfaces should be used in restrooms and residence halls.
2) Specify only 0.625” (5/8”) gypsum wallboard throughout the project and require fastening the studs entire height.
3) Specify high-density gypsum wallboard for all corridors, dining areas, storage rooms, residence halls, classrooms, and other high-use areas. Must be installed to a height of 48”.
4) All drywall to be installed horizontally.
5) A minimum of three coats of taping compound is needed on all walls and ceilings.
6) Tape and compound shall be used on corner beads; corner beads shall be screwed in, not crimped.
7) All taping compound shall be feathered out.
8) Notification is required prior to priming to inspect the taping surfaces first.
9) See section 05 40 00 for Metal Framing requirements.

**09 51 00 Acoustical Ceilings**
1) Use lay in acoustical ceiling tile to provide better access to the building utilities.
2) Suspended ceilings would be best in laboratory and office areas. Confer with the Owner when making this determination.
3) Acoustical plaster and acoustical ceiling tile should not be within touch without the use of a ladder to avoid damage to the finished surface. Minimum height of eleven (11) feet when using this type of material on common area ceilings in resident halls. Provide proper conditions above freezing when applying plaster. Include access panels in all plaster ceiling, where feasible, to provide access to mechanical pipe, duct work, etc.

**09 60 00 Flooring**
1) On high traffic areas, use ceramic tile, quarry tile, epoxy, or other hard surface flooring, to provide an easily maintained surface.
2) The base material shall be inspected by the Consultant prior to installation of the floor system to ensure expansion joints are provided to prevent cracking of floor covering due to settlement and noticeable failure.
3) In classrooms, student rooms, etc., use a vinyl composition tile (VCT) and a minimum four inch vinyl base. Owner will seal and coat all VCT floors.
4) Carpeting is acceptable only in low traffic areas or areas where acoustics or aesthetics are important. Avoid carpet seam placement in traffic-path areas.
5) Restroom flooring shall be a poured, seamless epoxy surface or ceramic tile and shall extend up wall to a height of 4”.
6) Epoxy floors shall have UV protection installed as part of the system.

**09 68 00 Carpet**
1) Pile shall be solution/yarn dyed with a minimum of 26 ounces.
2) Primary backing shall be woven polypropylene, high performance moisture barrier; secondary backing shall be “HP (High Performance)”.  
3) Fiber shall be 100% Invista Antron Legacy, Lumena, or Ultron Type 6.6 nylon
4) Install carpet using the manufacturer’s recommended adhesive applied at the manufacturer’s recommended spread rate.
5) Seam Seal all seams within the field of the carpet using the manufacturer’s approved product.
6) All carpet shall be installed having a tight fit against all surfaces.
7) Carpet shall be installed so as to minimize the overall lineal footage of seams required. Consider locating seams in order to maximize the useful life of carpet.
8) Ceiling and floor tile, carpet, paint, wood floors, etc., must have the same batch number when ordering each product in bulk. Extra quantities of the aforementioned products shall be made available to the Owner, at five (5) percent of the facilities total use, for future use to replace damaged materials. Discontinued batches or materials will not be accepted.

09 70 00 Wall Finishes
1) Provide washable finishes on all surfaces.
   A) On corridor walls, use either glazed brick, ceramic tile, or marble, which can be maintained with the least amount of effort.
   B) Vinyl wall covering is not allowed.
2) An easily cleanable, washable base material, a minimum four (4) inches high, should be installed throughout.
   1) When applying wood paneling over drywall or plaster, place joints on the center of stud and off the drywall joint to accommodate nailing.
   2) Vinyl wall coverings are not allowed.
   3) A hard-wearing washable surface shall be provided on walls in classrooms, especially beneath instructional boards.
3) In shower and drying room installations, provide glazed block on walls with cement plaster ceiling.

09 90 00 Painting and Coating
1) All paints shall be zero VOC.
2) Paint includes coating system materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats. Owner maintains a record of colors used throughout the campus which is to be complied with for renovation projects.
3) The semi-gloss paint grade shall be 100% Acrylic Latex with a specular gloss (sheen) not to exceed 25-45 units at 60° Fahrenheit. Verify with MSDS that the paint contains not less than 30% solids.
4) Varnish shall be a polyurethane composition for durability and quick drying periods. A compatible sealer is used on all varnished surfaces.
Division 10 Specialties

10 11 00 Visual Display Surfaces
1) All white boards and cork boards shall be mechanically fastened onto walls; gluing will not be allowed.
2) Support system:
   A) Extruded aluminum, 6061-T6 alloy, support keys securely mounted through continuous galvanized mounting strips on back of unit.
   B) Units over 13 inches high have 2 pair of support keys 5 modules apart vertically to allow height adjustment.
   C) Support keys interface horizontal support rail.
   D) Stand-off extrusion is provided on each unit to hold vertical surface parallel to wall surface.
3) Markerboard: Porcelain enamel on steel, minimum 26 gauge, laminated to 3/4 inch thick particleboard core using water-proof adhesives.
4) Tackboard: 1/4 inch thick tac-tex vinyl impregnated cork laminated to 1/2 inch thick particleboard core using water-proof adhesives.
5) Back surface sealed with 0.015 aluminum moisture barrier. Radius corners 2 inches. Edges finished with PVC with custom overhang lip.
6) Stiffen boards to minimize flexing.

10 13 00 Directories
1) Contact Owner for installation locations of directory boards.
   A) Use a minimum two-door, three (3) foot high by four (4) foot wide directory board with locks.
   B) Match directory boards finish with the room door hardware finish.

10 14 00 Signage
1) Buildings and the departments within are identified by the NDSU supplied stand-alone green building sign. The colors used shall be:
   A) Pantone 342 Green
   B) Pantone 123 Yellow
2) No logo or discipline sign is to be installed or applied to a building’s exterior.
3) If lettering is to be installed, it shall be six (6) inch cast aluminum with a matte edge and clean anodized finish such as #507 Heavy Ribbon style, provided by A.R.K. Ramos. Owner will provide electronic file of the text to the contractor to use for ordering exterior lettering.
4) Final room identification and numbers will be provided by the Owner.
   A) The Owner’s room numbering are the record numbers that the mechanical Building Control Unit and the electrical panels will use.
   B) Signage shall be manufactured by Orbus, Vista or approved equal.
5) For building Plaque requirements, see Exhibit E-12.

10 28 00 Toilet and Bath Accessories
1) Toilet and bath partitions
   A) Toilet and shower partitions shall be ceiling hung and urinal partitions shall be fastened to same wall as the urinal.
      1) All partitions shall use Phillip head, stainless steel fasteners; do not use security screws.
   B) Ceiling hung partitions shall be firmly installed at ceiling level to ten (10) inch by 10.5 weight cee-channel welded to 3x3 angle iron bracing that is firmly fastened to structure. The bottom of the cee-channel is to be at the ceiling elevation that the wallboard/plaster will cover with no gap in between.
   C) All hardware shall be standard manufacturer’s stainless steel.
   D) Latch and keepers shall be surface mounted, bolt-type.
   E) Standard manufacturer’s stainless steel hinges may be used on steel partitions; stainless steel piano hinges are to be used on solid-polymer partitions.
2) Dispensers
   A) NDSU will supply liquid soap dispensers, surface mounted paper towel dispensers and waste paper containers. Items shall be installed by contractor.
   B) The contractor shall furnish the following restroom accessories made of stainless steel with a No. 4 satin
Design Guidelines

Facilities Management

finish:
1) Surface mounted two-roll toilet paper dispensers, one per toilet stool (Impact Products Model 2501)
2) Surface mounted dual sanitary napkin tampon dispensers, 25 cents denomination notation, one per women’s room (Hospital Specialties Model NETWORK).
3) Partition mounted sanitary napkin receptacles, one per women’s stall (Rubbermaid Model 6140)
4) Surface mounted channel frame mirror sized to cover china basin(s) without a break
   C) Verify current product with the Owner’s Associate Director.

10 44 00 Fire Protection Specialties

1) Fire Extinguisher: Provide 10 pound ABC all-purpose extinguishers (Minimum 3-A: 40-B:C) in each fan, elevator machine, and mechanical equipment room.
2) In public areas, use 5 pound ABC all-purpose fire extinguisher (Minimum 2-A: 10-B:C).
   A) Install the fire extinguishers in recessed wall cabinets equipped with theft resistant, replaceable plastic locks and an acrylic plastic window.
   B) Key all boxes alike.
   C) The glass shall be transparent enabling the owner to view extinguisher pressure gauge.
Division 11 Equipment

11 21 23 Vending Equipment
   1) Program areas for vending machines including data connections, power, and proper ventilation.

11 52 13 Projection Screens
   1) Da Lite model E800-11 shall not be used.
Division 12 Furnishings

12 20 00 Window Treatment
1) Blinds or shades are to be installed in all exterior windows; discuss with Owner regarding window treatment of interior windows.
2) Standard design shall be based on (Architect may consult Owner with alternatives):
   - **Brand**: Hunter Douglas
   - **Material**: .008 Gauge Aluminum
   - **Slat Size**: 1”
   - **Color**: #002 Alabaster
   - **Style**: “Lightlines”

12 30 00 Manufactured Casework
1) See also section 06 41 00.
2) Manufacturers who wish to supply cabinetry must be approved prior to the bid by submitting a sample that meets the requirements in the casework specifications (Sections 06 41 00 and 12 30 00). Consult the Owner’s Cabinet Shop prior to specifying this section.
3) Design cabinets to be impermeable to anticipated corrosive materials and liquids.
4) Flammable storage cabinets shall have self-closing hinges.

12 31 00 Manufactured Metal Casework
   **Part 1 - General**
1) Description
   - **A)** This section specifies metal casework and related accessories, including base cabinets, wall cabinets, and full height cabinets.
   - **B)** Items specified in this section:
     1) Laboratory and Hospital Casework: Prefixed by “VL” AND “M”, including metal casework of the following types:
        a) Wardrobe Cabinet, Metal, 5A (SD123100-02)
        b) Wall Cabinet, Metal, 5B (SD123100-01).
2) Related Work
   - **A)** Color of casework finish: Section 09 06 00, SCHEDULE FOR FINISHES.
   - **B)** Electrical Components: Division 26, ELECTRICAL.
3) Quality Assurance
   - **A)** Approval by Contracting Officer of proposed manufacturer, or suppliers, will be based upon submission by Contractor certification that, manufacturer regularly and presently manufactures casework specified as one of their principal products.
   - **B)** Installer has technical qualifications, experience, trained personnel, and facilities to install specified items.
   - **C)** Furnish supervision of installation at construction site by a qualified technician regularly employed by casework installer.
4) SUBMITTALS
   - **A)** Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
   - **B)** Certificates:
     1) Manufacturer’s Certificate of qualifications specified and finish on casework.
     2) Contractor’s Certificate of installer’s qualifications specified.
     3) Safety glass meets requirements of ANSI Standard Z97.1.
   - **C)** Manufacturer’s Literature and Data:
     1) Brochures showing name and address of manufacturer, and catalog or model number of each item incorporated into the work.
     2) Manufacturer’s illustration and detailed description.
     3) List of deviations from contract specifications.
     4) Locks, each kind
   - **D)** Shop Drawings (1/2 Full Scale):
     1) Showing details of casework construction, including kinds of materials and finish, hardware,
accessories and relation to finish of adjacent construction, including specially fabricated items or components.

2) Fastenings and method of installation.
3) Location of service connections and access.

E) Samples:
1) Metal plate, 6” square, showing chemical resistant finish, in each color.
2) One complete casework assembly, including cabinet(s) with drawers and cupboard.
3) One glazed sliding door with track and pertinent hardware. A complete cabinet may be submitted to fulfill this requirement.
4) Cabinets for subsequent installation may be submitted for above requirements.

5) APPLICABLE PUBLICATIONS
A) Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B) American Society for Testing and Materials (ASTM):
   1) A36/A36M-08  Carbon Structural Steel
   2) A167-99(R 2009) Stainless and Heat-Resisting Chromium Steel Plate Sheet and Strip
   3) A283/A283M-03(R 2007) Low and Intermediate Tensile Strength Carbon Steel Plates
   4) A568/A568M-09  Steel, Sheet, Carbon and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled, General Requirements
   5) A794/A794M-09  Standard Specification for Commercial Steel (CS), Sheet, Carbon (0.16% Maximum to 0.25% Maximum) Cold Rolled
   7) C1036-06  Flat Glass

C) American National Standard Institute:
   1) Z97.1-09  Safety Glazing Material used In Buildings

D) Builders Hardware Manufacturers Association (BHMA):
   1) A156.1-06  Butts and Hinges
   2) A156.9-10  Cabinet Hardware
   3) A156.5-10  Auxiliary Locks and Associated Products
   4) A156.11-10  Cabinet Locks
   5) A156.16-02  Auxiliary Hardware

E) American Welding Society (AWS):
   1) D1.1-10  Structural Welding Code Steel
   2) D1.3-08  Structural Welding Code Sheet Steel

F) National Association of Architectural Metal Manufacturers (NAAMM):
   1) AMP 500-505-06 Series  Metal Finishes Manual

G) U.S. Department of Commerce, Product Standard (PS):
   1) PS 1-95  Construction and Industrial Plywood

H) Federal Specifications (Fed. Spec.):
   1) FF-N-836D  Nut, Square, Hexagon Cap, Slotted, Castle Knurled, Welding and Single Ball Seat Anchors
   2) A-A-55615  Shield, Expansion; Nail Expansion (Wood Screw and Lag Bolt Self-Threading Anchors)

Part 2 – Products

1) Materials
A) Sheet Steel:
   1) ASTM A794, cold rolled, Class 1 finish, stretcher leveled.
   2) Other types of cold rolled steel meeting requirements of ASTM A568 may be used for concealed parts.

B) Structural Steel: ASTM A283 or ASTM A36.

C) Stainless Steel: ASTM A167, Type 302B.

D) Glass:
   1) ASTM C1036 Type I, Class 1, Quality q3,
   2) For Doors: 1/4” thick; except where laminated glass is shown.
3) For shelves: Either 1/4” or 3/8” thick.

E) Laminated Glass:
   1) Fabricate of two sheets of 1/8” thick clear glass, laminated together with a 0.060” thick vinyl interlayer, to a total overall thickness of 5/16”.

F) Glazing Cushions:
   1) Channel shaped, of rubber, vinyl or polyethylene plastic, with vertical flanges not less than 3/32” thick and horizontal web 1/8” thick.
   2) Flanges may have bulbous terminals above the glazing heads or terminate flush with top of beads.

G) Plywood:
   1) Prod. Std. PS 1, seven ply, interior.
   2) Where both sides are exposed, use Grade AA.
   3) Grade AB for other uses.

H) Fasteners:
   1) Exposed to view, chrome plated steel or stainless steel, or finished to match adjacent surface.
   2) Use round head or countersunk fasteners where exposed in cabinets.
   5) Sex Bolts: Capable of supporting twice the load.

2) MANUFACTURED PRODUCTS
   A) When two or more units are required, use products of one manufacturer.
   B) Manufacturer of equipment assemblies, which include components made by other, shall assume complete responsibility for the final assembled unit.
   C) Constituent parts which are alike, use products of a single manufacturer.

3) CASEWORK FABRICATION
   A) General:
      1) Welding: Comply with AWS Standards.
      2) Reinforce with angles, channels, and gussets to support intended loads, notch tightly, fit and weld joints.
      3) Constructed of sheet steel, except where reinforcing required.
   B) Minimum Steel Thickness:
      1) 20 gage - Drawer fronts, backs, bodies, closure plates or scribe and filler strips less than 3” wide, sloping top, shelf reinforcement channel and shelves. Toe space or casework soffits and ceilings under sloping tops.
      2) 18 gage - Base pedestals, casework top sides, back, and bottom panels, closure scribe and filler strips 3” or more. Reinforcement for drawers with locks. Tables legs, spreaders and stretchers, when fabricated of cold rolled tubing. Metal for desks; except legs and aprons. Door exterior and interior panels, flush or glazed. Cross rails of base units. Front bottom rails, back bottom rails; rails may be 16 gage thick. Uprights or posts. Top corner gussets.
      3) 16 gage - Aprons, apron division, reinforcing gussets, table legs, desk legs and aprons, spreaders and stretchers when formed without welding. Toe base gussets, drawer slides, and other metal work. Front top rails and back rails except top back rails may be 1.2 mm (0.047 inch) (18 gage) thick.
      4) 14 gage - Drawer runners door tracks.
      5) 12 gage - Base unit bottom corner gussets and leg sockets.
      6) 11 gage - Reinforcement for hinge reinforcement inside doors and cabinets.
   C) Casework Construction:
      1) Welded assembly.
      2) Fabricate with enclosed uprights or posts full height or width at front, include sides, backs, bottoms, soffits, ceilings under sloping tops, headers and rail, assembled to form an integral unit.
      3) Form sides to make rabbeted stile 3/4” to 1-1/8” wide, closed by channel containing shelf adjustment slots.
      4) Make bottom of walls units flush, double panel construction.
      5) Make top and cross rails of “U” shaped channel.
      6) Provide enclosed backs and bottoms in cabinets, including drawer units.
      7) Provide finish panel on exposed cabinet backs.
8) Do not use screws and bolts in construction or assembly of casework, except to secure hardware, applied door stops, accessories, removable panels and where casework is required to be fastened end to end or back to back.

9) Fabricate casework, except benches, and desks with finished end panels.

10) Close flush exposed soffits of wall hung shelving, knee spaces in counters, and toe spaces at bases.

11) In base units with sinks provide one piece, lowered backs.

12) In base units with doors provide removable backs.

13) Provide built-in raceways or tubular or channel shaped members of casework for installation of wiring and electric work. Mount junction boxes on rear of cabinets, Electric work is specified in electrical sections of specifications.

14) Provide reinforcing for hardware.

15) Size Dimensions:
   a) Used dimensions shown or specified within tolerances specified.
   b) Tolerance:
      i) Depth: 13” in lieu of 12”, 18” in lieu of 16”, except wall hung units above counter. 21” to 24” in lieu of 22”.
      ii) Width: Minus 1”.
      iii) Height: 1” plus or minus for wall hung cabinets and counter mounted cabinets, excluding sloping tops. 1” plus for floor standing cabinets, excluding base and sloping tops. Full height cabinets shown back to back same height.
      iv) Manufacturer’s tolerance for the same length, depth or height: Not to exceed 0.0625”.

D) Base Pedestals:
   1) Provide adjustable leveling bolts accessible through stainless steel plugs, or notch in the base concealed when resilient base is applied.
   2) Except where flush metal base is shown, provide toe space at front recessed 3”.

E) Doors:
   1) Hollow metal type, flush and glazed doors not less than 5/8” thick.
   2) Fabricate flush metal doors of two panels formed into pans with corners welded and ground smooth. Provide flush doors with a sound deadening core.
   3) Fabricate glazed metal doors with reinforced frame and construct either from one piece of steel, or have separate stiles and rails mitered and welded at corners, and welds ground smooth.
      a) Secure removable glazing members with screws to back of doors.
      b) Install glass in rubber or plastic glazing channels.
   4) Provide sheet steel hinge reinforcement inside doors.
   5) Sliding doors: Provide stops to prevent bypass.
   6) Doors removable without use of tools except where equipped with locks.

F) Drawers:
   1) Drawer fronts flush hollow metal type not less than 5/8” thick with sound deadening core. Fabricate of two panels formed into pans. Weld and grind smooth corners of drawer fronts.
   2) Form bodies from one piece of steel, weld to drawer front.
   3) Provide reinforcement for locks and provide rubber bumpers at both sides of drawer head to cushion closing.
   4) Equip with roller suspension guides.

G) Sloping Tops:
   1) Provide sloping tops for casework where shown.
   2) Where ceilings interfere with installation of sloping tops. Provide filler plates as specified.
   3) Omit sloping tops or filler plates whenever ceiling material is turned down and furred-in at face of casework.
   4) Provide exposed ends of sloping tops with flush closures.
   5) Fasten sloping tops with sheet metal screws inserted from cabinet interior; space fastener as recommended by manufacturer.

H) Shelves:
   1) Capable of supporting an evenly distributed minimum load of 25 pounds per square foot without visible distortion.
2) Flange shelves down 3/4” on edges, with front and bearing edges flanged back 1/2”.
3) For shelves over 42” in length and over 12” in depth install 1-1/2” x ½” x 0.0359 thick sheet steel hat channel reinforcement welded to underside midway between front and back and extending full length of shelf.
4) Weld shelves to metal back and ends unless shown adjustable.
5) Provide means of positive locking shelf in position, and to permit adjustment without use of tools.
6) On pharmacy or sloping shelf provide 1/2” wide clear acrylic plastic raised edge, 1/8” thick, secured to front edge of shelf.

I) Undercounter Table and Bench Frames:
1) Using welded construction.
2) Open frame type with aprons and legs when required.
3) Aprons:
   a) Channels shaped welded at corners, with leg sockets and reinforcing triangular corner gussets welded in corners.
   b) Pierce sockets to receive leg bolts and notch gussets to receive legs.
   c) Upper flange perforated or slotted to receive screws at 8” centers, and back channels when installed against wall. Size slots for 1/4” anchor bolts.
   d) Pierce aprons to receive drawer formation, rail at top of drawer opening. Install channel shaped apron division welded at ends, 30” apart to front and back aprons, or at each side of drawer.
   e) Fabricate metal components from sheet steel.
      i) Use 1.5 mm (0.0598”) thick sheet for gussets and channel aprons.
      ii) Use 1.2 mm (0.0478”) thick sheet for other items.
   f) At knee space, provide exposed metal sides and metal closure plate for soffit. Where shown at knee space, provide exposed metal back secured with continuous angle closures at both side.
4) Legs:
   a) Cold rolled tubing or 1.5 mm (0.0598”) formed steel.
   b) Leveling-anchoring device at floor.
   c) Stud bolt at top for attachment to leg socket.
5) Leg Braces:
   a) Tables and benches not anchored to walls.
   b) Brace back against front legs near bottom with steel angle, channel or tubular braces.
   c) Fasten braces together with steel straps.
6) Leg Shoes:
   a) Fit laboratory casework legs at bottom with either stainless steel, aluminum, or chromium plated brass shoes, not less than 1” in height.
   b) Fit other legs with a movable molded vinyl shoe 4” high and coved at bottom.

J) Closures and Filler Strips at Pipe Spaces:
1) Flat steel strips or plates.
2) Openings less than 8” wide: 1.2 mm (0.047”) thick.
3) Openings more than 8” wide: 0.9 mm (0.359 inches) wide.

4) ACCESSORIES
A) Card or Label Holders for Shelves:
   1) Fabricate of 0.6 mm (0.0239 inch) thick steel approximately 5” long, or continuous where shown, having top and bottom edges bent over on face and welded to shelf.
   2) Finish exposed surfaces in same color as shelf.
B) Label Holders for Doors and Drawers:
   1) Cast or wrought brass or aluminum, 2” by 3-1/2”.
   2) Fasten to casework as recommended by manufacturer.
C) Shadow Boards in Cabinet VL 33:
   1) Plywood of size and thickness shown with exposed edges chamfered.
   2) Secure boards to back of exterior metal doors and cabinet back with screws.
   3) Use pivot top and bottom hinges on intermediate boards with pulls on each leaf.
   4) Paint exposed surfaces of shadow boards with two shop coats of shellac.

5) HARDWARE
A) Factory installed.
B) Exposed hardware, except as specified otherwise, satin finished chromium plated brass or nickel plated brass or anodized aluminum.
C) Cabinet Locks:
   1) Where locks are shown.
   2) Locked pair of hinged door over 900 mm (36 inches) high:
      a) ANSI/BHMA A156.5, similar to E0261, Key one side.
      b) On active leaf use three-point locking device, consisting of two steel rods and lever controlled cam at lock, to operate by lever having lock cylinder housed therein.
      c) On inactive leaf use dummy lever of same design.
      d) Provide keeper holes for locking device rods and cam.
      e) Use two point locking device both doors of cabinet 6D similar to ANSI/BHMA A156.5, E0251, key one side.
   3) Door and Drawer: ANSI/BHMA A156.11 cam locks.
      a) Drawer and Hinged Door up to 36” high: E07261.
      b) Pin-tumbler, cylinder type lock with not less than four pins. Disc tumbler lock "duo A" with brass working parts and case, as manufactured by Illinois Lock Company are acceptable.
      c) Sliding Door: E07161.
   4) Key locks differently for each type casework and master key for each service, such as Nursing Units, // Psychiatric, // Administrative, // Pharmacy //.
      a) Key drug locker inner door different from outer door.
      b) Provide two keys per lock.
      c) Provide six master keys per service or Nursing Unit.
   5) Marking of Locks and Keys:
      a) Name of manufacturer, or trademark which can readily be identified legibly marked on each lock and key change number marked on exposed face of lock.
      b) Key change numbers stamped on keys.
      c) Key change numbers to provide sufficient information for manufacturer to replace key.
D) Cabinet Hardware: ANSI BHMA A156.9.
   1) Door/Drawer Pulls: B02011.
      a) One for drawers up to 23” wide.
      b) Two for drawers over 23” wide.
      c) Sliding door flush pull, each door: B02201.
   2) Door in seismic zones: B03352.
      a) Do not provide thumb latch on doors equipped with three point locking device.
      b) Use lever operated two point latching device on paired doors over 36” high if three point locking or latching device is not used.
   3) Cabinet Door Catch:
      a) Install at bottom of wall cabinets, top of base cabinets and top and bottom of full height cabinet doors over 48”.
      b) Omit on doors with locks.
   4) Drawer Slides:
      a) Use B05051 for drawers over 6” deep.
      b) Use B05052 for drawers 3” to 6” deep.
      c) Use B05053 for drawers less than 3” deep.
   5) Butt Hinges:
      a) B01351, minimum 1.8 mm (0.072 inch) thick chrome plated steel leaves.
      b) Minimum 3.5 mm (0.139 inch) diameter stainless steel pins.
      c) Full mortise type, five knuckle design with 2-1/2” high leaves and hospital type tips.
      d) Two hinges per door except use three hinges on doors 48” and more in height. Use stainless steel leaves for tilting bin doors.
      e) Do not weld hinges to doors or cabinets.
   6) Pivot hinges:
      a) ANSI/BHMA A156.1 A875B.
7) Shelf Supports:
   a) Install in casework where adjustable shelves are noted.
   b) Adjustable Shelf Standards: B04061 with shelf rest B04081.
   c) Vertical Slotted Shelf Standard: B04102 with shelf brackets B04112 sized for shelf depth.
8) Sliding Doors:
   a) Doors supported by two ball bearing bronze or nylon rollers or sheaves riding on a stainless steel track.
   b) Sliding Door Tracks: B07093. Plastic tracks not acceptable.
   c) Doors restrained by a nylon, polyvinylchloride, or stainless steel guide at opposite end.
9) Auxiliary Hardware:
   a) ANSI A156.16.
10) Door silencers:
   a) LO3011 or LO3031.
   b) Install two rubber bumpers each door.
   c) Silencers set near top and bottom of jamb.
11) Closet Bar:
   a) LO3131 chrome finish of required length.
6) METAL FINISHES
A) Comply with NAAMM 500 series and as specified.
B) Steel Cabinets including Closures and Filler Strips:
   1) Acid resisting finish except hardware and stainless steel.
   2) After fabrication of cabinet submerge in a degreasing bath, and thoroughly rinse to remove dirt and grease, and other foreign matter.
   3) Apply non-metallic phosphate coating, then finish with baked-on acid resisting enamel not less than one mil thick.
   4) Finish resistant to action of the following reagents when 10 drops (0.5 cm³) are applied to the surface and left open to the atmosphere for period of one hour:
      - Hydrochloric Acid 37 percent
      - Ethyl Alcohol
      - Phosphoric Acid 75 percent
      - Methylcyclohexane Ketone
      - Sulfuric Acid 25 percent
      - Acetone
      - Glacial Acetic Acid
      - Ethyl Acetate
      - Sodium Hydroxide 10 percent
      - Ethyl Ether
      - Sodium Hydroxide (concentrated)
      - Carbon Tetrachloride
      - Ammonia Hydroxide (concentrated)
      - Xylene
      - Hydrogen Peroxide 5 percent
      - Phenol 85 Percent
      - Formaldehyde 37 percent
   5) Color of finish is specified in Section, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULES.
C) Brass:
   1) U.S. Standard Finish No. 26 for hardware items.
   2) Other brass items: ASTM B456, chromium plated finish meeting requirements for Service Condition SCI.
D) Aluminum:
   1) Chemically etched medium matte, clear anodic coating, Class II, Architectural, 0.4 mils thick.
E) Stainless Steel:
   1) Mechanical finish No. 4 on sheet except No. 7 on tubing.
7) DISPENSING TRAYS AND BINS
A) Design trays and bins to fit cabinets where shown.
B) Fabricate of steel, polypropylene, fiberglass reinforced polyester resin, or other suitable material.
C) Lock securely in place without the use of tools.
D) Fit at angle to provide gravity feed where shown.
E) Dispensing Trays:
   1) Equip trays with two longitudinal dividers adjustable to three position.
   2) Approximate dimensions: 6” in width 3” in depth, and length to suit cabinet’s depth furnished.
F) Dispensing Bins:
   1) Open front, except for retaining rim.

G) Approximate dimensions: 6” in width, 5” in depth, and length to suit cabinets furnished.

8) ELECTRICAL FIXTURES
   A) Comply with requirements of Division 26 – ELECTRICAL specifications for fixtures, receptacles, wiring and
      junction boxes required for fixtures and receptacles, included with casework.
   B) Suitable for use with electrical system specified and shown.
   C) Factory install in casework.

9) VL 33
   A) Construct as shown.
   B) Use pivot hinges on center shadow boards, secured to bottom and top of cabinet with bolts or screws.

10) SUSPENSION SYSTEM FOR INTERCHANGEABLE CASEWORK:
    A) Suspension system shall provide for independent suspension of interchangeable under-counter cabinets
       and of countertops. Provide for removal or exchange of under counter cabinets of various heights, widths
       and types, and for vertical adjustment of counter tops to heights indicated on drawings.
    B) Suspension Frames: Fabricate of 1-1/4" square) or 1”x 1-1/2” rectangular, 12 gauge steel tubing welded to
       form full rectangle. Provide integral, adjustable leveling device in steel leg with non-marring foot cap.
    C) Mounting channels and support frames shall allow for pipe chases and service channels when required.
    D) Cabinets to have a 1.49 mm (0.059 inch) steel shaped form welded across entire width of back to engage
       continuous slot in wall mounting channel. Two fastening devices through case stile at front shall provide
       final positive location and locking of case in position.
    E) All construction materials that are exposed shall be painted.

11) WHEELED CARRIER
    A) Provide a wheeled carrier to facilitate installation, removal, and transport of interchangeable cases as part
       of the interchangeable laboratory furniture system.

PART 3 - EXECUTION

1) COORDINATION
   A) Before installing casework, verify wall and floor surfaces covered by casework have been finished.
   B) Verify location and size of mechanical and electrical services as required.
   C) Verify reinforcement of walls and partitions for support and anchorage of casework.

2) FASTENINGS AND ANCHORAGE
   A) Do not anchor to wood ground strips.
   B) Provide hat shape metal spacers where fasteners span gaps or spaces.
   C) Use 1/4” diameter toggle or expansion bolts, or other appropriate size and type fastening device for
      securing casework to walls or floor. Use expansion bolts shields having holding power beyond tensile and
      shear strength of bolt and breaking strength of bolt head.
   D) Use 6 mm (1/4 inch) diameter hex bolts for securing cabinets together.
   E) Use 6 mm (1/4 inch) by minimum 1-1/2” length lag bolt anchorage to wood blocking for concealed
      fasteners.
   F) Use not less than No. 12 or 14 wood screws with not less than 1-1/2” penetration into wood blocking.
   G) Space fastening devices 12” on center with minimum of three fasteners in 3 foot to 4 foot unit width.
   H) Anchor floor mounted cabinets with a minimum of four bolts through corner gussets. Anchor bolts may
      be combined with or separate from leveling device.
   I) Secure cabinets in alignment with hex bolts or other internal fastener devices removable from interior of
      cabinets without special tools. Do not use fastener devices which require removal of tops for access.
   J) Where units abut end to end anchor together at top and bottom of sides at front and back. Where units
      are back to back anchor backs together at corners with hex bolts placed inconspicuously inside casework.
   K) Where type, size, or spacing of fastenings is not shown or specified, show on shop drawings proposed
      fastenings and method of installation.

3) CLOSURES AND FILLER PLATES
   A) Close openings larger than 6 mm (1/4 inch) wide between cabinets and adjacent walls with flat, steel
      closure strips, scribed to required contours, or machined formed steel fillers with returns, and secured
      with sheet metal screws to tubular or channel members of units, or bolts where exposed on inside.
   B) Where ceilings interfere with installation of sloping tops, omit sloping tops and provide flat steel filler
plates.
1) Secure filler plates to casework top members, unless shown otherwise.
2) Secure filler plates more than 6” in width top edge to a continuous 1"x1” by 0.889 mm thick steel formed steel angle with screws.
3) Anchor angle to ceiling with toggle bolts.
C) Install closure strips at exposed ends of pipe space and offset opening into concealed space.
D) Paint closure strips and fillers with same finishes as cabinets.
E) Caulk and seal laboratory furniture as specified in Section 07 92 00, JOINT SEALANTS.

4) CABINETS
A) Install in available space; arranged for safe and convenient operation and maintenance.
B) Align cabinets for flush joints except where shown otherwise.
C) Install cabinets level with bottom of wall cabinets in alignment and tops of base cabinets aligned.
D) Install corner cabinets with hinges on corner side with filler or spacers sufficient to allow opening of drawers.
E) Plug Buttons:
   1) Install plug buttons in predrilled or pre-punched perforations not used.
   2) Use chromium plate plug buttons or buttons finish to match adjacent surfaces.
F) Cabinets 6D: Ground to nearest cold water pipe in accordance with NFPA, Underwriters Laboratories, Inc., or other nationally recognized laboratory approved ground specified system.

5) PROTECTION TO FIXTURES, MATERIALS, AND EQUIPMENT
A) Tightly cover and protect cabinets against dirt, water chemical or mechanical injury.
B) Thoroughly clean interior and exterior of cabinets, at completion of all work.

12 36 00 Countertops
1) In restrooms, use a molded counter top unit with vitreous china recessed lavatory and the faucet unit(s) mounted in lavatory.
2) Decorative Laminate Countertops
   A) Core: 1” thick ANSI A 208.1-1993 M-2 particleboard.
   B) Surface: HGS/HGP high-pressure decorative laminate with balanced backer sheeting.
   C) Edges, including applied backsplash:
      1) 3mm PVC, exposed edges and corners machine profiled to 1/8” radius.
      2) Edges are machine applied with moisture curing polyurethane (PUR) hotmelt for fast setting, high strength adhesion.
3) Laboratory Countertops:
   A) Provide chemical-resistant countertops, such as epoxy resin or Trespa chemical-resistant products.

12 50 00 Furniture
   A) To accommodate both men and women use the dimension of the large man to the corresponding small women and divide by 2 for the average adult.
2) Desktop Heights
   A) Desk heights will be a maximum of 29”. This must include allowances for leveling.
   B) Working reception areas must also be a maximum of 29”, unless plans call for a working counter. The working counter will be a maximum of 40”.

12 60 00 Multiple Seating
1) Classroom Furniture: Fixed auditorium seating shall have a retractable desk top that is easily placed out of the way and a spring-loaded seat that will close automatically as manufactured by “American Seating”, “Irwin” or approved equal.
Division 13 Special Construction
There are currently no items for this division.
Division 14 Conveying Systems

14 20 00 Elevators
1) All elevator work shall conform to ASME A17.1 Safety Code for Elevators and Escalators and ASME A17.3 Safety Code for Existing Elevators and Escalators.
2) Elevator equipment shall be hydraulic or traction type. Holeless or machine room-less (MRL) type equipment shall not be used without the approval of the Owner’s representative.
3) Controllers shall be microprocessor based with a solid state starter and shall be coordinated with a ShuntTrip disconnect. Provide dedicated telephone circuit into the controller cabinet.
4) Hydraulic jack cylinder shall be installed with a Schedule 40 PVC casing with glued cap at the bottom. Consult with Owner’s representative on required fill of the annular space of the PVC casing.
5) Call stations, car stations, handrails, and other fixtures shall be stainless steel and vandal resistant fixtures.
6) Install hands-free, vandal resistant communication system with automatic dialer. Consult with Owner’s representative for setup of automatic dialer.
7) Maintenance software tool shall be non-proprietary and provided to the Owner.
8) All door finishes and casings shall be stainless steel unless otherwise approved. Consult with Owner’s representative regarding walls, floor and ceiling finishes.
9) Acceptable suppliers are Otis, Schindler or approved equal.

14 40 00 Lifts
1) Avoid the use of chairlifts if the vertical rise is above eight feet in elevation.
<table>
<thead>
<tr>
<th>Division</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 15</td>
<td>Reserved</td>
</tr>
<tr>
<td>Division 16</td>
<td>Reserved</td>
</tr>
<tr>
<td>Division 17</td>
<td>Reserved</td>
</tr>
<tr>
<td>Division 18</td>
<td>Reserved</td>
</tr>
<tr>
<td>Division 19</td>
<td>Reserved</td>
</tr>
<tr>
<td>Division 20</td>
<td>Reserved</td>
</tr>
<tr>
<td>Division 21</td>
<td>Fire Suppression</td>
</tr>
</tbody>
</table>

There are currently no items for this division.
### Design Guidelines

#### Facilities Management

#### Division 22 Plumbing

**22 05 00 Common Work Results for Plumbing**

1) Each restroom plumbing fixture supply and drain line tree shall be accessible within a chase, with access to chase through a full height door. Install the chase with a minimum width of two (2) feet.

2) All pipe lines should be accessible by use of tunnels, chases, crawl spaces, accessible ceilings, etc.

3) Be liberal with clean-outs in sewer lines within buildings. Locations shall be verified by owner during design.

4) Clean-out plugs should be set with a suitable lubricant to facilitate removal.

5) Furnish sufficient thermometers to check temperature properly. All thermometers should be fitted with wells.

6) Chemical storage rooms
   - A) Provide adequate ventilation.
   - B) Provide a bermed floor.
   - C) Verify the possibility of installing a fire suppression system.

7) All floors susceptible to water shall drain to floor drains. Indicate floor pitch on plan.

8) All building sanitary drainage systems with fixtures below grade shall incorporate backflow prevention strategies, e.g., backwater valves, knife gate valves or sewage ejectors.

#### 22 05 53 Identification for Plumbing Piping and Equipment

1) Valves shall be identified with a brass tag with brass ball-chain affixed to each valve indicating its enumeration.

2) Piping Identification:
   - A) Contents and direction of flow on all piping (steam, gas, water, condensate, etc.) shall be identified with labels or stencils.
     1) Labels on piping up to 1-1/4” size shall be 1/2” high.
     2) Labels on piping or pipe covering larger than 1-1/4” size or shall be 1” high.
     3) Labels shall be applied at all points where pipes pass through walls, at each change of direction and on each 20 feet of straight lengths.
     4) Labels shall be as noted below in note 22 05 53.2.E.
   - B) Paint all piping labels with paint or waterproof ink according to the University color code as identified in section 22 05 53.
   - C) Label valves with tags, valves used for isolating equipment do not require IDtags. See section 01 77 00 for project close-out requirements regarding valve chart.
   - D) Mark all valves above ceilings with appropriately colored ½” diameter stickers.
   - E) Pipe identification shall be as follows:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ABBRV.</th>
<th>PIPE COLOR</th>
<th>LETTERING COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water (Potable)</td>
<td>CW</td>
<td>Blue</td>
<td>White</td>
</tr>
<tr>
<td>Hot Water (Potable)</td>
<td>HW</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Circulating Hot Water (Potable)</td>
<td>CHW</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Industrial Cold Water (Non-potable)</td>
<td>ICW</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Industrial Hot Water (Non-potable)</td>
<td>IHW</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Circulating Industrial Hot Water</td>
<td>CIHW</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Reverse Osmosis</td>
<td>RO</td>
<td>Blue, Dark</td>
<td>White</td>
</tr>
<tr>
<td>Tempered Water</td>
<td>TW</td>
<td>Blue</td>
<td>White</td>
</tr>
<tr>
<td>Drain Line</td>
<td>D</td>
<td>Green, Dark</td>
<td>White</td>
</tr>
<tr>
<td>Storm Drain</td>
<td>STORM</td>
<td>Blue, Light</td>
<td>White</td>
</tr>
<tr>
<td>Sanitary Drain</td>
<td>SAN</td>
<td>Green, Dark</td>
<td>White</td>
</tr>
<tr>
<td>Vacuum</td>
<td>VAC</td>
<td>Blue, Dark</td>
<td>White</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>AIR</td>
<td>Yellow</td>
<td>Blue</td>
</tr>
<tr>
<td>Laboratory Air</td>
<td>LAB AIR</td>
<td>Yellow</td>
<td>Blue</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>GAS</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>100 PSIG Steam</td>
<td>STM-100</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>60 PSIG Steam</td>
<td>STM-60</td>
<td>Yellow</td>
<td>Black</td>
</tr>
</tbody>
</table>
### Design Guidelines

#### Facilities Management

<table>
<thead>
<tr>
<th>15 PSIG Steam</th>
<th>STM-15</th>
<th>Yellow</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensate</td>
<td>COND</td>
<td>Gray-Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Pumped Condensate</td>
<td>PCOND</td>
<td>Gray-Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>CWS</td>
<td>Blue, Light</td>
<td>White</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>CWR</td>
<td>Blue, Light</td>
<td>White</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>CHWS</td>
<td>Blue, Light</td>
<td>White</td>
</tr>
<tr>
<td>Chilled Water Return</td>
<td>CHWR</td>
<td>Blue, Light</td>
<td>White</td>
</tr>
<tr>
<td>Glycol-Heating Water Supply</td>
<td>GHWS</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Glycol-heating Water Return</td>
<td>GHWR</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heating Water Supply</td>
<td>HWS</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heating Water Return</td>
<td>HWR</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heat Recovery Supply - Sys. 1</td>
<td>HRS-1</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heat Recovery Return - Sys. 1</td>
<td>HRR-1</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heat Recovery Supply - Sys. 2</td>
<td>HRS-2</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heat Recovery Return - Sys. 2</td>
<td>HRR-2</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heat Recovery Supply - Sys. 3</td>
<td>HRS-3</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Heat Recovery Return - Sys. 3</td>
<td>HRR-3</td>
<td>Green, Light</td>
<td>White</td>
</tr>
<tr>
<td>Fireline (Zone No. 1)</td>
<td>FIRE-1</td>
<td>Red</td>
<td>White</td>
</tr>
<tr>
<td>Sprinkler Piping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fireline (Zone No. 2)</td>
<td>FIRE-2</td>
<td>Red</td>
<td>White</td>
</tr>
<tr>
<td>Fireline (Zone No. 3)</td>
<td>FIRE-3</td>
<td>Red</td>
<td>White</td>
</tr>
<tr>
<td>Fireline (Zone No. 4)</td>
<td>FIRE-4</td>
<td>Red</td>
<td>White</td>
</tr>
<tr>
<td>Radioactive</td>
<td></td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Toxic</td>
<td></td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Foam</td>
<td></td>
<td>Red</td>
<td>Black</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td></td>
<td>Red</td>
<td>Black</td>
</tr>
<tr>
<td>Halon</td>
<td></td>
<td>Red</td>
<td>Black</td>
</tr>
</tbody>
</table>

### 22 07 00 Plumbing Insulation

1) Unless otherwise specified, the application of all insulation shall be in accordance with the manufacturer's published recommendations.

2) Insulation shall be installed full-thickness through all wall and floor penetrations.

3) Insulation shall be installed at full-thickness through oversized pipe hangers and supports with appropriate rigid inserts and protection saddles.

4) Vapor barriers shall be maintained on systems at ambient or lower temperature.

5) All insulation work under this contract shall be done by skilled, competent workmen familiar with this type of work. All insulation work shall present a neat, finished and workmanlike appearance.

6) Insulation shall be applied over clean dry surfaces, butting adjoining sections firmly together.

7) All insulation, jackets, and PVC coverings shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

### 22 07 16 Plumbing Equipment Insulation

### 22 07 19 Plumbing Piping Insulation

1) All hot and cold water domestic water lines, roof drain lines and other plumbing systems operating at temperatures other than room temperature shall have adequate insulation.

2) Roof drain sumps shall be insulated as specified for fittings.

3) On domestic water, a pipe insulation protection saddle of 22 gauge galvanized sheet metal for piping 3" diameter and smaller, and 18 gauge for piping larger than 3" diameter, shall be provided at every pipe hanger or support. The saddle shall be at minimum length of 10 inches.
A) All domestic piping smaller than 2”, no saddle required below the insulation if inserts are used.
B) Both inserts and saddles shall be provided for all piping 2” and larger.

4) Hot and Cold Line Insulation

A) All water piping (in tunnels and) within the building as well as all rain leaders, including those concealed and in furred spaces or pipe chases, shall be insulated with glass fiber pipe insulation in one piece molded sections, 4 lb. nominal density, and of the following thickness:

<table>
<thead>
<tr>
<th>Application</th>
<th>Pipe Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold water lines and</td>
<td>1-1/2” and less</td>
<td>1/2”</td>
</tr>
<tr>
<td>Rain leaders</td>
<td>2” and larger</td>
<td>1”</td>
</tr>
<tr>
<td>Hot water lines</td>
<td>1” and less</td>
<td>1/2”</td>
</tr>
<tr>
<td>106°F - 149°F</td>
<td>1-1/4” to 3”</td>
<td>1”</td>
</tr>
<tr>
<td></td>
<td>4” and over</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>Hot water lines</td>
<td>1-1/4” to 3”</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>150°F - 212°F</td>
<td>4” to 6”</td>
<td>2”</td>
</tr>
<tr>
<td></td>
<td>8” and over</td>
<td>2-1/2”</td>
</tr>
</tbody>
</table>

B) Insulate floor drain sumps and all horizontal sanitary waste pipe and fittings for all floor drains above grade receiving cooling coil condensate.
1) Insulate horizontal sanitary waste line from floor drain to nearest vertical sanitary riser.
2) Insulation shall be 1/2” thick glass fiber pipe insulation, 4 lb. density.

C) Insulate sump pump discharge lines from sump pit to wall where discharge line leaves the building.

D) Insulate ALL above grade cooling coil condensate discharge lines with 1/2” thick glass fiber insulation, 4 lb. density. This shall include, but not be limited to air handler, fan coil, furnace, and heat pump cooling coils.

5) Execution of Pipe Covering Installation:

A) Hot Lines with Glass Fiber Insulation:
1) Pipe
   a) Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips.
   b) Seal laps, pulling jacketing tight and smooth.
   c) Self-sealing laps shall be secured according to manufacturers published recommendations.
   d) Open ends of pipe insulation shall be neatly stopped off and tapered down with insulating cement and covered with canvas embedded into a wet coat of fire retardant lagging adhesive.
2) Fittings
   a) All fittings shall be insulated with segments of glass fiber pipe insulation or loops of insulating blocks firmly held in place with #16 galvanized soft wire.
   b) Cover all fitting insulation with white plastic fitting covers.
3) Valves Etc.
   a) All valve bodies, strainers and flanges shall be insulated as specified for fittings.

B) Cold Lines with Glass Fiber Insulation:
1) Pipe
   a) Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips.
   b) Seal laps, pulling jacketing tight and smooth.
   c) Ends of pipe insulation shall be sealed with a fire retardant vapor barrier coating at all fittings and valves, and at intervals of 21'-0” on continuous runs of pipe.
   d) Self-sealing laps shall be secured according to manufacturers published recommendations.
2) Fittings
   a) All fittings shall be insulated with molded fiber glass fittings, segments of pipe covering, or with compressed flexible glass fiber secured in place with non-corrosive wire.
   b) All thicknesses to be equal to that of adjoining pipe covering.
   c) Cover all fitting insulation with white plastic fitting covers.
   d) If batt type insulation is used, it must be a minimum of 1 pound density and 1” thick.
3) Valves Etc.
a) All valve bodies, strainers and flanges shall be insulated as specified for fittings.

C) Exterior or Exposed Piping
   1) Apply metal jacket with 2" overlap at seams and joints.
      a) Seal weather tight with manufacturers recommended sealant.
      b) Apply the jacket such that the longitudinal seam is on the bottom of pipe.
      c) Secure jacket with stainless steel bands 12" on center and at end joints.

22 10 00 Plumbing Piping and Pumps
   1) Ball valve with hose adapters should be provided in all toilet chases/machinery spaces.
      A) If ball valve is located in common area, place in recessed, lockable box.
   2) Hose bibs shall be placed at 100 ft. intervals for exterior use (frost-proof type). All bibs should be key operated with inside valve control.
   3) PVC DWV piping maybe used as allowed by the Plumbing Code for DWV and Roof Drain piping.
      A) Do not use PVC in locations that will may handle heated or warmed fluids such as from humidifiers or other process or lavatory equipment.
      B) PVC may not be used in ventilation ceiling plenums.
      C) Care should be taken to install adequate support as per code requirements and long straight runs should consider the thermal expansion and contraction characteristics of plastic materials.
      D) PVC is the preferred piping material below grade.
   4) Heavy Duty No Hub clamps shall be used when connection Cast Iron No Hub DWV and Roof Drain joints.
   5) All future connections shall be fitted with valves and capped.
   6) Install valves at all major connections and at each floor.
   7) Use only best quality piping materials.
      A) If copper is used for drain lines, use only Type "L" or "M" hard copper tubing, DWV weight copper is not acceptable.
      B) Hot or cold water Type "L" hard copper using 95-5 solder or other no lead industry acceptable solder. Pro-Press or other similar crimped type copper piping system is acceptable. Groove copper joints maybe be acceptable to the owner on a project by project bases. Verity acceptance with Owner.
      C) Pipes penetrating exterior walls must be installed to prevent breakage if building settles.
      D) In general, pressure piping should not be placed under concrete slabs within buildings.
      E) No piping should be run in concrete floors with the exception of waste piping.
      F) No piping should be buried under the lowest floor level with the exception of waste piping.
      G) At every point where piping and duct work penetrate a floor slab, except slabs on grades, a cast-in sleeve or other curbing at least 1” high must be provided so that any leakage of water or liquids must be at least 1” deep in order to spill through floor penetrations.
      H) Use care in considering the routing of sump pump water discharge from a building.
      1) The water should not run over any pedestrian walkways or driveways.
      2) Provide proper slope away from the building for drainage.
   8) Floor drain elevation shall installed such at sufficient floor slope is provided for proper floor drainage. This is especially important if ceramic floor tile is to be installed.
   9) Provide full-port ball valves at all water lines up to two inches in diameter.
  10) An above floor inspection door shall be installed in each under floor duct to be used to pump out water.

22 14 00 Facility Storm Drainage
   1) No roof drains shall be placed in joints in the roof deck.
   2) All primary roof drains shall be directly connected to the internal building storm drainage system.
      A) Any proposed drainage other than the above must be approved by Owner.
   3) Scuppers with downspouts may be used as the secondary roof drainage system on smaller roof sections not more than 2-stories above grade. Discharge locations must be reviewed with Owner.
      A) Scuppers maybe used as the primary roof drainage system on small roof areas such as vestibules, however a piped roof drainage system is preferred.

22 30 00 Plumbing Equipment
   1) Domestic water heaters should be located in a heated area as close as possible to the larger demand sources
and the steam source location shall also be considered.

A) Each domestic water heater shall have a service area of 4'-0” by 4'-0” in front of the unit clear of obstructions.

B) Water Heaters (Aerco, PVI, EnviroSep, Cemline or approved equal) shall be of the instantaneous or semi-instantaneous type using steam as the energy source unless otherwise directed by the Owner.

2) Sewage Ejectors and Sump Pumps

A) Sewage Ejectors shall be installed in a duplex fashion and should be of the vertical, cover mounted, pedestal pump type by Weil or equal.

B) Ground dewatering pumps maybe submersible, and should be installed a duplex arrangement when practical.

C) High water alarms are to be monitored by the Building Fire Alarm System.

22 40 00 Plumbing Fixtures

1) Fixtures

A) Provide wall hung water closets with white, elongated, open-front seats and Sloan, Zurn or approved equal diaphragm flush valves.

B) Install battery powered automatic flush valves.

C) Vitreous china lavatories supplied by American Standard, Kohler or approved equal.

D) Chicago, Moen, T+S Brass or approved equal commercial grade faucets with a single lever handle on all lavatories and sinks. Sensor facets maybe considered, consult with owner.

E) Shower valves shall be approved by Owner.

F) Water saver shower heads should be installed in all shower rooms.

G) Use water saver aerators in all sinks and wash basins.

H) Recessed electric water coolers, Halsey Taylor, Elkay or approved equal, shall be vandal proof and constructed of stainless steel.
   1) Provide bottle fill stations as necessary. Coordinate with Owner.
   2) Contractor to provide access panels below unit for final connections as required.

2) All laboratories shall be supplied with emergency shower and eye wash stations.

A) Place a floor drain under shower
Division 23 Heating, Ventilating, and Air Conditioning

23 05 00 Common Work Results for HVAC

1) All valves must be accessible. Install access doors as required.
2) Number and schedule all Fire and/or Smoke Dampers on the construction drawings. Each damper shall be labeled with the device type and sequential number along with the floor number. Examples FD-1-01 (Fire Damper 1st Damper on the 1st Floor), SD-1-02 (Smoke Damper 1st Damper on the 2nd Floor) or FS-2-01 (2nd Combination Fire/Smoke Damper on the 1st Floor). Use floor designation from the design drawings.
3) Upon completion of the project, the contractor shall provide a written schedule of all Fire, Smoke, and Fire/Smoke Dampers along with a plan showing all locations. Similar to the valve tag list.
4) Provide access doors in ductwork to allow access to coils, fire/smoke dampers, control devices, control dampers for inspection and cleaning.
5) Specify decibel ratings on all potential noise producing equipment, e.g., fans, blowers, transformers, etc. The permissible sound level increase in occupied spaces should be specified at 4db greater when all equipment is turned on as compared to the sound level when all equipment is off.
6) Pedestrian safety shall be considered when designing elements such as steam pressure relief systems.
7) Air-conditioning equipment and cooling towers shall be installed on the roof of the facility where ever possible and practical.
8) Try to contain the majority of mechanical equipment in one utility area around the building. Check with the Owner on installing a visual barrier around cooling towers and other mechanical equipment that is integrated into the building design.
9) Install thermometer wells in each location where function of unit can be checked, i.e. before and after heat exchanger and chillers, before and after supply fan coils, in the return air, supply air, fresh air, and mixed air sides of supply fan units.
10) When applicable, provide a color coded schematic systems layout of HVAC System showing area served: location of controls, control valves, unit location. Schematic should be suitable for framing and wall mounting in respective mechanical spaces.
11) All new, and extension of existing, hydronic systems shall be flushed and chemically cleaned as recommended by a reputable chemical treatment supplier. All residual cleaner must be flushed from the system.
12) Utilize optimum water treatment for closed circuit heating and cooling systems, and condenser water treatment. Consult with University Chemical supplier for their recommendations on water treatment.
13) Incorporate an economizer cycle on all supply air fans. Other strategies maybe be used following the requirements of ASHRAE Std 90.1 latest version.
14) Building Heating shall be accomplished with hot water systems heated from the central steam system.
15) Recover heating and cooling energy from exhaust air whenever possible and practical.
16) Furnish liberal quantity of hand air vent valves on closed circuit heating and cooling water systems.
17) Refrain from installing under-ground floor duct distribution systems. If there are no other design alternatives, the underground duct distribution system shall pitch to a central point and drain tile shall be installed below duct which drains to sump fitted with a sump pump.
18) The following requirements must be met prior to connection of University supplied utilities.
   A) All valves feeding utilities into the Contractor's building area from the Owner's utilities will be opened and closed by University personnel.
   B) The contractor will, at all times, respect the use of owner supplied utilities, using them prudently. The Contractor will be responsible for the cost of utilities until a point of substantial completion is attained. This determination will be made in conjunction with the Architects and Engineering consultants.
   C) Condensate return from the units will be dumped in lieu of being returned for a period of time to be determined by the Engineer in consultation with Owner. Contractor should determine when this will be accomplished and should submit that information to the Engineer for approval.
   D) All strainers in piping shall be removed and cleaned when placed back in service. Valves shall be checked for tight closing.
19) All valves regardless of service, including future connections, shall be plugged or capped.
20) All building services piping shall be installed as per ASME B31.9 including flanged connections.
21) Valves shall be identified with a brass tag with brass ball-chain affixed to each valve indicating its enumeration. Valve tags are not required when the valve serves an isolation function for a piece of equipment as long as the
22) Piping Identification:
   A) Contents and flow direction shall be shown on all piping system (steam, gas, water, condensate, etc.) and shall be identified with labels or painted stencils.
      1) Labels on piping up to 1-1/4" size shall be 1/2" high.
      2) Labels on piping and larger than 1-1/4" size or pipe covering shall be 1" high.
      3) Labels shall be applied at all points where pipes pass through walls, at each change of direction and on each 20 feet of straight lengths.
      4) Labels shall be as noted below in note 22 05 53.2.E.
   B) Paint and all piping labels with paint or waterproof ink according to the University color code as identified in section 22 05 53. Pre-manufactured labels may also be used.
   C) Label valves with tags, valves used at isolating equipment not required. See section 17 00 00 for project close-out requirements regarding valve chart.

23) Mark all valves above ceilings with appropriately colored ½" diameter stickers.
24) All floor mounted mechanical equipment shall rest on 4" high housekeeping pad.
25) All hangers and fasteners in mechanical rooms and exposed areas shall be prime coated and painted or galvanized.
26) Stairs shall be provided over roof piping and ductwork as needed.

23 07 00 HVAC Insulation
1) Unless otherwise specified, the application of all insulation shall be in accordance with the manufacturer's published recommendations.
2) All insulation work under this contract shall be done by skilled, competent workmen familiar with this type of work. All insulation work shall present a neat, finished and workmanlike appearance.
3) Insulation shall be applied over clean dry surfaces, butting adjoining sections firmly together.
4) Insulation shall be installed at full-thickness through oversized pipe hangers and supports with appropriate rigid inserts and protection saddles.
5) Insulation shall be installed full-thickness through all wall and floor penetrations.
6) All insulation, jackets, and PVC coverings shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

23 07 13 Duct Insulation
1) Ductwork shall be externally insulated in accordance with the appropriate following schedule:

<table>
<thead>
<tr>
<th>Ductwork System</th>
<th>Insulation Type</th>
<th>Insulation Thickness</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Duct</td>
<td>Foil faced fiberglass</td>
<td>2&quot;</td>
<td>3/4 lb/ft³</td>
</tr>
<tr>
<td>Return Duct</td>
<td>None</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Mixed Air Duct</td>
<td>Foil faced fiberglass</td>
<td>2&quot;</td>
<td>1-1/2 lb/ft³</td>
</tr>
<tr>
<td>Outdoor Air Duct</td>
<td>Sheet metal over rigid board fiberglass</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
<tr>
<td>Relief Air Duct</td>
<td>Foil faced fiberglass</td>
<td>2&quot;</td>
<td>1-1/2 lb/ft³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ductwork System</th>
<th>Insulation Type</th>
<th>Insulation Thickness</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust duct from exhaust fan to 10'-0&quot; back from exhaust fan</td>
<td>Foil faced fiberglass</td>
<td>2&quot;</td>
<td>1-1/2 lb/ft³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ductwork System</th>
<th>Insulation Type</th>
<th>Insulation Thickness</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relief duct from hoods and louvers to 10’ back from hoods or louvers</td>
<td>Foil faced fiberglass</td>
<td>2&quot;</td>
<td>1-1/2 lb/ft³</td>
</tr>
</tbody>
</table>
Mechanical Room Ductwork
Tops of ducts may be 2” foil faced fiberglass in lieu of rigid

<table>
<thead>
<tr>
<th>Ductwork System</th>
<th>Insulation Type</th>
<th>Insulation Thickness</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Duct</td>
<td>Sheet metal over rigid board fiberglass</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
<tr>
<td>Return Duct</td>
<td>None</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Mixed Air Duct</td>
<td>Rigid board fiberglass</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
<tr>
<td>Outdoor Air Duct</td>
<td>Rigid board fiberglass</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
<tr>
<td>Combustion Air Duct</td>
<td>Rigid board fiberglass(10’ back)</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
<tr>
<td>Exhaust Air Duct</td>
<td>Rigid board fiberglass(10’ back)</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
<tr>
<td>Relief Air Duct</td>
<td>Rigid board fiberglass(10’ back)</td>
<td>2&quot;</td>
<td>3 lb/ft³</td>
</tr>
</tbody>
</table>

2) Supply duct shall mean all supply duct from air handling unit discharge to air outlet (diffuser, register, etc.). This includes all non-insulated devices such as back pan of diffusers, terminal coils, distribution boxes, air flow measuring stations, sound attenuators, etc. installed in the supply or return duct system. Foil faced fiberglass insulation shall be reinforced foil faced flame resistant craft flexible vapor seal fiberglass insulation.

3) Rigid board fiberglass shall be reinforced foil faced vapor barrier jacket.
   A) Ductwork located inside of building with foil faced flame resistant vapor seal flexible fiberglass insulation shall be installed as follows.
      1) All end and longitudinal joints shall be butted firmly and lapped and sealed by adhesive.
      2) At all joints, the vapor barrier jackets shall be covered with 4” wide pressure sensitive vapor seal tape, or shall have 2” wide laps drawn tight, stapled, and secured with vapor barrier adhesive.
      3) The joints and all openings where facing is pierced or punctured by pins, staples, etc., shall be coated with two inch wide strips of vapor barrier coating compound.
   B) Rigid insulation shall be secured with a bonding adhesive on top, and with mechanical fasteners on sides and bottom spaced at the rate of one fastener per two square feet.
      1) Insulation shall be protected at corners and edges with metal corner strips or clips.
      2) After the insulation is in place, all joints seams, chipped edges, etc., shall be filled with a suitable bedding compound to leave a smooth workmanlike surface.
      3) At all joints, the vapor barrier jackets for rigid insulation shall be covered with 4” wide pressure sensitive vapor seal tape, or shall have 2” wide laps drawn tight and secured with vapor seal adhesive.
      4) The joints and all openings where facing is pierced or punctured by pins, staples, etc., shall be coated with two inch wide strips of vapor barrier coating compound.
   C) All ducts indicated as being insulated shall be insulated even if the duct is lined. Both shall be applied.

23 07 16 Equipment Insulation
1) Heat exchanger and air separator fitting shall be insulated with 3” thick pre-molded mineral wool pipe insulation, 8 lb. density. All seams shall be taped smooth. Ends shall be finished with mastic, troweled smooth.
2) Insulation shall not be applied over equipment nameplates or ASME stamps. Bevel and seal insulation around such locations.

23 07 19 HVAC Piping Insulation
1) Hot Water Heating Piping
   A) All hot water heating supply and return piping, shall be insulated with glass fiber pipe insulation in one piece molded sections, 4 lb. nominal density, and of the following thickness:

<table>
<thead>
<tr>
<th>Application</th>
<th>Pipe Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot water lines</td>
<td>1” and less</td>
<td>1”</td>
</tr>
<tr>
<td>120°F - 200°F</td>
<td>1-1/4” to 4”</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>5” to 6”</td>
<td>2”</td>
<td></td>
</tr>
<tr>
<td>8” and over</td>
<td>2-1/2”</td>
<td></td>
</tr>
<tr>
<td>Hot water lines</td>
<td>1” and less</td>
<td>1”</td>
</tr>
<tr>
<td>201°F - 250°F</td>
<td>1-1/4” to 2”</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>2-1/2” to 4”</td>
<td>2”</td>
<td></td>
</tr>
</tbody>
</table>
2) Steam Heating Piping Insulation:
   A) All steam and condensate piping insulation located in vaults shall be covered with .016 mil smooth aluminum lagging with a minimum 2" overlap at joints.
   B) All steam lines, steam condensate lines, and flash tanks shall be insulated with glass fiber pipe insulation in one piece molded sections, 4 lb. nominal density, and of the following thickness:

<table>
<thead>
<tr>
<th>Application</th>
<th>Pipe Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam lines (Low Pressure) 201°F - 250°F</td>
<td>2&quot; and less</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>2-1/2&quot; - 4&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td></td>
<td>5&quot; - 6&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>8&quot; and over</td>
<td>3&quot;</td>
</tr>
<tr>
<td>Steam lines (Medium Pressure) 251°F - 305°F</td>
<td>1&quot; and less</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>1-1/4&quot; - 2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td></td>
<td>2-1/2&quot; - 4&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>5&quot; - 6&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td></td>
<td>8&quot; and over</td>
<td>3-1/2&quot;</td>
</tr>
<tr>
<td>Steam lines (High Pressure) 306°F - 460°F</td>
<td>1&quot; and less</td>
<td>2&quot;</td>
</tr>
<tr>
<td></td>
<td>1-1/4&quot; - 2&quot;</td>
<td>2-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>2-1/2&quot; - 4&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td></td>
<td>5&quot; - 6&quot;</td>
<td>3-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>8&quot; and over</td>
<td>4&quot; total thickness</td>
</tr>
<tr>
<td>Condensate lines</td>
<td>1-1/4&quot; - 2&quot;</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>Flash Tanks</td>
<td>2-1/2&quot; and over</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>

3) High Temperature Fitting Insulation:
   A) All steam valves including control valves, expansion joints and the access end of strainers shall be covered with a custom fabricated insulation jacket secured around the fitting. Insulation Systems will be custom designed and engineered for each individual item which is not a standard product based on type of application, operating temperature, and environment. A close contour fit is essential for proper thermal performance and neat appearance.
   B) Insulation jacket shall be constructed of PTFE Teflon Impregnated Fiberglass Cloth with a temperature rating to 550°F, 0.016 Inch Thickness and Dark Grey in color. Insulation shall be one (1”) inch thick, lightweight, and moisture-resistant. Insulation shall meet Flammability Test Class 1-16 CFR Part 1610 and have an R-Value of 1.58.
   C) Insulation jacket shall be secured to the fitting with Woven Nylon Hook and Loop fastener, Grey Color, Maximum Temperature Resistance 250°, V-0 UL94 Burn Test, 1.20 lbs. Peel Strength. Heavy Duty Hook and Loop fastener shall be located at edges where covers will butt together. Insulation Seams which do not tightly butt one another are Not Acceptable.
   D) All reusable insulation blanket assemblies shall be labeled with a 1” x 2” white laser label. The tagging systems will facilitate installation and reinstallation of all blankets and enable the manufacturer to provide replacements upon request by number assigned as imprinted on the label.
   E) All blanket seams shall be double sewn lock stitched interior seams (except for final closure). Stitching to be ten (10) to fourteen (14) stitches per inch and one quarter (1/4”) inch spacing between seams. Hog ringed blankets are not acceptable.

4) Refrigeration Piping Insulation:
   A) All refrigeration suction lines and hot gas lines both inside and outside the building shall be insulated with 3/4” thick closed cell foam insulation. Protect exterior exposed closed cell insulation with a UV protectant latex paint.

5) Pipe Insulation Jackets and Covering:
   A) All pipe insulation shall have a Fire Retardant Vapor Barrier Jacket.
B) For insulated piping outdoors and in steam vaults, the following jacket covering shall be applied:
   1) Apply a .032" thick stucco aluminum jacket with stainless steel bands. Seal jacket and all building and roof and wall penetrations weather tight.

6) Protection Saddles and Rigid Inserts for Insulated Pipe:
   A) On chilled water piping and hot water heating piping, a pipe insulation protection saddle of 22 gauge galvanized sheet metal for piping 3" diameter and smaller, and 18 gauge for piping larger than 3" diameter, shall be provided at every pipe hanger or support. The saddle shall be at minimum length of 10 inches.
   B) Where required, rigid inserts shall be installed in the pipe insulation at all hangers and supports.
      1) For piping which operates below 100°F, rigid inserts shall be HAMFAB H-Blocks as manufactured by ICA, Inc.
      2) For piping which operates above 100°F, rigid inserts shall be calcium silicate.

7) Execution of Pipe Covering Installation:
   A) Hot Lines with Glass Fiber Insulation:
      1) Pipe
         a) Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips.
         b) Seal laps, pulling jacketing tight and smooth.
         c) Self-sealing laps shall be secured according to manufacturers published recommendations.
         d) Open ends of pipe insulation shall be neatly stopped off and tapered down with insulating cement and covered with canvas embedded into a wet coat of fire retardant lagging adhesive.
      2) Fittings
         a) All fittings shall be insulated with segments of glass fiber pipe insulation or loops of insulating blocks firmly held in place with #16 galvanized soft wire.
         b) Cover all fitting insulation with white plastic fitting covers.
   B) Cold Lines with Glass Fiber Insulation:
      1) Pipe
         a) Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips.
         b) Seal laps, pulling jacketing tight and smooth.
         c) Ends of pipe insulation shall be sealed with a fire retardant vapor barrier coating at all fittings and valves, and at intervals of 21'-0" on continuous runs of pipe.
         d) Self-sealing laps shall be secured according to manufacturers published recommendations.
      2) Fittings
         a) All fittings shall be insulated with molded fiber glass fittings, segments of pipe covering, or with compressed flexible glass fiber secured in place with non-corrosive wire.
         b) All thicknesses to be equal to that of adjoining pipe covering.
         c) Cover all fitting insulation with white plastic fitting covers.
         d) If batt type insulation is used, it must be a minimum of 1 pound density and 1" thick.
   C) Valves Etc.
      a) All valve bodies, strainers and flanges shall be insulated as specified for fittings.
   C) Cold Lines with Glass Fiber Insulation:
      1) Pipe
         a) Butt all side and end joints tightly and apply a brush coat of fire retardant lagging adhesive to all laps and joint strips.
         b) Seal laps, pulling jacketing tight and smooth.
         c) Ends of pipe insulation shall be sealed with a fire retardant vapor barrier coating at all fittings and valves, and at intervals of 21'-0" on continuous runs of pipe.
         d) Self-sealing laps shall be secured according to manufacturers published recommendations.
      2) Fittings
         a) All fittings shall be insulated with molded fiber glass fittings, segments of pipe covering, or with compressed flexible glass fiber secured in place with non-corrosive wire.
         b) All thicknesses to be equal to that of adjoining pipe covering.
         c) Cover all fitting insulation with white plastic fitting covers.
         d) If batt type insulation is used, it must be a minimum of 1 pound density and 1" thick.
      3) Valves Etc.
         a) All valve bodies, strainers and flanges shall be insulated as specified for fittings.
   C) Apply metal jacket with 2" overlap at seams and joints.
      1) Seal weather tight with manufacturers recommended sealant.
      2) Apply the jacket such that the longitudinal seam is on the bottom of pipe.
      3) Secure jacket with stainless steel bands 12" on center and at end joints.

23 09 00 Instrumentation and Control for HVAC
   1) Trane or Johnson Controls are acceptable for new projects.
      A) For existing buildings, provide compatible system to the existing control system, although if minimal existing controls in the building, either Trane or Johnson Control are acceptable. The bidding process shall determine the controls contractor.
      2) Provide temperature sensors on the inlet and outlet water piping for all heat transfer equipment such as coils and heat exchanger.
3) All equipment shall have the capability to be started, stopped, or adjusted from a web-based workstation. The equipment would include, but not limited to, the air handling units, fans, pumps, and chillers.

4) Thermostatic Controls shall be adjustable units in private areas (office, conference, sleeping rooms) and non-adjustable in common areas (classrooms, auditoriums, corridors, etc).

5) To the extent feasible, establish separate temperature control zones that can be heated, cooled, or ventilated independently. Review temperature control zone layout with Owner.

6) All heating systems should have outdoor air resetting capabilities.

7) Low limit control. Consider software control low temperature limits on projects in which a coils are filled with glycol in lieu of standard manual reset low limit controllers.

8) Graphical user interface shall be provided with all controls projects. The graphics shall include floor plans with vav box and/or zone control noted (color coded is preferable), air handling units, chilled water systems, hot water heating systems and other major mechanical systems.

23 20 00 HVAC Piping and Pumps

1) All future connections shall be valved and capped.
2) Install valves at all major connections and at each floor.
3) All pump seals shall be suitable for use with water and/or a solution of 50% Glycol and water. The seals shall be rated to handle the following items as a minimum standard:
   A) Operating Temperature Range -20°F to 250°F
   B) pH Range 7.0 to 12.5
   C) Dissolved Solids 25,000 ppm
   D) Un-dissolved Solids 1,000 ppm
   E) Silica Content 20 ppm
4) Side-stream filters shall be installed for chilled water and hot water heating loops. Provide Owner with a carton of 30 micron filters.
5) Tangential air separator shall be used in hydronic loops with ball valve isolated automatic air vent.

23 22 01 Underground Steam and Condensate Distribution System

1) For Steam and Condensate Piping and Pumps within buildings, see 23 22 02.
2) Tunnels and Vaults for Steam and Condensate Distribution
   A) Consult with the Owner concerning the installation of a tunnel or direct buried systems.
   B) Tunnels and direct buried lines are to be covered with sufficient soil/insulation to prevent damage to vegetation above them.
   C) Tunnels shall be of minimum size four (4) feet wide by six (6) feet high interior dimension.
   D) Tunnels and vaults shall be constructed following the Concrete Specifications (Division 3).
   E) Vaults shall be provided with two manholes. Manholes shall be, 26” Neenah Watertight Manhole Frame with a Bolted Lid, R-1916-F or approved equal. Vaults with condensate pumps, reducing stations, or other large equipment shall be 36” R-1916-K or approved equal. Each entrance shall be provided with an aluminum ladder where possible.
   F) Water proof tunnel and vaults with a roll-type, self-adhering waterproofing membrane. Water stop is required where a vertical wall connects with a horizontal slab.
   G) Each vault shall have drain tile with a sump pit that is piped into the storm sewer system with galvanized steel pipe inside the vault and no-hub pipe outside of the vault. (No plastic will be allowed). Grade the floor to the sump pit.
   H) No corrugated metal decking shall be used for forming ceilings of vaults or tunnels.
3) Direct buried Steam and Condensate System
   A) Direct buried steam and condensate piping shall be a prefabricated distribution system supplied by Perma-Pipe™. The steam line shall be Multi-Therm 500 with galvanized steel conduit. The condensate line shall be Poly-Therm.
   B) All steam and condensate pipe connections shall be welded; all welders must be certified (AMSE Section IX).
   C) Contractor shall verify and assure the quality of all steam pipe welds by performing x-ray testing on 10 percent of all welded connections, determined by Owner. If failures are detected, Owner reserves the right to have all welded connections inspected.
D) Vault and tunnel wall penetrations shall be sealed using a metal wall sleeve with a center water stop, low durometer link seals, and roll-type, self-adhering waterproofing membrane lapping onto the pipelines and vault or tunnel wall a minimum of 6 inches.

4) Piping and Fittings
   A) High Pressure Steam supply piping shall be Schedule 40 A106 Grade B Seamless black steel or Schedule 40 A53B ERW (electric-resistance welded). Flanges shall be Class 150 carbon steel. Weld fittings shall be carbon steel weld fittings or forged steel socket weld fittings.
   B) All condensate return piping shall be Schedule 80 A53B ERW (electric-resistance welded), black steel. Threaded low pressure condensate piping shall use class 150 black malleable fittings. Weld fittings shall be carbon steel weld fittings or forged steel socket weld fittings.
   C) Flanged connections for High Pressure Steam, Low Pressure Steam, and Condensate piping shall be provided with spiral wound gaskets and B7 studs.
   D) Threaded pipe is not allowed above 2” on High Pressure Steam, Low Pressure Steam, and Condensate piping. All drip leg and drain piping 2” and bellow shall be threaded.
   E) All low points on steam and condensate piping shall have a 1” or ¾” drain installed. The shut off valve for the drain shall be an 800# forged steel threaded gate valve.

5) Gate Valves High Pressure Steam and Condensate
   A) Provide a clear access to shut-off valves.
   B) Flanged valves shall be Class 150 cast steel and rated for steam use.
   C) Valves 2” and larger shall be flanged, OS & Y, with stellite trim. (Optional for 1-1/2” and smaller). Expectable manufacturers are Crane, Velan or approved equal.
   D) Valves 1 1/2” and smaller shall be rising stem, bolted bonnet, threaded 800# forged steel or (socket weld 800# forged steel where expansion may cause problems with threaded valves).

6) Globe Valves
   A) Flanged valves shall be Class 150 cast steel and rated for steam use.
   B) Valves 2” and larger shall be flanged, bolted bonnet with stellite trim. (Optional for 1-1/2” and smaller). Expectable manufacturers are Crane, Velan or approved equal.
   C) Valves 1 1/2” and smaller shall be bolted bonnet, threaded 800# forged steel or (socket weld 800# forged steel where expansion may cause problems with threaded valves).

7) Pressure Regulators
   A) Install Spence Type "E" pressure regulators or approved equal with bypasses at mechanical entrances of high pressure distribution lines.
   B) Use parallel pressure reducing stations where large fluctuation in steam use is anticipated.
   C) Small equipment may be supplied with an Armstrong GD-30 pressure regulator or approved equal.

8) Condensate Pumps
   A) Condensate pumps shall be Gestra FRS-24 non-electric positive displacement pressure-powered pumps or approved equal for larger applications. Pumps shall be provided with stainless steel spring loaded wafer check valves, sight glass, and removable insulating jacket for the pump tank and valves.
   B) Electric condensate pumps may be used for smaller loads at Owner’s discretion.

9) Steam Traps
   A) High Pressure drips in vaults, tunnels and pits where High Pressure Steam enters a building shall be provided with a threaded ¾” Gestra MK45-2 steam trap or approved equal. A threaded 800 lb. forged steel gate valve shall be provided for isolation prior to the steam trap. Threaded fittings prior to the steam trap shall be 300# black malleable.
   B) Install drip traps before all thermostatic temperature regulating valves, pressure reducing valves, at the low point of vertical risers, at a minimum of 500’ intervals in horizontal runs and at line’s end.

10) Expansion joints for High Pressure Steam, Low Pressure Steam, and Condensate located in vaults or tunnels shall be domestic Metraflex Metragators with 150# flanged connections or approved equal.
    A) Expansion joints must have an affixed metal identification tag.
    B) Expansion joints are to be covered with a removable insulating jacket.

11) Hangers, Supports, and Anchors
A) Where possible piping shall be hung from vault ceiling or walls. If piping must be supported from the floor a house keeping pad must be provided to protect exposed metal from wet floor conditions.
B) All threaded rod and hangers shall be zinc coated.
C) Exposed metal shall have one coat of red primer. Zinc coated threaded rod and hangers should not be primed.
D) Extension split pipe clamps are not allowed.

12) Insulation
A) Insulation for piping, valves, and equipment shall follow subsection (23 07 19).
B) All pipe insulation inside vaults shall be covered with Aluminum jacketing.
C) All valves 2” and larger, expansion joints, and equipment that requires access for maintenance shall have removable jacket covers.

13) Meters
A) Each new construction shall have a condensate meter installed for both selling back steam to the contractor and for monitoring steam consumption after building occupation.
B) The flow meter shall be an ABB mag flowmeter model# FEM325025E1D0W1Y1A1A0P1BOY1AYF6M5 or approved equal.
C) The remote flow meter reader shall be an ABB model# FET3251A0P1B3C0H2 or approved equal.
D) A conductivity meter shall be installed in the condensate main line before it leaves the building. A manual sample port shall be installed close to the conductivity meter.
E) The conductivity probe shall be an ABB model# TB26-010111000332 with a ¾” NPS male connection or approved equal.
F) The remote conductivity meter reader shall be an ABB model AX400 or approved equal.

14) Electrical Requirements for Vaults and Tunnels
A) Vaults shall be supplied with two circuits, one designated for the sump pump and one for lights and work receptacles.
B) Tunnels shall have lights at a minimum interval of 20’ and receptacles at a minimum of 100’ intervals.
C) Lights shall be vapor tight fixtures, clear glass globes, and cast aluminum housing and cage.
D) Conduit shall be rigid.

15) Other Utilities
A) Consult with the owner for other utilities that may need to be installed in tunnels or trenches between vaults. Examples (air lines, communication lines, or conduits for future use).

23 22 02 Steam and Condensate Piping and Pumps within buildings
1) For Underground Steam and Condensate Distribution System, see 23 22 01.
2) High pressure steam and condensate valves shall be Class 150 SWP cast steel and stamped for high-pressure steam application.
A) Flange valves OS & Y (required for 2” and larger, optional for 1-1/2” and smaller) shall be Crane, Velan or approved equal.
B) Threaded valves 1-1/2” and smaller shall be 800# forged steel, rising stem, bolted bonnet.
3) Owner may require the Contractor to verify and assure the quality of all steam pipe welds by performing x-ray testing on 10 percent of all welded connections as determined by Owner.
A) If failures are detected, Owner reserves right to have all welded connections inspected.
4) Provide a clear access to all valves.
5) Install pressure regulators with manual bypasses at mechanical entrances of high pressure steam distribution lines.
A) Use parallel pressure reducing stations where large fluctuations in steam use is anticipated or where steam use is critical.
6) Condensate pumps shall be non-electric positive displacement pressure-powered pumps for larger applications. The units shall be a LMV series Johnson Liquid Mover, Gestra or approved equal.
A) Provide stainless steel, spring loaded wafer check valves.
B) Provide sight glass.
C) Provide removable insulating jacket for the pump tank and valves.
7) Electric condensate pumps may be used for smaller loads and at Owner’s discretion.
8) Each new construction project condensate pump discharge that serves a building shall be fitted with a condensate meter and conductivity meter (with temperature sensing) in a valves bypass. Install lockable, manual bypass valve around the meters.
   A) Condensate Meter shall be an ABB Automation Mini-Mag with magnetic flow meter signal convertor. The output shall be connection to the building automation system. Verity connection with Owner.
   B) Conductivity Meter shall be an ABB Two Electrode Conductivity Sensor TB26, 392°F, 1-2000 µS/cm, with conductivity and temperature sensors. The meter shall be connected to the transmitter which in turn will be connect to the building automation system. Verity connection with Owner.
9) Install drip traps before all thermostatic temperature regulating valves and pressure reducing valves, and at line's end.
10) Expansion joints in high pressure steam shall be externally pressurized, equipped with stainless steel bellows, flanged connections, flow liner, internal and external guide rings.
   A) The end to end dimension of expansion joints must meet current NDSU specifications. Contact Owner for current required dimensions.
   B) Expansion joints are to be covered with a removable insulating jacket.
11) Install strainer upstream from all steam traps. Strainer to be fitted with manual blow-down valve.

23 23 00 Refrigerant Piping
1) Refrigeration tubing shall be Type "L ACR" hard copper with long turn elbows and brazed joints. Care shall be taken in assembling the refrigerate piping purging with nitrogen during all brazing operations.
2) Piping to be sized as per manufactures recommendation.
3) Expansion valves will be installed on circuits over five tons unless otherwise specified by the manufacture.
4) Liquid line sight glasses to be installed on all circuits over five tons.
5) Replaceable core and canister style filter driers with isolation valves will be installed in a serviceable location on all circuits over ten tons. Under ten tons disposable dryers will be allowed.
6) Electronic solenoid valves to be installed on circuits over five tons and as per manufacturer’s instructions.
7) Charging/access ports to be installed at the air handling unit.
8) All piping to be brazed.
9) Nitrogen or comparable gas to be purged through system while brazing is being done.
10) No soft solder will be used.
11) Piping to be properly sloped as per manufactures recommendations.
12) Suction line to be insulated with closed cell foam rubber type insulation with sealed seams and joints. Any insulation outdoors is to be painted with a latex based ultra violet resistive paint.
13) Cushion clamps will be used at all hanger points, no solid type clamps.
14) Vibration eliminators will be installed near condensing unit on circuits 7-1/2 tons and larger, if the condensing unit is spring mounted, or as per manufacturer’s instructions.
15) Systems will be evacuated to the specified micron readings as per the manufacturer’s recommendations.
16) Careful consideration will be taken at the end of every shift to ensure the system is sealed in a way to prevent moisture and particles from entering the system.
17) All circuits to be pressure tested with nitrogen or other comparable gas before evacuation and dehydration.
18) Underground refrigerant piping is not allowed.

23 30 00 HVAC Air Distribution
1) All exhaust fan equipment shall have gravity back draft dampers at point air exits building.
2) Be aware of existing or future conditions.
3) Fresh Air Intake Locations
   A) Wall fresh air intakes are preferred to roof intakes. Do not place fresh air louvers by loading docks; vehicle exhaust could create hazardous indoor air.
   B) Raise all roof intake units high enough to protect them from blowing or drifting snow, but keep them low enough to avoid negative aesthetic appeal.
4) Ventilation systems should utilize variable air volume systems with reheat coils.
5) Use CO2 sensors in the return air from classrooms, auditoriums, and large meeting places.
6) All ductwork shall be installed as per SMACNA standards and consult Owner for duct leak testing requirements.
23 40 00 HVAC Air Cleaning Devices
1) Provide a complete replacement set of filters at completion of project.
2) Provide a minimum of MERV 11, preferred MERV 13.
3) Angled filter configuration preferred over straight.

23 25 00 HVAC Water Treatment
1) Air handling units subject to outside air shall be supplied with a glycol mixture to prevent damage to heating and cooling coils and system freeze-up. Air cooled chiller systems shall be given consideration to the prevention of freezing with the addition of glycol solutions.
   A) Specify glycol manufactured by Dow Chemical Company or Freemont Industries, Inhibited Ethylene Glycol or Inhibited Propylene Glycol designed for closed circuit hydronic systems.
   B) Distilled or RO water shall be used in the HVAC system rather than municipal water.

23 60 00 Central Cooling Equipment
1) Chillers are based upon Trane, York or Daikin units, or approved equal.
2) Supply the chiller with a microprocessor control panel with a password-protected keypad interface. The interface shall communicate with the existing digital control system.
3) All chillers shall have full factory supplied architectural louvered enclosures covering the condensing and compressor units.
4) Domestic water-cooled refrigeration condensing units are not allowed.

23 81 26 VRV Air Conditioners
1) VRV systems must be capable of automatic switch over between cooling and heating.
<table>
<thead>
<tr>
<th>Division 24 Reserved</th>
<th>This division is reserved for future use.</th>
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</thead>
<tbody>
<tr>
<td>Division 25 Integrated Automation</td>
<td>There are currently no items for this division.</td>
</tr>
</tbody>
</table>
Division 26 Electrical

26 05 00 Common Work Results for Electrical

1) Check individual electrical equipment such as motors and lighting for proper power factor. Power factor should be at least 90% or more under rated condition.

2) Where applicable, provide general accessibility to ceiling spaces and pipe chases, to facilitate potential fixture changes or remodeling.

3) Motors
   A) In general, design using 480V / 3 ph. motors with maximum speed of 1800 RPM.
   B) All motors shall be premium efficiency, VFDs shall be duty rated if required.
   C) Use Square D, Cutler Hammer or approved equal for motor/starter disconnect.
      1) Indicator lights shall be colored so that green indicates the motor is energized (on) and red indicates the motor is de-energized (off).
      2) All three phase starters shall have three overhead relays.

D) Install variable frequency drives on motors that cycle and for energy efficiency.
   1) ABB, Dan Foss or approved equal.
   2) Drives provided with circuit breaker disconnects and lockout.

E) All three phase motors shall have phase failure protection.

F) Encourage use of Electronic Control Module (ECM) motors for single phase applications.

4) Receptacles (Outlets)
   A) In corridors and classrooms, receptacles shall be installed such that no point measured horizontally along the floor line of any space is more than 12’-0” from a 120V receptacle duplex outlet. Consult with Owner regarding additional power requirements.
   B) In stair towers, one (1) 120V receptacle duplex outlet shall be installed on each level.
   C) Furnish a 120-volt clock outlet in each classroom.
   D) White or Light Almond plastic device or outlet covers.

5) Junction Boxes
   A) Provide a junction box above dropped ceilings in outlet home run circuit(s) for individual rooms.
   B) Provide a junction box above dropped ceilings in individual rooms if multiple rooms exist on one run for future wiring.

6) A three-quarter inch (3/4”) EMT conduit shall be run from the top of entrance frames (hollow metal frames and aluminum frames) to above the finished ceiling for electronically access controlled doors.

26 10 00 High-Voltage Electrical Distribution

1) High voltage underground lines shall have a yellow or red warning tape and be buried a minimum of 48 inches deep covered with six inches of sand.

2) Where applicable, all Service entrances into campus buildings shall be 480/277 volts. Building transformers are provided by Xcel Energy and they are to be consulted as to the transformer placement.

26 20 00 Electrical Distribution

1) All underground wire of 600 volts or less shall be buried in PVC conduit.

2) All step-downs and power drops shall take place within the building.

3) The service entrance distribution equipment shall be manufactured by Square D, Cutler Hammer or approved equal.
   A) Service entrance distribution equipment shall be supplied fully equipped with bussing and mounting hardware.
   B) Provide Shark, Veris or approved equal electrical meter, PT’s, and C/T’s. Provide the circuit monitor with display and Ethernet communication.
   C) Provide surge suppression equipment as required by code. This equipment will be field-installed; make provisions in the equipment to accept this direct connection to circuit breaker.

4) Each power distribution panel shall have a minimum of twenty percent (20%) spare capacity. Fill the panel with spare breakers for future use. Consult with Owner.
26 32 00 Packaged Generator Assemblies
1) Consult with Owner concerning back-up power generation requirements for new facilities.
2) Caterpillar, Onan, Cummins or approved equal. Service technicians shall be within one hour of campus.
3) ATS shall be States, Asco or approved equal.

26 50 00 Lighting
1) Emergency lighting
   A) Self-diagnostics shall not be used for emergency lighting.
   B) Emergency lighting shall be powered by a generator; battery-powered units are not preferred.
2) Lamp Ballast
   A) Only high efficiency electronic ballasts are to be installed. For general 2x4 drop-in, fluorescent fixtures the ballast shall be GE Ultramax, Advance or approved equal, typically normal power.
   B) Ballast shall be multi-voltage.
3) Interior Lighting
   A) Interior light shall be installed such that fixtures are easily accessible for maintenance. Fixtures that require special equipment, such as lifts or scaffolds, for maintenance or service shall be kept to a minimum.
   B) General facility lighting shall be designed around high-efficiency fluorescent two (2) feet by four (4) feet, two (2) lamp fixtures supplied with T-8 lamps with electronic ballast.
      1) The use of LED lighting is encouraged where cost effective.
   C) Use selective switching or dimmers to control lighting levels when possible.
   D) Special consideration should be given to classroom lighting. Coordinate with Owner.
   E) Consider using motion detectors or vacancy sensors to control lights in class rooms, store rooms, custodial rooms, etc., where lights are apt to be left on.
   F) Minimize lighting used only for decorative purposes.
   G) Minimize atypical lighting fixtures, lamps, and ballasts; consider life-cycle cost (including lamp replacement) and accessibility for maintenance in selecting lighting fixtures.
4) Exterior Lighting
   A) Parking Lot and Street Lighting:
      1) Luminaire fixture shall be LED roadway cobra head light. Consult with Owner if an alternative fixture is to be considered.
      2) Standard pole shall be 30’-0” tall, tapered, octagonal, hot-dipped, galvanized steel, or stainless steel with Type H base, 6’-0” mast arm and vibration damper.
      3) Lighting circuits shall be energized with contactor controlled by a photoelectric cell.
      4) Install bypass switch to energize circuit for maintenance purposes.
   B) Walkway Lighting:
      1) Fixture shall be clear 18” polycarbonate globe with refractor to cast light down
      2) Lamps shall be 150 watt, high-pressure sodium
      3) Poles shall be 10’-0” tall, brushed aluminum, hinged, tilt-down
      4) Form for poured concrete base shall be supplied by Owner
      5) Lighting circuits shall be energized with contactor controlled by a photoelectric cell.
      6) Install bypass switch to energize circuit for maintenance purposes.
Division 27 Communications

27 10 00 Structured Cabling

1) Telecommunications Facilities
   A) Building Entrance/Outside Plant
      1) Provide three four inch PVC ducts from proposed building entrance to nearest communications vault or access facility.
      2) Populate one of the three, four inch ducts with three 1 1/4 inch inner ducts.
      3) All ducts and inner ducts should be equipped with a pull rope or mule-tape.
      4) Ensure two to three inches separation between each underground duct. Spacers are to be used.
      5) Ducts should be buried at a depth of 30 inches below finished grade to top of ducts with warning tape installed approximately six inches above top of ducts.
      6) All ducts should be sealed watertight at all vault and building penetrations.
      7) Facilities Management and Network Services will communicate to all details relating to outside cable infrastructure including sizing of fiber optics and twisted pair, type of protection and terminations to the architect and/or electrical engineer for the project.
      8) Aerial installations and intermediate pedestals will be avoided.
   B) Telecommunications Room (Closet)
      1) Locate this room as close as possible to the center of the serving area. Longest cable run cannot exceed 90 meters (295 feet).
      2) Efforts should be made to collapse all communications circuits into a single Telecommunications room; however, this may not be feasible or practical based on design and architecture.
      3) Room size is based on usable square footage within the facility that the closet will serve:
         a) Less than 5,000 sq. ft., room shall be 10 ft. by 8 ft.
         b) 5,000 sq. ft. to 8,000 sq. ft., room shall be 10 ft. by 9 ft.
         c) 8,000 sq. ft. to 10,000 sq. ft., room shall be 10 ft. by 11 ft.
      4) Minimum ceiling height 8.5 feet above finished floor.
      5) The Telecommunications Room should not be shared with other electrical distribution facilities or other equipment that would produce any EMI.
      6) The telecommunications room should be provided with adequate environmental control that will maintain a temperature of 64°F to 75°F and a relative humidity level 30% to 55%.
      7) Minimum floor loading of 2.4 kPa (50 lb/ft²).
      8) Provide access to building ground.
      9) Minimum lighting equivalent of 500 LUX (50 foot candles) measured 1 meter above finished floor.
      10) If multiple Telecommunications rooms are required to support a facility, adequate conduit or tray capacity should be placed to accommodate current and future cabling needs.
      11) All drop terminations should be on ‘110’ hardware using 4-pair connecting blocks rated at Category 5e or higher.
      12) Provide two 20 Amp (non-switched) 3-wire, 120 volt duplex electrical outlets, on separate branch circuits.
      13) This room should be properly secured (card key or keyed separately)
      14) Three walls should be lined with 3/4 inch AC – Grade or better plywood, eight feet high. Plywood surface shall be painted with two coats of gray enamel.
      15) If fire protection is required, a dry-pipe sprinkler system should be considered.
   C) Work Area (Offices)
      1) For each occupant of a work area, provide a minimum of one communications outlet. Two outlets would provide additional flexibility.
      2) The work area outlet should be located within three feet of an electrical outlet and installed at the same height.
      3) Coordinate location of all floor outlets with furniture design and placement.
      4) Each outlet should be roughed-in with a four inch square deep box with a single gang mudring.
      5) Each outlet should have two 4-pair; 100-ohm cables rated at category 5e or higher pulled in. Leave 18 inches of cable at the outlet and 12 – 20 ft. in the telecommunications room (depending on location
Design Guidelines

27 50 00 Distributed Communications and Monitoring Systems

1) Clock and Program Systems (Clock Program System)
   A) Use standard program system and corridor clocks, to be compatible with present Primex system.

D) Horizontal Distribution

1) Each communications outlet should have a 3/4 inch EMT conduit installed from the rough-in outlet box to either a cable distribution tray or home run to the telecommunications room.
2) Cable runs cannot exceed 90 meters (295 feet) from the outlet to the telecommunications room termination point.
3) Each cable should be adequately labeled for easy identification (i.e. room number / voice-data/ run number etc.).
4) If a metallic tray is being used for horizontal distribution, ensure that there is a continuous bond to ground throughout the distribution system.

E) Miscellaneous:

1) Consult with Facilities Management and Network Services on the need and locations for the following applications and/or systems:
   a) Private CATV system
   b) Electronic Access Systems
   c) HVAC Networking / Communications
   d) UPS for Telecommunications
   e) Roof access for external antennas (wireless or microwave / weather-head)
   f) “Code Blue” emergency towers
   g) PA / speaker systems

References:
- ANSI/TIA/EIA – 568 – A
- ANSI/TIA/EIA – 569 – A
- ANSI/TIA/EIA – 606
- ANSI/TIA/EIA – 607
- NEC ARTICLE 318 (Cable trays)

Division 28 Electronic Safety and Security

28 10 00 Electronic Access Control and Intrusion Detection

1) The University employs a CBORD system for Access Control and Intrusion Detection
   A) Confer with the University’s Telecommunications Department regarding installation requirements.
   B) The University will contract with its vendor to install and commission the system.
   C) Contractors will be responsible for electrical rough-ins and door hardware associated with the access control system.

2) See also section 08 70 00.18 for hardware requirements.

28 30 00 Electronic Detection and Alarm

1) The alarm system shall be designed to permit future extension of alarm circuits to a central alarm center, which is controlled by “SimplexGrinnell”. Any new building and renovation is required to be compatible to add additional screens for the color graphics, addressable alarm system.

2) Locate alarm equipment in the building where damage could be caused due to equipment failure. Examples are high water in sump pit, low control air, low house air, low temperature, generator status and alarm, building security, fire pumps and values and fire protection.

3) The University utilizes a fire alarm control system by SimplexGrinnell; new and existing facilities shall utilize this same system and shall be connected to the central University fire detection and alarm system.
   A) Fire Alarm Annunciator with Fire Fighter’s Microphone shall be located in the primary entrance of the facility.
   B) The facility’s Fire Alarm Control Panel (FACP) shall communicate with the wider University alarm system via connection to the University’s local area network (LAN).
   C) Provide duct smoke detector within 5’-0” of smoke dampers; damper shall close when the associated detector is in an alarm condition and the associated air handling unit is to shut down.
   D) Motor controllers shall shut down during an alarm condition.
   E) Audible-Visual notification appliances shall be utilized throughout the facility; these appliances shall include horn, strobe, and speaker notifications.

4) During renovations, all provisions must be taken to transfer all alarm points from existing SimplexGrinnell monitoring panels or systems to new or updated panels or systems.

5) During the time of construction work on all renovations or new construction, the SimplexGrinnell alarm system must be kept in a “system normal” state such that the central University fire detection and alarm system is not receiving any alarms or troubles from the building or area of construction.
<table>
<thead>
<tr>
<th>Division 29 Reserved</th>
<th>This division is reserved for future use.</th>
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<tr>
<td>Division 30 Reserved</td>
<td>This division is reserved for future use.</td>
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</table>
**Division 31 Earthwork**

**31 14 00 Earth Stripping and Stockpiling**

1) Excess black dirt, clay or contaminated material will be removed from campus and become the property of the Contractor.

**31 22 00 Grading**

1) For general projects, rough grade level shall be twelve (12) inches below finish grade.
2) For general projects, the final slopes of the finish grade should not exceed 3:1; if grade exceeds 3:1 see Section 32 32 00.
3) Topsoil:
   A) Topsoil shall be salvaged from the construction site for reuse.
   B) Contractor provided topsoil shall be natural loam, which is fertile, friable, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, rhizomes, litter, roots, stumps, stones larger than 1/2” in any dimension, construction debris, and other extraneous or toxic matter harmful to plant growth.
      1) Owner to inspect topsoil source or individual loads of topsoil prior to placement. Verify suitability of topsoil with Owner.
   C) Topsoil shall be lightly compacted when placed.
   D) Topsoil shall not be compacted to achieve grade.
   E) Topsoil shall be manually placed to prevent damage to existing plants.
   F) Roots, weeds, rocks, and foreign material shall be removed while spreading.
   G) Contractor shall place topsoil to the following compacted thicknesses:

<table>
<thead>
<tr>
<th>Application</th>
<th>Compacted Topsoil Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeded with Grass</td>
<td>6” minimum</td>
</tr>
<tr>
<td>Shrub Beds</td>
<td>18” minimum</td>
</tr>
<tr>
<td>Flower Beds</td>
<td>18” minimum</td>
</tr>
<tr>
<td>Planter Boxes</td>
<td>To within 3” of box rim</td>
</tr>
</tbody>
</table>

**31 23 00 Excavation and Fill**

1) For general projects, earth backfill compacted to 95% minimum density as per Standard Proctor ASTM D698-91 in six (6) inch lifts.
2) Earthwork for concrete placement projects
   A) Site Restoration:
      1) Backfill the areas affected by the new concrete work with clean black dirt which shall be free of debris and be fine graded – ready for planting and seeding.
   B) Compaction:
      1) Sub-grade shall be between 95 to 105 percent of maximum density as determined by ASTM D698 in the top 12 inches of the sub-grade.
      2) The Contractor may scarify, dry the material, or apply water as necessary to obtain the required density and stability.
      3) Material that will not compact readily shall be removed and replaced with Owner approved suitable material.
   C) Fill:
      1) Sub-grade areas that require fill to bring the elevation up to the base course shall be compacted in 6 inch lifts to 95 to 105 percent of maximum density.
      2) No stones larger the three inches in diameter are permitted in fill as well as other objectionable material.
      3) Fill outside the pavement areas are to be compacted to 90 percent.
      4) Backfill the areas affected by the new concrete work with clean black dirt which shall be free of debris and be fine graded – ready for planting and seeding.
         a) Based on project size & scope, Owner may backfill and/or restore all plantings, including the grass.
         b) Surfaces shall be broom-cleaned of any debris or dirt when site is left.
Division 32 Exterior Improvements

32 05 00 Common Work Results for Exterior Improvements

1) Soils for Exterior Improvements:
   A) Contractor shall thoroughly loosen any compacted subgrades prior to placing topsoil, to a minimum depth of 9”.
   B) Topsoil shall not be compacted to achieve grade.
   C) Contractor shall remove all weeds, contaminated soils, misc., construction debris (including concrete), and waste materials from areas to be planted and sodded. Contractor shall loosen compacted soils by tilling and import new topsoil as required to restore grades and maintain positive drainage away from structures.
   D) Shrub and perennial beds are to receive 4” depth of shredded hardwood mulch.

32 11 00 Base Courses

1) Aggregate Base for Concrete Work
   A) Material: Material shall be crushed or uncrushed gravel, crushed stone, natural gravel, or combination thereof and free from sod, plants, roots, other organic matter or other objectionable material.
   B) Gradation:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Weight Passing Square Mesh Sieve</th>
<th>Sieve Designation</th>
<th>Weight Passing Square Mesh Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>100 %</td>
<td>1 1/2”</td>
<td>100 %</td>
</tr>
<tr>
<td>3/4”</td>
<td>90 – 100</td>
<td>1”</td>
<td>90 - 100</td>
</tr>
<tr>
<td>3/8”</td>
<td>50 – 90</td>
<td>3/4”</td>
<td>80 - 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>35 – 70</td>
<td>No. 4</td>
<td>35 - 70</td>
</tr>
<tr>
<td>No. 10</td>
<td>20 – 55</td>
<td>No. 30</td>
<td>16 - 40</td>
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<tr>
<td>No. 40</td>
<td>10 – 35</td>
<td>No. 200</td>
<td>4 - 20</td>
</tr>
<tr>
<td>No. 200</td>
<td>3 -10</td>
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</tbody>
</table>

C) Compaction: Shall be between 95 to 105 percent of maximum density as determined by ASTM D698.

32 14 00 Unit Paving

1) Unit pavers are not permitted.

32 32 00 Retaining Walls

1) Retaining walls must be installed if the final slopes of finished grade exceed 3:1.

32 80 00 Irrigation

1) Irrigation systems shall be coordinated with the Owner and match the landscape design.
   A) Water Meter:
      1) Provide a City of Fargo acceptable water meter on the water supply line to the irrigation system.
      2) This meter is to be installed near the building water meter.
   B) Piping:
      1) All underground irrigation piping shall be installed prior to the installation of plantings.
      2) Sprinkler contractor is to coordinate with the paving and sidewalk contractor the placement of PVC pipe sleeves under the paved areas.
      3) Mainline irrigation piping shall be Class 200 PVC placed a minimum 18 inches below finished grade.
      4) The lateral lines shall be 100 psi polyethylene SDR rated.
      5) Piping from the building water supply to the main outside, underground sprinkler system valve shall be Type K soft copper.
C) Controller:
   1) Electronic irrigation controller shall be Toro Sentinel Controller. See Owner for specs.

D) Backflow Preventer:
   1) Supply all systems with a backflow preventer on the mainline irrigation piping.
   2) Acceptable manufacturer and respective manufacturers’ part/model numbers, or approved equal:

<table>
<thead>
<tr>
<th>Size</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>Watts</td>
<td>800M4FR</td>
<td>PVB</td>
</tr>
<tr>
<td>1”</td>
<td>Watts</td>
<td>919-QT</td>
<td>RPZ</td>
</tr>
<tr>
<td>1-1/4”</td>
<td>Watts</td>
<td>800M4FR</td>
<td>PVB</td>
</tr>
<tr>
<td>1-1/4”</td>
<td>Watts</td>
<td>919-QT</td>
<td>RPZ</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>Watts</td>
<td>800M4FR</td>
<td>PVB</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>Watts</td>
<td>919-QT</td>
<td>RPZ</td>
</tr>
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<td>919-QT</td>
<td>RPZ</td>
</tr>
<tr>
<td>2-1/2”</td>
<td>Watts</td>
<td>909-OSY</td>
<td>RPZ</td>
</tr>
<tr>
<td>3”</td>
<td>Watts</td>
<td>909-OSY</td>
<td>RPZ</td>
</tr>
<tr>
<td>4”</td>
<td>Watts</td>
<td>909-OSY</td>
<td>RPZ</td>
</tr>
</tbody>
</table>

E) Sprinkler Heads:
   1) Acceptable manufacturers and respective manufacturers’ part/model numbers, or approved equal:

<table>
<thead>
<tr>
<th>Hunter</th>
<th>Rainbird</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGJ</td>
<td>1800 Series</td>
</tr>
<tr>
<td>PGP</td>
<td></td>
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<tr>
<td>I-20</td>
<td></td>
</tr>
<tr>
<td>I-40</td>
<td></td>
</tr>
</tbody>
</table>

F) Valves:
   1) Acceptable manufacturer and respective manufacturers’ part/model numbers, or approved equal:

<table>
<thead>
<tr>
<th>Rainbird</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEB</td>
</tr>
</tbody>
</table>

G) Valve Boxes:
   1) Valve boxes shall be Rain Bird VB-Series or equivalent.
   2) Properly size valve boxes to allow for ample maintenance room.
   3) Place the boxes in planting beds where possible; no boxes will be allowed in sidewalks or vehicle driving areas.
   4) Valve box shall be supported by two 2” x 4” x 8” concrete pavers. Bottom of valve pit shall be filled with 1” layer of 3/8” pearock.

32 90 00 Planting

1) Landscape designs shall be coordinated through the Owner’s Landscape Designer.
2) Contractor shall become familiar with the location of all existing and future underground services and utilities.
3) Contractor shall lay out plant material per plan and face to give best appearance to adjacent plants.
4) Plant material shall not be installed in an area which will cause harm to adjacent structures or obstruct irrigation spray pattern. Notify Owner should conflicts arise.
5) All plant material shall be in a healthy condition and well-watered before and during planting.
   A) Planting material shall not have wilted leaves or dry root balls when planted.
   B) Planting material shall not be devoid of leaves during the months of June, July, August, and September when planted.
   C) Trees shall not have any damage to the main trunk, and tree leaders shall be intact.
6) Trees: (See Figure 32 90 00-1: Evergreen Planting and Figure 32 90 00-2: Deciduous Tree Planting, starting on page 32-4)
   A) Trees shall not to be planted with the root flair below grade.
B) All trees shall receive at least ten gallons of water each within 3 hours of planting.
C) Thirty days after planting contractor shall restake and straighten trees as necessary. Refer to Figure 32 90 00-5: Tree Staking on page 34-5 for a diagram about proper staking.

7) Shrubs: (See Figure 32 90 00-3: Shrub Planting and Figure 32 90 00-4: Creeping Evergreen Planting, starting on page 32-4)
   A) All shrubs shall receive at least five gallons of water each within 3 hours of planting.
   B) Shrubs shall not be planted with the root flair below grade
   C) Shrub beds are to receive 4” depth of shredded hardwood mulch.

8) Perennials:
   A) Perennials shall receive at least 2 gallons of water each within 3 hours of planting.
   B) Perennial beds are to receive 4” depth of shredded hardwood mulch.

9) Mulching around trees, shrubs, and perennials: (See Figure 32 90 00-1: Evergreen Planting, Figure 32 90 00-2: Deciduous Tree Planting, Figure 32 90 00-3: Shrub Planting, Figure 32 90 00-4: Creeping Evergreen Planting, and Figure 32 90 00-5: Tree Staking, starting on page 34-2)
   A) All planting material shall have a mulch free zone of 1” radius around the base of each plant after mulch is laid down.
   B) Deciduous trees are to receive 4” of shredded hardwood mulch within a muddle ring with a minimum diameter of 5’-0”.
   C) Evergreen trees are to receive 4” of shredded hardwood mulch within a muddle ring with a diameter equal to the diameter of the tree’s drip line.
**Design Guidelines**

**Facilities Management**

**Figure 32 90 00-1: Evergreen Planting**

PLANTING PIT SHOULD BE DUG THREE TIMES (3X) LARGER THAN ROOTBALL WITH SOIL REMOVED FROM THE TOP OF THE ROOTBALL TO THE ROOT FLAIR. THE DEPTH OF THE PIT SHALL BE NO DEEPER THAN THE TOP OF THE ROOTBALL.

PLACE NATIVE SOIL FILL AROUND ROOTBALL

UNDISTURBED SUBSOIL

REMOVE DAMAGED BRANCHES BY PRUNING

WOODCHIP MULCH FOR BEDDING AROUND TREE 4" MIN. DEPTH AND WITH A DIAMETER EQUAL TO THE TREE'S DRR LINE. DO NOT PLACE MULCH AGAINST TRUNK

MUDDELE RING WITH A 6'-0" DIA. AND MIN. HEIGHT OF 4'

PULL BAG 3/4 WAY DOWN ROOTBALL AFTER PLACED IN PIT. GREEN TREAT BURLAP AND WIRE BASKET SHALL BE REMOVED.

**Figure 32 90 00-2: Deciduous Planting**

PLANTING PIT SHALL BE DUG TWO TO THREE TIMES (2-3X) LARGER THAN ROOTBALL WITH SOIL REMOVED FROM THE TOP OF THE ROOTBALL TO THE ROOT FLAIR. THE DEPTH OF THE PIT SHALL BE NO DEEPER AS TO HAVE ROOT FLAIR LEVEL WITH GRADE.

PLACE NATIVE SOIL FILL AROUND ROOTBALL

UNDISTURBED SUBSOIL

REMOVE DAMAGED BRANCHES BY PRUNING

ROOT BALL SHALL BE PLACED IN CENTER OF PIT, TOP OF ROOTBALL SHALL NOT BE EXPOSED ABOVE GROUND.

WOODCHIP MULCH FOR BEDDING AROUND TREE 4" MIN. DEPTH BY 5'-0" DIA. DO NOT PLACE MULCH AGAINST TRUNK

MUDDELE RING WITH A 5'-0" DIA. AND MIN. HEIGHT OF 4'

POT SHALL BE REMOVED AND SOIL REMOVED DOWN TO ROOT FLAIR. FOUR (4) VERTICAL CUTS SHALL BE MADE, ONE (1) ON EACH SIDE OF THE ROOTBALL WITH AN X CUT AT BOTTOM OF ROOTBALL. GROWING ROOTS SHALL BE CUT.

**Figure 32 90 00-3: Shrub Planting**

PLANTING PIT SHOULD BE DUG THREE TIMES (3X) LARGER THAN CONTAINER. THE DEPTH OF THE PIT SHALL BE AS DEEP AS THE CONTAINER.

MUDDELE RING WITH A 3'-0" DIA. AND MIN. HEIGHT OF 4'

PLACE NATIVE SOIL FILL AROUND ROOTBALL

UNDISTURBED SUBSOIL

REMOVE DAMAGED BRANCHES BY PRUNING

WOODCHIP MULCH FOR BEDDING AROUND SHRUB 4" MIN. DEPTH BY 3'-0" DIA. DO NOT ALLOW MULCH TO COME IN CONTACT WITH PLANT BASE.

FILL 1/4 OF PIT WITH WATER BEFORE PLANTING.

ROOTBALL SHALL BE PLACED IN CENTER OF PIT WITH FOUR (4) VERTICAL CUTS MADE DOWN EACH SIDE AND AN X CUT AT BOTTOM OF ROOTBALL. TOP OF THE ROOT SHALL NOT BE EXPOSED ABOVE GROUND. SET ROOT FLAIR AT SAME ELEVATION AS GROWN IN NURSERY.
ALL CONTAINERS ARE TO BE REMOVED UNLESS WRITTEN NOTIFICATION FROM SUPPLIER.

- REMOVE DAMAGED BRANCHES BY PRUNING
- PLANTING PIT SHOULD BE DUG THREE TIMES (3x) LARGER THAN CONTAINER. THE DEPTH OF THE PIT SHALL BE AS DEEP AS THE CONTAINER.
- MUDDLE RING WITH A 3'-0" DIA, AND MIN. HEIGHT OF 4'
- PLACE NATIVE SOIL FILL AROUND ROOTBALL
- UNDISTURBED SUBSOIL
- WOODCHIP MULCH FOR BEDDING AROUND SHRUB 4" MIN. DEPTH BY 3'-0" DIA. DO NOT ALLOW MULCH TO COME IN CONTACT WITH PLANT BASE.
- FILL 1/4 OF PIT WITH WATER BEFORE PLANTING.
- ROOTBALL SHALL BE PLACED IN CENTER OF PIT WITH FOUR (4) VERTICAL CUTS MADE DOWN EACH SIDE AND AN X CUT AT BOTTOM OF ROOTBALL. TOP OF THE ROOT SHALL NOT BE EXPOSED ABOVE GROUND. SET ROOT FLAIR AT SAME ELEVATION AS GROWN IN NURSERY.

**FIGURE 32 90 00-4: CREEPING EVERGREEN PLANTING**

- PREVAILING WIND
- TREE STAKES SHALL BE METAL
- 12 GAUGE GALVANIZED WIRE
- TREE STRAPS 2'-0" TO 3'-0" FROM GROUND
- TREE
- 4" EARTHEEN SAUCER SURROUNDS MULCH TO CREATE WATERING WELL

**FIGURE 32 90 00-5: TREE STAKING**
Division 33 Utilities

33 30 00  Sanitary Sewerage Utilities
1) Manhole spacing shall not exceed 300 lineal feet.
2) Install manholes where any line will intersect, tie into existing lines or a 90° elbow is encountered.

33 46 00  Storm Drainage Utilities
1) Drain tile must be installed whenever a garden level or full basement is considered.
2) Drain tile shall be placed beside the footing, not where the foundation wall meets the footing, and surrounded by not less than six (6) inches of pea-rock with a maximum diameter of 0.5 inch.
3) Manhole spacing shall not exceed 300 lineal feet.
4) Install manholes where any line will intersect, tie into existing lines or a 90° elbow is encountered.
5) Area drainage shall be connected to the storm sewer system.
## Division 34 Transportation

### 34 05 00 Common Work Results for Transportation

1) Consult with Owner concerning vehicular traffic flow.

## Division 35 Waterway and Marine Construction

There are currently no items for this division.

## Division 36 Reserved

This division is reserved for future use.

## Division 37 Reserved

This division is reserved for future use.

## Division 38 Reserved

This division is reserved for future use.

## Division 39 Reserved

This division is reserved for future use.

## Division 40 Process Integration

There are currently no items for this division.

## Division 41 Material Processing and Handling Equipment

There are currently no items for this division.

## Division 42 Process Heating, Cooling, and Drying Equipment

There are currently no items for this division.

## Division 43 Process Gas & Liquid Handling, Purification, and Storage Equipment

There are currently no items for this division.

## Division 44 Pollution Control Equipment

There are currently no items for this division.

## Division 45 Industry-Specific Manufacturing Equipment

There are currently no items for this division.

## Division 46 Reserved

This division is reserved for future use.

## Division 47 Reserved

Division is intentionally blank.

## Division 48 Electrical Power Generation

There are currently no items for this division.

## Division 49 Reserved

Division is intentionally blank.
Exhibit A. Advertisement for Bids (00 10 00)
ADVERTISEMENT FOR BIDS

PROJECT: NDSU – Building Name – Building Number – Project Name Project

OWNER: North Dakota State University

Sealed proposals for the work associated with the NDSU – Building Name – Building Number – Project Name Project on the campus of North Dakota State University, Fargo, North Dakota will be received at the Facilities Management Department front desk of the Thorson Maintenance Center, 1310 Bolley Drive, North Dakota State University, (Dept. 3200, PO Box 6050, Fargo, ND 58108-6050), until 2:00 pm. Central Time Zone, Wednesday, December 2, 2015, at which time they will be opened and publically read.

Multiple prime bids for general, mechanical, and electrical work will be accepted.

Single prime bids will be accepted but will not be awarded unless that bid is lower than the combined total of the lowest responsible prime bids.


Bids shall be in accordance with, and submitted on supplied bid form within, from bidding documents prepared by consultant name and street address. Failure to use supplied bid forms will result in rejection of the Bid.

One copy of the bidding documents (Project Drawings, Specifications, and Addendums) may be obtained by prime bidders, no deposit required from Consultant firm name, between the hours of 8:00 a.m. and 5:00 p.m. Monday – Friday, or may be examined at the following locations until bid opening time:

Consultant firm name, Fargo, North Dakota
North Dakota Builders Exchanges: Fargo/Moorhead

Pre-Bid Inspection: (Attendance Mandatory – or Optional Attendance)
Access to the building is restricted; a pre-bid inspection is scheduled for Day and Date at Time a.m., p.m., local time. Interested sub-bidders may also attend. Bidders will meet at the Building Number – Project Name Project.

Attendees can park in the Lot located.

Each bidder shall fully inform themselves prior to bidding as to existing conditions and limitations under which the work is to be performed, and include in the bid a sum to cover the cost of items necessary to perform the work as set forth in the contract documents. No allowance will be made to any contractor because of the lack of such examination or knowledge. The submission of a bid will be considered as conclusive evidence that the contractor(s) has made such examination.

Each bid submitted shall consist of two separate sealed envelopes one clearly marked “Bid Proposal” and the other clearly marked “Bid Bond” on the outside. The two envelopes shall be attached to each other.

In addition the Bid Proposal envelope shall be marked with the contractor’s name and address, the contractor’s prime (General, Mechanical, or Electrical), NDSU Building Name – Building Number – Project Name Project and Day, Date. On the envelope containing the Bid Proposal form, bidder shall also acknowledge receipt of all addenda.

In the envelope marked Bid Bond, a Bidder’s Security Bond in a sum equal to five percent (5%) of the full amount of the bid to the North Dakota State Board of Higher Education, executed by a surety company authorized to do business in North Dakota; the bond shall be for the highest amount of the bidder’s total bid combination including add alternates. All bonds shall comply with North Dakota Century Code, including Chapter 48-01 as amended.

Each bidder shall hold a current and valid North Dakota Contractor’s License of the proper class issued by the Secretary of State, and shall enclose a copy of the license or certificate of renewal of the license in the same envelope as the Bidder’s Security Bond.

Each bidder shall complete the Bidder Questionnaire, and shall enclose the questionnaire in the same envelope as the Bidder’s Security Bond.

In the envelope marked Bid Proposal each prime contractor shall submit 2 copies of the bid form supplied with the bidding documents or through addenda.

Refer to the Information to Bidders for specific bid submittal instructions. Bids submitted that do not follow the bidding requirements will be returned unopened.

All bids must be upon the basis of cash payment for the work and materials and must be sealed. All construction items covered in the contract must be completed by the defined schedule

No base bids or alternate bids may be withdrawn for a period of sixty (60) days after the date and time set for the opening of bids.

North Dakota State University reserves the right to reject any or all bids, and to waive any informalities therein.

The successful bidder is required at the time the Contract is executed to provide a Sales Tax Certificate, Workers’ Compensation Certificate, Certificate of Insurance to include North Dakota Stop Gap and Builders Risk coverage, Additional Insured Statement, Waiver of Subrogation, Company Safety Manual, and North Dakota University System Performance – Payment Bond.

North Dakota State University
Fargo, North Dakota
Mr. Michael Ellingson
Facilities Management Director

(Month, Days)
Exhibit B. Bidder Questionnaire (00 45 13)
NDSU Bidder Questionnaire

To Determine Lowest Responsible Bidder

North Dakota Law, N.D.C.C. § 48-01.2-07, provides that public construction contracts are to be awarded to the lowest responsible bidder. The purpose of this form is to assist NDSU in determining if there is any reason to believe, should you bid on an NDSU project, that your company is or is not a responsible party to be awarded a contract at NDSU. This form must be signed by an officer of the organization. Failure to provide completed Bidder Questionnaire in the bond envelope will result in rejection of bid. Failure to provide all information and answer questions truthfully will result in rejection of bid.

A. Company Information

COMPANY NAME: ____________________________________________________________
ADDRESS: __________________________________________________________________
CONTACT PERSON: ____________________________________________________________
TELEPHONE NUMBER: ___________________________ E-MAIL ADDRESS: ________________

TYPE OF FIRM:  □ Corporation □ Partnership □ Individual □ Joint Venture □ Other
If the firm is a successor to a previous firm within the last three years, state the name and type of organization of the previous firm.

B. Company Performance Record

1. How many years has your organization been in business as a contractor? __________________________________

2. Indicate if any bid has been rejected for lack of responsibility in within the last 5 years. □ Yes □ No

3. Indicate if your bonding company has had to take over any construction contract. □ Yes □ No

4. Indicate if you have ever been banned from bidding to any entity. □ Yes □ No

5. Indicate if you or any officer or partner of your organization has ever been an officer or partner of some other organization that has filed for bankruptcy. □ Yes □ No

6. Are you now in default on any obligations to banks or other financial institutions or have you filed for bankruptcy? □ Yes □ No

7. In the past five years, has your organization ever failed to complete a contract, been defaulted, had a contract terminated for convenience or had liquidated damages assessed against it? □ Yes □ No

8. In the past five years, have you failed to meet a specified substantial completion date for any NDSU or other North Dakota State Agency project. □ Yes □ No

9. Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? □ Yes □ No

10. If you have indicated “yes” to any of the above questions, furnish the name and address of the Owner and the particulars of such failure to perform.

C. Company Work Performance

1. List the three largest (dollar value) projects your organization has completed in the last five (5) years, giving the name and address of the project, owner, architect, contract amount and date of completion. This information may be provided on a separate sheet, if so insert the word “Attachment” in the table below.
### Project Name | Address | Owner | Architect | Contract Amount | Completion Date
---|---|---|---|---|---
| | | | | |
| | | | | |
| | | | | |

2. List the three largest current projects (state contract amount) under construction by your organization. This information may be provided on a separate sheet, if so insert the word “Attachment” in the table below.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Address</th>
<th>Owner</th>
<th>Architect</th>
<th>Contract Amount</th>
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</tbody>
</table>

D. Company Acknowledgement of Information

I, the undersigned, do hereby certify that I have read and truthfully completed this questionnaire and, to the best of my knowledge, the information provided is true and accurate.

Authorized Signature

Title

Date

STATE OF

) ss.

COUNTY OF

On this _____ day of__________, 20__, before me, ________________________________, the undersigned officer, personally appeared __________________________________________ subscribed to the within instrument and acknowledged that he/she executed the same for the purposes therein contained.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

(SEAL)

Notary Public

My commission expires: ____________________________
Exhibit C. Maintenance and Operating Manuals, Specifications, and Record Document Submittal Checklist (01 78 00)
### Architect

<table>
<thead>
<tr>
<th>REFERENCE</th>
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<td>DWG Format?</td>
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<td>DWG Format?</td>
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<td>Specification book, with addendums</td>
<td>PDF/DOC(X) Format?</td>
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### General Contractor

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<tr>
<td>01 78 00.10.B</td>
<td>Certificate of Substantial Completion (AIA G704-2000 or applicable alternative)</td>
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<td>01 78 00.10.C</td>
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</table>
Exhibit D. Contractor Five Year Roof Guarantees
CONTRACTOR FIVE YEAR ROOFING GUARANTEE

ROOF TYPE:  
☐ Mechanically Attached EPDM, Adhered EPDM, or Built-up  
☐ Sheet Metal Roof

OWNER:  

ADDRESS:  

PROJECT:  
PROJECT NO.:  

PROJECT ADDRESS:  

DATE OF FINAL ACCEPTANCE:  

CONTRACTOR:  

ADDRESS:  

PHONE NO.:  

Conditions for Mechanical Attached or Adhered EPDM, and Built-Up Roofs ONLY
This guarantee stipulates that the above named Contractor shall, during a period of five (5) years from the date of final acceptance of the Work, maintain the roof system, including the wood blocking, vapor retarder, insulation, roof membrane and base flashing in a watertight condition and repair all defects which result from faulty workmanship or defective materials, without further cost to the Owner, including replacement of any wet insulation caused by such defects.

Conditions for Sheet Metal Roofs ONLY
This guarantee stipulates that the above named Contractor shall, during a period of five (5) years from the date of final acceptance of the Work, maintain the sheet metal flashing systems in a weather tight condition and repair all defects which result from faulty workmanship or defective materials, without further cost to the Owner, including replacement of any wet insulation caused by such defects.

Conditions for All Guarantees
This guarantee does not include replacing damaged building components or contents in the building. Excluded from this guarantee may be any and all damage to said roof, the building or their contents caused by acts or omissions of the Owner; fire, lightning, windstorms exceeding a strong gale (55 MPH), hailstorm, or other unusual phenomenon of the elements; movement or failure of the supporting building structure that causes membrane or flashing failure; or vapor condensation beneath the roof.

Before expiration of the above guarantee period, the roofing Contractor shall inspect the roof in the presence of the Owner’s representative and make necessary correction of all deficiencies not considered normal. The guarantee shall remain in force until the necessary repair work has been done.

SIGNED:  

DATE:  

TITLE:  
Exhibit E. NDUS Architects-Engineers Manual (AEM)
ACKNOWLEDGMENT

The 2012 revision and up-date of the North Dakota University System Architect–Engineer Manual required the effort of a number of people. The Architect-Engineer Manual Task Force is particularly indebted to Vice Chancellor for Administrative Affairs Laura Glatt and General Counsel Pat Seaworth of the University System office for their guidance, support and help in accomplishing the review and revision of this Manual.

Don W. Hanson, Chair, NDSCS

Task Force Members

Don Hanson, NDSCS
LeRoy Sondrol, UND
Chuck Evans, UND
Virginia Lepage, NDSCS
Rick Johnson, NDSCS
Wayne Flack, NDSCS
Roger Jensen, NDSCS
PREFACE

This manual has been designed as a guide for these professional services contracted with the State Board of Higher Education.

ARCHITECT, ENGINEER REQUIRED:
In altering, repairing, or constructing any building, or in making any improvements to it, where the cost exceeds $100,000, plans, drawings, and specifications must be prepared by a licensed Architect, North Dakota Century Code (NDCC) § 48-01.2-02, or a licensed Engineer if work involves structural, mechanical or electrical design. Drawings and specifications for construction of public works involving an estimated cost in excess of $100,000 shall be prepared by a registered professional Architect or Engineer in accordance with NDCC § 43-19.1-28.

ARCHITECT, ENGINEER, LAND SURVEYOR SELECTION:

A. In accordance with NDCC §48-01.2-02.1 and SBHE Policy 902.5, the services of an architect or engineer must be engaged for construction projects for which the estimated cost exceeds $100,000.

B. In accordance with NDCC chapters 54-44.7 and 48-01.2 and SBHE Policy 902.5, architect, engineer, construction management and land surveying services shall be procured by negotiating contracts on the basis of demonstrated competence and qualifications for the particular type of services required.

C. In accordance with NDCC §54-44.7-04, architect, engineer, construction manager and land surveyor services for projects for which fees are estimated to be $25,000 or less may be secured by direct negotiation. In order to be eligible for purposes of this section, any one architect, engineer or land surveyor person or firm may not have been paid more than $50,000 in cumulative fees by any single state agency or institution during the preceding 12-month period.

1. Consultant shall provide a letter to NDSU stating the fees paid to them by NDSU over the last 12 months with their proposal for the current proposed project.

D. No institution may separate service contracts or split or break projects for the purpose of circumventing the provisions of NDCC chapter 54-44.7.

The architect, engineer and construction manager shall work closely with the designated institutional representative and institutional building committee and is directly responsible to institution officials, and is ultimately responsible to the State Board of Higher Education. The contract for architect or engineering services shall name the parties as the SBHE, acting through [the institution], and the architect or engineer, and shall consist of the appropriate AIA contract documents and the Owner’s Addendum or other Owner Amendments (see Owner Addendum templates set out in (Exhibit C - Owner Addendums to AIA Documents)). As applicable, substitute the word "engineer" for the word "architect" through the contract documents.
1. **BUILDING/PROJECT REQUIREMENTS**

1.1 All buildings/projects/improvements shall be constructed within the limits of the state appropriations, bond issues, or other specific authorization of the legislature or Board.

1.2 Costs allocated to a project shall include the cost of fixed or attached equipment and furnishings, architect's and engineer's fees, miscellaneous and reimbursable expenses and all other costs as defined in SBHE Policy 902.3, excluding only costs identified as costs to be excluded in Procedure 902.1.d.

**NOTE:** Fixed furnishings and equipment means any piece of property which, when installed in a facility for continuing use in connection with the facility, is considered a permanent part of the facility and cannot be reasonably removed without affecting the structural integrity of the facility, including its utility or ventilation systems. The simple connection of electric power by plugging a piece of equipment into the facility’s electrical system, or the temporary attachment of equipment to a utility system does not qualify the item as fixed equipment. Fixed equipment must be installed with hard connections.

1.3 Every building or approved part must be completed, and upon acceptance, be ready for occupancy for its designed purpose and function except for possible placement of moveable furniture to be delivered. Any exception to this must be approved in advance by the Board. Plans or change order to leave any portion of a building unfinished or to postpone the completion of any work on a building or other improvement must be approved in advance by the Board.

1.4 The institution shall determine the optimal method for delivery of any construction project, and shall do so, if able, in advance of soliciting the services of an architect or engineer.

1.5 Plans to leave any portion of a building unfinished or to postpone the completion of any work on a building or other improvement must be approved by the SBHE.

1.6 New construction and remodel projects must include private space to be dedicated solely for use by nursing mothers as a lactation room ("Mother’s Room"); incorporate a unisex restroom (where feasible in existing facilities).
2. INTRODUCTORY MEETINGS

Upon selection of the Architect/Engineer (A/E), the institutional representative shall arrange for introductory meetings to discuss the following:

2.1 If not previously determined then the most effect construction delivery method for the project.

2.2 The Owner-Architect Agreement AIA B101-2007, including SBHE amendments (Exhibit G).

2.3 The role of the institutional building committee.

2.4 The scope of the project, including site location.

2.5 Preliminary budget to include the following, as may be applicable:

- Design costs (to include OMB preplanning revolving funds)
- Architect and engineer fees
- Permits
- Insurance
- Land acquisition
- Site preparation or development
- Demolition and disposal
- Foundation and building construction or renovation, including fixed or attached equipment and furnishings
- Landscaping
- Infrastructure and utilities
- Mechanical and electrical
- Paving and driveways or roadways
- Hazardous material abatement
- Third party costs
- Contingencies
- Value of work to be completed by institutional trade staff

FF&E costs, with funding source, shall be separately disclosed, but are not considered in $250,000 project approval limit.

2.6 Tentative project and progress schedules.

2.7 Providing or directing the A/E to obtain, at the owner’s expense, a certified survey of the site, soil testing, and other tests or reports required for the project.

2.8 Arrangements by the institutional representative to obtain legal, audit, and insurance counseling services as may be required for the project.

2.9 Progress schedule. Suggested time allocations for performances of various project phases are provided in the following table (which can be agreed to during Architect/Engineer selection process). If the project requires Federal agency approval, add one month.
<table>
<thead>
<tr>
<th>Size of Project</th>
<th>Schematic &amp; Design Development Phase</th>
<th>Construction Document Phase</th>
<th>Bidding Phase</th>
<th>Construction Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $200,000</td>
<td>Two (2) months</td>
<td>Two (2) months</td>
<td>One (1) month</td>
<td>Six (6) months</td>
</tr>
<tr>
<td>$200,000 through $1,000,000</td>
<td>Four (4) months</td>
<td>Three (3) months</td>
<td>One (1) month</td>
<td>6-12 months</td>
</tr>
<tr>
<td>Over $ 1,000,000</td>
<td>Four - eight (4 - 8) months</td>
<td>Four - six (4 - 6) months</td>
<td>One (1) month</td>
<td>12+ months</td>
</tr>
</tbody>
</table>
3. **PROGRAMMING PHASE**

3.1 The A/E and building committee shall meet as often as required to remain within the schedule and program.

3.2 The A/E shall inspect and become familiar with the use, design and condition of the present facility, if the project involves designing an addition or renovating an existing building. Available drawings and specifications for the existing facility shall be provided to and reviewed by the A/E.

3.3 Information to be obtained and reviewed includes whether the construction, renovation or other work involves occupied or to-be occupied space or is instead infrastructure work or other mechanical/electrical/technology systems construction, and then further consider:

   a. If involving construction of occupied or to-be occupied space: intended use of the facility; number of occupants and their functional needs; configuration of space, considering unique needs of occupants or institutional goals; and

   b. If not involving construction or renovation of occupied space: functional use of the work; seasonal information which impacts the work; scheduling to avoid or minimize disruption of institution operations.

3.4 The A/E will prepare a program brief for institution which outlines this information. Institution will indicate its acceptance by approving the brief in writing prior to A/E undertaking further design work.
4. **SCHEMATIC DESIGN**

Upon approval of the project, the A/E shall proceed with the schematic design phase.

4.1 The Architect and institutional building committee shall meet as often as required to remain within the schedule and program.

4.2 It is the responsibility of the A/E to monitor project cost estimates throughout the schematic design phase. The A/E will prepare for each meeting an opinion of probable cost, accurate to the extent of available information, and advise the building committee on whether the project appears to be within budget. If estimated costs are exceeding the budget, the A/E will provide this information in writing to the building committee and institutional representative, with explanation of the reason or the higher costs and suggested remedial action.

4.3 Minutes of meetings shall be made by the A/E with copies distributed to the institutional representative and building committee and meeting attendees prior to the next meeting. The meeting minutes will be reviewed during each successive meeting and the A/E will note, within the current minutes, any changes made within the minutes from the last meeting.

4.4 All communications on requirements, change in requirements, change in scope of design, or possible alternates shall be submitted in writing to the institutional representative.

4.5 The A/E shall comply with applicable laws, regulations and ordinances, including but not limited to: federal regulations; state building code; zoning laws or ordinances; regulations or ordinances enforced by city and state fire marshals or health, plumbing, electrical, and safety inspectors; laws or regulations governing access for the handicapped; policies of the Board; and standards of the American National Standards Institute.

4.6 New or replacement electric services to buildings shall be placed underground unless otherwise approved by the institution.

4.7 Prior to designing an addition to or remodeling of an existing building, the Architect shall, by inspection, become familiar with the use, design, and condition of the present facility. If drawings and specifications for the existing facility are available, the institutional building committee shall provide same to the Architect.

4.8 The A/E shall submit a statement of estimated total project costs to the institutional representative and building committee at the end of the schematic design phase. If the estimate exceeds the budget, the A/E shall not proceed further until notified, in writing, by the institutional representative. The institution will not approve a schematic design for which the probable cost exceeds the budget.

4.9 The schematic design studies shall be distributed to the institutional representative.
5. **DESIGN DEVELOPMENT**

5.1 Upon approval of the schematic design, the A/E shall proceed with the design development phase.

5.2 The A/E shall regularly meet with the building committee or institutional representative to review design work, describe details of construction associated with design(s), discuss changes in scope of design and impacts of such changes on cost estimates or tentative schedule(s), discuss other changes in cost estimates and in tentative schedules, and provide samples of materials for approval.

5.3 The design development documents shall be distributed to the institutional representative and building committee for review and comments.

5.4 It is the responsibility of the A/E to monitor project cost estimates throughout the design development phase. If estimated costs are exceeding the budget, the A/E shall provide this information in writing to institutional representative, with suggested remedial action. The A/E shall submit a statement of probable project cost to the institutional representative at the end of the design development phase.
6. **CONSTRUCTION DOCUMENTS**

6.1 Upon written approval of the design development documents by the institution, the A/E shall proceed with the preparation of the construction documents consisting of plans and specifications.

6.2 Final plans and specifications shall be distributed to the institutional representative with a request to advertise for bids.

6.3 The construction specifications shall include Board Performance and Payment Bond ([Exhibit I - Performance Payment Bond](#)); all Owner required insurance coverages and related items, and including Builders' Risk coverage, if applicable (SBHE Policy 902.3(10)); Contractor's Safety Plan; campus notification of contractor employees who are registered sex offenders ([Exhibit J - Insurance and Safety Requirements](#)).

6.4 Procedures for advertisement for bids, bid opening date, etc., shall be determined by the institutional representative. Reference Section 6 of this manual for bidding procedures.

6.5 The A/E shall provide a statement that the plans and specifications are, in the professional judgment of that person, in conformance with the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities as contained in the appendix to Title 28, code of Federal Regulations, part 36 [28 CFR 36], as required by NDCC §§48-01.24 and 54-21.3-04.1. A statement of conformance must be submitted to the office of North Dakota Department of Commerce, Division of Community Services, for recording and a copy submitted to the institutional representative.
7. BIDDING

7.1 Upon approval of the construction documents and setting of the bid opening date by the institution, the A/E shall proceed with the advertisement for bids.

7.2 The A/E shall prepare the advertisement for bids and submit a copy to the institutional representative for review. Upon approval, the A/E shall be responsible for advertising the project in the official newspaper where the project is located, appropriate trade journals(s), and other publications as appropriate. Pursuant to state law, the ad must be published weekly, for three weeks, prior to bid opening date.

7.3 The A/E shall furnish a list of potential bidders to the institutional representative. The A/E will distribute or make available for distribution to interested bidders the plans and specifications. The A/E shall maintain a list of all bidders and others who have been provided a copy of the plans and specifications.

7.4 Addenda shall be issued by the A/E with copies to the institutional representative and Board's consultant(s). Addenda may not be issued within 24 hours of the scheduled bid opening.

7.5 All statutory requirements regarding bid submission, bid content and bidding procedures shall be followed.

7.6 Bidding procedures regarding Single vs. Multiple Prime Bids shall comply with NDCC § 48-01.2-06.

7.7 The bid opening shall be conducted cooperatively by the institutional representative and A/E.

7.8 The A/E shall provide a signed tabulation of all bids, with recommendation, to the institutional representative for review. The recommendation will address that the bid is within budget; the contractor meets the statutory requirements for award of bid and completion of the work; and that the contractor, in the opinion of the A/E, is responsible.
8. AWARD OF CONTRACTS

8.1 NDCC chapter 48-01.2 and this procedure shall be followed for award of contracts.

8.2 Upon award of contracts, the A/E shall prepare necessary contracts using current AIA contract documents with the appropriate Owner Addendum or other Owner amendments. The contracts proposed by the A/E must be approved by the institutional representative before submission to other parties. After signatures of other parties, three copies of the contract with original signatures shall be submitted to the institutional representative for final approval.

8.3 Guidelines for preparing contracts and related documents, and Owner Addendum are attached as (Exhibit C - Owner Addendums to AIA Documents).

8.4 Payments to a contractor may not be approved until all contractual obligations have been met and the contract has been signed by both the owner and contractor.

8.5 Contracts must be fully executed prior to preparation of any Change Orders.
9. **CONSTRUCTION PHASE**

9.1 Regularly scheduled meetings shall be held with the A/E, representatives of all prime contractors, and with an institutional representative in attendance, unless otherwise specified in the contract documents. The A/E is responsible for providing minutes of these meetings.

9.2 A change order shall be issued on AIA form G701 for any change in the work, adjustment to the contract sum, or in the contract time. The budget for the project must have sufficient funds to support any changes in contract amounts. Change orders are not to be utilized as a procedure for substantially increasing the scope of the project. The A/E shall prepare all change orders and submit three copies to the institutional representative for review. The institutional representative shall obtain approval of the change order. Change orders must be signed by 1) the contractor, 2) the A/E and 3) the institutional representative. Change orders shall contain the following information:

1. Number of change order.
2. Original contract amount.
3. Total amount of previous amendments or change orders.
4. Amount of present change order request, including a list and cost of each change.
5. Total revised contract amount.

9.3 If a contractor desires to store certain materials off the project site, the Agreement for Storing Materials Off-Site ([Exhibit F - Agreement for Storing Materials](#)) shall be completed and three copies submitted to the institutional representative for review.

9.4 As set forth in the contract documents, during the construction phase all contractor's payment requests shall be submitted to the A/E for review, use AIA form G702 and G703. Upon approval, one copy shall be forwarded to the institutional representative for payment.

9.5 Guarantees and Warranties:

1. All guarantee and warranty documents, including manuals relating to warranties on the project, and a listing and explanation of all project components that have separate manufacturer or dealer warranties will be provided to the institutional representative by the A/E.
2. Other warranties and guarantees shall be provided as set forth in the contract documents.

9.6 At Owner's request, the A/E shall provide to the institutional representative As-Built drawings in electronic format. If the institution does not maintain a CAD system, or does not want this item in electronic format, then the A/E shall provide one complete set of reproducible drawings with all changes as noted on the contractor's record copy. As-Built drawings prepared by the contractor will be submitted directly to the institutional representative.

9.7 When requested, the A/E shall provide a schematic systems layout of the project, i.e., electrical, plumbing, and HVAC systems. The size and detail of the schematics shall communicate with detail and clarity, the areas served, controls and controlling devices, and system operational characteristics.

9.8 Equipment may be moved into the building prior to final inspection provided that:

1. The contractor is in agreement and understands that the Builder's Risk Insurance must remain in effect until final inspection and acceptance. A written communication by the contractor to the institutional
representative is required.

2. The institutional representative approves.

9.9 Final payment requests shall be accompanied by AIA Document G707, Consent of Surety Company to Final Payment. Supporting AIA documents may be required upon request by the institution.
10. **INSPECTION AND ACCEPTANCE**

10.1 There shall be a final inspection of each newly constructed or remodeled building. It shall be made by the institutional representative, A/E and Contractor(s).

10.2 The A/E shall be responsible for preparing a punch list during the inspection. Upon completion, the A/E shall be responsible for issuing the punch list to all participants in the inspection.

10.3 Every building or designated portion must be substantially complete before occupancy by the institution. A Certificate of Substantial Completion (A1A 709) shall be prepared and submitted to the institutional representative.

10.4 Before final acceptance of the project is made and after concurrence of the A/E and contractor, a 48-hour continuance performance test may be conducted by an independent firm engaged by, and responsible to, the institution. Air-water flow, temperature, and ampere readings, etc., shall be recorded and become the property of the owner if satisfactory. If the tests do not meet the design requirements, the deficiencies shall be corrected, and another 48-hour test shall be run until all corrections are made. All costs of performance testing shall be the responsibility of the institution; however, costs involving correction of deficiencies and additional testing shall be borne by the contractor, if of an adjustment/installation nature, or by the A/E if redesign is necessary.

10.5 Final payment by the institution may not be issued until all items on the punch list have been completed and all guarantees, as required, have been provided to the institution.

10.6 The A/E shall provide a written statement to the institution that the project has been constructed as designed, meets all applicable code requirements and has not been designed with any material prohibited by law.

10.7 An inspection shall be arranged by the A/E to occur approximately ten months after the final acceptance for purposes of uncovering work to be corrected under the one year guarantee provisions of the contract and to be attended by A/E, institutional representative and prime contractors or their designees.
11. CONSTRUCTION MANAGEMENT

11.1 Pursuant to NDCC chapters 54-44.7 and 48-01.2, a governing body may select and use a construction manager on a public improvement, based upon a determination by the agency that such a choice is in the best interests of the public and that the construction management services will not duplicate the services provided by an A/E; and based upon demonstrated competence and qualifications of the construction manager. State laws set out two options for securing construction management services: agency construction manager or construction manager at risk. NDCC §§48-01.2-18 - 23.

11.2 When a construction manager is used, current and appropriate AIA contract documents must be used, with related Owner Addendum or other Owner Amendments. (See Exhibit G for guidelines for use with contracts for construction management services and related Owner Addendum and other Owner Amendments).

11.3 Duties of the Construction Manager. There are many duties that are normally the responsibility of the A/E that become the responsibility of the Construction Manager when a Construction Manager is used. Where these duties conflict with the duties of the A/E as contained in Board policies and procedures, the terms contained in the AIA contract documents and Owner Addendums and other Owner Amendments take precedence. Also, some of the duties normally the responsibility of the A/E are shared by the A/E and Construction Manager. However, pursuant to NDCC §48-01.2-18, the services provided by the Construction Manager may not duplicate those provided by the A/E. Generally speaking, an individual acting as the agency construction manager acts as an agent for the Owner throughout the project; and the individual acting as the construction manager at risk serves as an advisor to the Owner, until the time that construction begins, at which time this individual changes to general contractor for the project.
12. BUILDING PLAQUES

1. In accordance with SBHE Policy 907, plaques must be placed on eligible projects using the following procedure. This either needs to be removed, since it will be redundant with the policy or updated as it is not consistent with the policy language.

2. To determine if a Project requires a plaque based on the requirements set forth in Policy 907, institutions shall use the following evaluative criteria:
   b. Building additions which serve primarily as an entrance, mechanical area, or other function which does not supplement the primary occupancy role of the existing building, including ADA entrances, roof-top mechanical penthouses, generator shelters, and other similar functions, do not require a plaque.
   c. Major public improvements costing less than $500,000. For the purpose of Policy 907, major public improvements include bridges, parks (green spaces), athletic fields, and plazas. Roadway paving, parking lots, utilities, and sidewalks are exempt from this policy.

3. The plaque shall be cast in lead-free alloy 22000 Navy G bronze, 18 inches in width, 24 inches in height, and ¾ inches in thickness at the outer edge of the plaque. The plaque edges and letters shall be raised and polished, with the background rendered black in color with a pebble or similar surface. The letters shall be in Times New Roman font, and sized appropriately for the information within the plaque.

4. The plaque shall contain the following information only, centered on the plaque face symmetrically, with line numbers indicating the hierarchy of position from top to bottom:
   a. Line 1: The name of the project (underscored) as approved by the SBHE.
   b. Line 2: Governor (underscored), with the name of the governor serving at the time of the approval (not underscored) immediately below.
   c. Line 3: State Board of Higher Education (underscored), with the names of the voting members serving at the time of the approval in two columns below. The Chair of the SBHE serving at the time of the approval shall be at the top of the left-hand column, with “Chair” included with the name.
   d. Line 4: North Dakota University System Chancellor (underscored), with the name of the Chancellor serving at the time of the approval immediately below (not underscored).
   e. Line 5: (institution name) President (underscored), with the name of the President serving at the time of the approval immediately below (not underscored).
   f. Line 6: (institution name) Vice President (underscored) of the division for which the project has been constructed, with the name Vice President serving at the time of the approval immediately below (not underscored).
   g. Line 7: (institution name) Vice President for Finance (underscored) or the related division, with the name of the Vice President serving at the time of the approval immediately below (not underscored).
   h. Line 8: Column 1 – Architect (underscored); Column 2 – Constructor (underscored); with the names of the appropriate firms representing each category listed below (not underscored).
   i. Line 9: Year the project was approved (not underscored)

5. The plaque shall be installed at the primary entrance to the Project when it is a building or addition. The architect shall include the location of the plaque within the Project design and organize its placement appropriately.

6. For Projects other than buildings or additions, the plaque shall be placed on a prominent feature of the improvement, or on a separate plinth or similar feature prepared for the plaque. The architect shall include the location of the plaque within the Project design and organize its placement appropriately.
Reference: SBHE Policy - 902.5

Amend. SBHE Minutes, February 6, 1987, pg 5566.
Amend. Section 4, SBHE Minutes, July 16, 1986, pg 5625.
Amend. Section 3, SBHE Minutes, June 27, 1988, pg 5731.
Amend. Section 2 & Exhibit A, SBHE Minutes, Nov. 8, 1990, pg 6059.
Amend. Section 6 & Exhibit B, SBHE Minutes, Sept. 19, 1996, pg 6685
Amended, July 1, 2015.
Exhibit F. NDUS AEM – Compensation Guidelines for Architectural Services
COMPENSATION GUIDELINES FOR ARCHITECTURAL SERVICES

1. Negotiated fees may be based on a percentage of construction contract costs, a lump sum, or hourly compensation with a stated maximum.

2. Architectural services shall be provided in accordance with Owner-Architect Agreement AIA Document B101-2007, current edition as modified and adopted by this document, Exhibit G, or subsequent action by the State Board of Higher Education.

3. Compensation for Architectural Services shall include the following services required in connection with building design and construction:
   - Landscape Architect
   - Civil Engineering
   - Structural Engineering
   - Mechanical Engineering
   - Electrical Engineering
   - Survey work
   - Soil borings
   - Special consultants if required

4. For small projects, a B105-2007 may be used.

5. Reimbursable expenses will be paid at a rate of not more than 1.10 times the expense. Detailed back of reimbursable expense is required.
Exhibit G. NDUS AEM – Owner-Architect Agreement Amendments
ADDENDUM: OWNER’S AMENDMENTS TO OWNER-ARCHITECT AGREEMENT.

AIA DOCUMENT B101—2007

This Addendum is hereby made a part of an incorporated into that agreement between the North Dakota State Board of Higher Education acting through North Dakota State University (Owner) and _______________________________ (Architect) and amends that agreement, which is the AIA Document B101—2007 entitled “Standard Form of Agreement between Owner and Architect” and its Exhibit A (collectively, Contract) for the “______________________________Project.” The parties agree to the following terms and conditions and expressly agree that if any of the following terms and conditions are in conflict with any of the terms and conditions of the Contract, then notwithstanding any term in the Contract, the following terms and conditions govern and control the rights and obligations of the parties. Any amendments to the Contract or to this Addendum, or any other amendments, must be in writing and executed by both parties. When applicable, substitute the word “Engineer” for the word “Architect” throughout this Addendum and the Contract.

AIA  B101—2007

Section Reference  The following sections and paragraphs are amended as follows:

2.5  Add:

The Architect shall maintain the following insurances for the duration of this Agreement. Architect agrees to indemnify, save and hold harmless the Owner and State of North Dakota and its agencies, officers and employees, from any and all claims of any nature, including all costs, expenses and attorneys’ fees, which may in any manner arise out of or result from Architect’s negligent acts or omissions in performing work under this Agreement, except for claims arising out of the sole negligence of Owner or State. Architect’s obligation to indemnify, save and hold harmless the Owner and State shall not be limited to the amount of insurance actually secured under this Agreement, including any insurance above the minimum required, but shall extend to the full amount on any claims, loss or damage incurred or awarded, including costs, expenses and attorneys’ fees. Insurances may not be canceled or modified without at least 30 days’ prior written notice to Owner.

1.5.1 General Liability Insurance. From insurance companies authorized to do business in North Dakota, commercial general liability, with minimum limits of liability of $1,000,000 per claim and annual aggregate limit. The Architect shall furnish Owner with certificates of insurance as evidence these policies are in effect.

1.5.2 Automobile Liability Insurance. Minimum limits of liability of $250,000 per person and $1,000,000 per occurrence. Architect shall furnish Owner with certificates of insurance as evidence these policies are in effect.

1.5.3 Workers’ Compensation. Workers compensation insurance as required by North Dakota state law. Architect shall furnish Owner with documentation that shows this coverage is in place.

1.5.4 Professional Liability Insurance. Providing coverage for negligent acts, errors or omissions in providing or failing to provide professional services, with minimum limit of $500,000. Coverage shall be in force during the terms of the Agreement and for a period of at least twelve months.
thereafter. Architect shall furnish Owner with a certificate of insurance as evidence this policy is in effect.

2.6 Add a new section, 2.6, which states as follows:

Owner has an obligation to make information available to the campus on where to get information about Registered Sex Offenders who are working on property owned or controlled by Owner. Architect has an obligation to inform Owner in advance of any of Architect’s employees who will be on Owner’s property who is a Registered Sex Offender.

3.1 Amend this sentence by inserting the word “civil,” after the word “customary” and before the word “structural, ...”

3.2.7 Amend this sentence by adding at the end, after the phrase “Owner’s approval” the phrase “in writing.”

3.3.3 Amend this sentence by adding at the end, after the phrase “Owner’s approval” the phrase “in writing.”

3.4.5 Change this one-sentence paragraph to read:

The Architect shall submit the Construction Documents to the Owner, advise the Owner of any adjustments to the estimate of the Cost of the Work, take any action required under section 6.5, and request the Owner’s approval in writing. The architect will ascertain that all elements of the construction documents specific to the Owner’s requirements, including modifications to the General Conditions, are correctly contained within the construction documents prior to bidding.

3.5.2.2 Add a new subsection 6 which states:

Determining all documents and procedures comply with relevant North Dakota state laws and with State Board of Higher Education policies.

3.6.2.1 Insert in second line from end of this paragraph, after word “known” and before the word “deviations” the phrase “or reasonably ascertainable”

3.6.2.4 Add in second sentence, fourth line, after the word “liable” and before the word “for”: “, absent negligence,”

3.6.5.1 Add to this paragraph the following sentence:

The Architect shall promptly report to Owner, in writing, those minor changes in the Work authorized by Architect pursuant to this section.

3.6.6.5 Change this paragraph to read:

Prior to the expiration of one year from the date of Substantial Completion, the Architect shall, without additional compensation, conduct a meeting with the Owner or Owner’s designated representative and the Prime Contractor or its designated representative to review the facility operations and performance, and warranty claims, if any.
4.3.2 DELETE subsections 1, 2 and 3, thereby making these part of the Basic Services provided by Architect.

5.4 Add in first sentence, first line, after word “surveys” and before the word “to” the phrase “, as demonstrated by Architect to be necessary, ”

5.5 Replace this paragraph with the following:

As specifically provided by this Addendum, either the Owner, or the Architect if required by the Owner for specific Projects, shall furnish services of geotechnical engineers, which may include but are not limited to test borings, test pits, determinations of soil bearing values, percolation tests, evaluations of hazardous materials, seismic evaluations, ground corrosion tests and resistivity tests, including necessary operations for anticipating subsoil conditions, with written reports and appropriate recommendations.

5.6 Add in first sentence, first line, after the word “coordinate” and before the word “the”: “, with the assistance of Architect,”

5.7 Add in first sentence, first line, after the word “furnish” and before the word “tests”: “or authorize the Architect to furnish them as an Additional Service,”

5.11 Add in first sentence, first line, after the word “Owner” and before the word “shall”: “, with the assistance of Architect,”

6.1 Change this paragraph to read:

For purposes of this Agreement, the Cost of the Work shall be the total cost to the Owner to construct all elements of the Project designed or specified by the Architect and shall include contractors’ general conditions costs, overhead and profit. The cost of the Work does not include the compensation of the Architect, the costs of the land, rights-of-way, financing, and contingencies for change in the Work. The Cost of the Work does include those charges for the Owner’s own employees completing inspections or other services for the Owner.

6.5 Add a new sentence:
Owner also reserves the option to terminate the Project in accordance with Section 9.5.

6.6.1 Change this subsection to read:

.1 undertake a good faith effort to obtain necessary and timely approval from those governmental entities having jurisdiction over the Project for an increase in the budget for the Cost of the Work, as may be necessary, and then if approval is timely obtained, given written approval of an increase in the budget for the Cost of Work;

6.7 Change the first sentence to read:

If the Owner choses to proceed under Section 6.6.4, the Architect, without additional compensation, shall modify the Construction Documents and re-bid the Work as necessary to comply with the
Owner’s budget for the Cost of the Work at the conclusion of the Construction Documents Phase Services, or the budget adjusted under Section 6.6.1.

7.3.1 Change the first sentence to read:

In the event the Owner uses the Instruments of Service without retaining the author of the Instruments of Service, the Owner releases Architect from liability for claims and causes of action arising from such use.

Delete the second sentence, which begins with the words “The Owner, to the extent permitted by law, ...” and ends with the words “...Section 7.3.1.”

8.1.1 Change this paragraph to read:

The Owner and Architect shall commence all claims and causes of action, whether in contract, tort, or otherwise, against the other arising out of or related to this Agreement within the period specified by applicable North Dakota law.

8.1.3 Consequential Damages Waiver. DELETE this paragraph in its entirety.

8.2 Mediation. DELETE all subsections, 8.2.1 through 8.2.4.

8.3 Arbitration. DELETE all subsections, 8.3.1 through 8.3.3.

8.3.4 Consolidation or Joinder. DELETE all subsections, 8.3.4.1 through 8.3.4.3.

9.1 Change the second to last sentence of this paragraph to read:

Before resuming services, the Architect shall be paid all agreed upon sums due prior to suspension and all agreed upon expenses incurred in the interruption and resumption of the Architect’s services.

9.2 Change the second sentence of this paragraph to read:

When the Project is resumed, the Architect shall be compensated for those agreed upon expenses incurred in the interruption and resumption of the Architect’s services.

9.7 Change this one sentence paragraph to read:

Termination Expenses are in addition to compensation for the Architect’s services and include the actual expenses directly attributable to termination for which the Architect is not otherwise compensated.

10.7 Change the first sentence to read:

The Architect, subject to Owner’s approval, which approval will not be unreasonably withheld, shall be entitled to include photographic or artistic representations of the design of the Project among the Architect’s promotional and professional materials.
10.8 Add to this one sentence paragraph, after its subsection (3) the following:

or (4) as may be required by law or by a court order. It is understood that the definition of the terms “confidential” and “business proprietary” as used here will be determined by the application of North Dakota open records laws, and that this Contract and records generated or received by either party pursuant to this Contract are subject to North Dakota open records laws and may, therefore, be open to the public upon request.

11.8.1.1 After the word “subsistence” add the phrase: “, excepting in connection with trips between Architect’s office and Project site.”

13.2.3 To this subsection “Other Documents,” add the sentence:

This document, entitled ADDENDUM: OWNER’S AMENDMENTS TO OWNER-ARCHITECT AGREEMENT, AIA DOCUMENT B101-2007.

This Addendum is entered into and agreed to by:

OWNER:   ARCHITECT:

____________________________________   ______________________________________

Its:__________________________________   Its:__________________________________

Date:________________________________  Date:________________________________
Exhibit H. NDUS AEM – Guidelines for Preparation of Construction Contracts and Related Documents
GUIDELINES FOR PREPARATION OF CONSTRUCTION CONTRACTS AND RELATED DOCUMENTS

BUILDING PROJECTS

1. The Standard Form of Agreement between Owner and Contractor, AIA Document A101-2007 should be used unless a Construction Manager is used, in which case AIA Document A101CMa-1992: Standard Form of Agreement Between Owner & Contractor-Stipulated Sum-Construction Manager/Advisor Edition, should be used.

PUBLIC WORKS PROJECTS

2. The Standard Form of Agreement between Owner and Contractor or other contract approved by the SBHE or institutional legal counsel should be used.

3. Names of parties to the contract should appear identically throughout the contract and supporting documents.

4. If a change, an addition, or an omission is made on the contract, it must be initialed by both parties.

5. If the contracting party is a corporation, the president of that corporation must sign the contract or, if some other corporate officer signs, proof of authority to sign must be submitted along with the contract. Proof of authority to sign is often evidenced by a corporate resolution or bylaw.

6. Surety bonds for public improvement contracts are required if a project exceeds $100,000.

7. The date of the contract referred to in the surety bond must be identical to the date on the face of the contract.

8. The name of the contractor as it appears on the contract and on the surety bond must be identical as to spelling, capitalization, spacing, and placing of commas.

9. The dollar amount of the bond cannot be for less than the contract.

10. The surety bond may be dated on or after the contract date, but not prior to the contract date.

11. The signatures of the principal and the attorney-in-fact of surety on the surety bond must be acknowledged before a notary public. The surety bond does not have to be signed by the president; the Acknowledgment of Principal will identify the signatory's official position.

12. Notaries should endorse, separately from the seal, the date of expiration of their commission.

13. The surety bond need only be countersigned by a North Dakota resident agent if required by NDCC § 26.1-11-07. Frequently the attorney-in-fact of surety is also the resident agent.

14. The dates of the acknowledgments must not be prior to the date of the surety bond.

15. The surety bond must be signed by an attorney-in-fact who has current authority to sign for the surety. (Such authority is evidenced by the power of attorney.) The date the attorney signed the surety bond must not be prior to the date of the surety bond.

16. The surety bond must comply with NDCC § 48-01.2-10 and must be in the standard format required by the SBHE which includes provisions for the payment of interest on bills and claims not paid within 90 days, the payment of all sales and use taxes and worker's compensation premiums. (Exhibit I)

17. The power of attorney should be current as of the contract date. If the power of attorney was initially executed prior to the contract date, the update certificate on the power of attorney must be dated on or after the contract date.

18. Does the power of attorney limit, to a certain dollar amount, the value of the contract which the attorney is authorized to ensure on behalf of the surety? If so, the contract amount may not exceed the dollar amount stated in the power of attorney.

19. The name of the insured must coincide with the party whose name is on the contract.
20. Insurance requirements must include all coverages and limits outlined in Exhibit J. North Dakota State Board of Higher Education, North Dakota State University and the State of North Dakota and its agencies, officers, and employees shall be endorsed on the commercial general liability policy and automobile liability policy as additional insured. The contractor shall furnish certificates of insurance and copies of the additional insured endorsements prior to commencement of the contract. Include a copy of the Signed Endorsement indicating the additional insured.

**NDSU REQUIREMENT:**
Certificates of Endorsement shall accompany the contract documents. Disclaimers that are attached to the commercial general liability policy and automobile liability policy shall have from the endorsee, such a statement modifying the endorsement.

Endorsements shall contain a "Waiver of Subrogation" waiving any right of recovery the insurance companies may have against the State. Copies of the policies must be provided upon request.

The general contractor’s bid shall include the builder’s risk premium on an amount equal to 100 percent of the base bid plus all add alternates, plus 75 percent of the base bid and add alternates for other contracts, including the architect’s fee and owner provided equipment or furnishings. Builders’ risk insurance shall remain in effect until the building or project is accepted by the Board. The Consultant shall determine the builders risk insured value taking into account all items listed in this paragraph. If the insured value varies from the formula in this paragraph, an add or deduct change order shall be issued to the General Contractor.

For all projects for which the total estimated cost exceeds $100,000, Contractor shall submit to the Owner a copy of the written safety program to be used as guidelines and direction of the Contractor’s and subcontractors' worksite activities. Details of the requirement appear in Exhibit J.

21. The Tax Clearance certificate and Worker’s Compensation certificate must be current, i.e., must not have expired, as of the date the contracts are submitted for approval.

22. The name of the contractor indicated on the tax clearance certificate and Worker’s Compensation certificate should correspond to the name of the contractor on the face of the contract.

23. The "Agreement for Storing Materials Off-Site, Exhibit K, shall be accompanied by a current power of attorney. The power of attorney evidences the authority of the attorney to sign for the surety.

24. **NDSU Amendments to AIA A101-2007:** The following must be placed in Subparagraph 9.1 of “AIA A101-Standard Form of Agreement Between Owner and Contractor.”

Amend AIA Document A101-2007 as follows:

- **Subparagraph 5.1.8** Add to this paragraph: “Reduction or limitation of retainage, if any, shall be as follows: Retainage and payments to Contractor shall be pursuant to NDCC § 48-01.2-13.”

- **Subparagraph 6.2** This section, entitled “Binding Dispute Resolution” is DELETED.

- **Subparagraph 8.2** Replace the paragraph with: “Payments due and unpaid under the Contract shall bear interest from the date payment is due and until the date payment is issued. The interest rate per annum shall be two percentage points below the Bank of North Dakota prime interest rate as set thirty days after the date payment is due.”

- **Subparagraph 9.1.7** Add to this paragraph: Other Documents, if any, forming the Contract Documents are as follows: The State’s Addendum to AIA Documents A101 and A201.

25. **NDSU Amendments to AIA A201-2007:** The following must be placed in Subparagraph 9.1 of “AIA 101-Standard Form of Agreement Between Owner and Contractor”:

Amend AIA Document A201-2007 as follows:
Subparagraph 3.4.3 Add to the end of this paragraph: “The State has an obligation to make information available to the campus on where to get information about Registered Sex Offenders who are working on State Institution property. You are obligated to inform the Campus Police or Security Office or other appropriate campus office, in advance of your employees being on State Institution property, of any such employee who is a Registered Sex Offender. This obligation includes property owned or controlled by the institution that is at locations other than the main campus.”

Subparagraph 3.5 Number the existing paragraph to be “3.5.1” and add these new subsections to Section 3.5, Warranty: “3.5.2 The Contractor shall guarantee and maintain the stability of all work and materials and keep same in reasonable repair and condition for the period of one (1) year from the date of final acceptance of the Work but with respect to any part of the Work which the Owner takes possession of prior to final acceptance, the guarantee shall continue for a period of one year from the date the Owner takes possession. This is in addition to any manufacturer’s warranty specified.

Subparagraph 3.5.3 Defects of any kind, due to faulty work or materials appearing during the above-mentioned period must be promptly made good by the Contractor at his own expense to the entire satisfaction of the Owner and Architect. Any such construction and repairs shall include the costs of all damages to the finish or furnishings of the building resulting from the original defect or repairs to the building. Where equipment is required to be replaced, the one-year warranty shall be reinstated for that piece of equipment from the date of replacement.

Subparagraph 3.5.4 The guarantee, as provided in paragraph 3.5.2, does not apply to injuries or damages occurring after final acceptance due to “acts of God,” fire, violence, abuse, or carelessness of other Contractors or agents of the Owner; however, the Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor’s guarantee nor relieving the Contractor of the Contractor’s responsibilities during the guarantee period.

Subparagraph 3.5.5 The guarantee, as provided in paragraph 3.5.2, shall be extended if other guarantees for different lengths of time are specifically called for in the Contract Documents or if manufacturer’s standard warranties extend for a longer period.”

Subparagraph 3.9.1 Add the following sentence: “Contractor may not change the Superintendent during the progress of the Project without first obtaining the written authorization of both the Owner and the Architect.”

Subparagraph 3.11 Add the following paragraphs to the end of 3.11:

1. Immediately upon receipt of contract documents, identify one each of the documents with the title, “RECORD DOCUMENTS—JOB SET.” Update the record set with all Addenda items.

2. Through progress of the work, the Contractor shall maintain an accurate record of changes in the contract documents, as described below. Upon completion of the work, transfer the recorded change in ink to a set of record documents.

3. Changes that must be recorded are major concealed items from what is called for by the Contract Documents. This includes such items as main pipes and conduit or changed structural members, which cannot be observed on completion even with the use of access doors or removable panels.

4. Coordinate changes within the record documents, making adequate and proper entries on each page of specifications and each sheet of drawings and other documents where any such entry is required to show the change properly.

5. Accuracy of records shall be such that future searches for items shown in the contract documents may reasonably rely on information obtained for the approved project record documents.
6. Make entries within 24 hours of receipt of information that the change has occurred. Prior to submitting request for final payment, submit the final project record documents to the Architect and secure the Architect’s approval. Maintain the job set of record documents completely protected from loss and damage.

7. Submit the completed set of project record documents to the Architect.

8. Participate in review meetings as required.

9. Make required changes and promptly deliver the final project record documents to the Architect.

10. The Architect will review for completeness of record documents. The purpose of the final project record documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site investigation, measurement and examination.”

Subparagraph 3.13
Number the existing paragraph to be “3.13.1,” and add a new subsection to Section 3.13, Use of Site: “3.13.2 The Contractor shall hold and save the Owner, its officers, employees and agents, free and harmless from liability of any nature occasioned by Contractor’s operations on the site.”

Subparagraph 3.18.1
Add to end of paragraph 3.18.1: “The legal defense provided by Contractor to the State under this provision must be free of any conflicts of interest, even if retention of separate legal counsel for the State is necessary. Contractor also agrees to defend, indemnify, and hold the State harmless for all costs, expenses and attorneys’ fees incurred in establishing and litigating the indemnification coverage provided herein. This obligation shall continue after the termination of this agreement.”

Subparagraph 6.2.3
Add to this paragraph the following sentence: “Specifically excluded from costs or damages that the Contractor may recover under this paragraph are profit and overhead.”

Subparagraph 8.3.1
Modify paragraph 8.3.1 to state: “8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay authorized by the Owner or by other causes beyond Contractor’s control and which the Architect determines may justify delay, then the Contract Time will be extended by Change Order for a reasonable time as the Architect may determine.”

Subparagraph 9.3.3
Modify paragraph 9.3.3 to state: “9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for payment have been previously issued and payments received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, materials and equipment relating to the Work.”

Subparagraph 9.6
Add the following paragraph to Section 9.6: “9.6.8 Retainage and payments to Contractor shall be pursuant to NDCC § 48-01.2-13.”

Subparagraph 9.7
Change this paragraph to state as follows: “9.7. If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor’s Application for Payment, or if the Owner does not pay the Contractor within fourteen days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon 14 additional days’ written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract sum shall be increased by the amount of the Contractor’s reasonable costs of shut-down, delay and start-up, plus interest
as provided for in the Contract Documents.”

**Subparagraph 9.10.2**
Add the following language at the end of paragraph 9.10.5: “Additional items specifically required by Owner to be submitted by Contractor prior to final payment as a minimum are enumerated as follows:

1. Contractor’s Release or Waiver of Liens.
2. Current Statement of ND Tax Commissioner relating to income tax and sales tax clearance.
3. Current Certificate of Premium Payment to Workforce Safety & Insurance.”

**Subparagraph 10.2**
Add a new subsection: 10.2.8 For all projects for which the total estimated costs exceed $100,000, Contractor shall submit to Owner a copy of the written safety program to be used as guidelines and direction of the Contractor’s and subcontractors’ worksite activities. This program must meet all federal, state and local laws and other legal requirements and include the following minimum provisions: (1) a worksite safety policy and mission statement; (2) assigned responsibilities among management, supervisors and employees; (3) a system for periodic self-inspections, including inspection of job sites, materials, work performance and equipment; (4) a thorough accident and injury reporting and investigation process; (5) a safety orientation program including first aid, medical attention, emergency facilities, fire protection and prevention, housekeeping, illumination, sanitation, personal protective equipment and occupational noise exposure; and (6) a safety training program including safety "tool box" meetings and other systems for ongoing training, including training for employees on the recognition, avoidance and prevention of unsafe conditions.

It shall be a condition of the Contract, and shall be made a condition of each subcontract entered into pursuant to the Contract, that the Owner assumes no liability relating to its receipt and review of the Contractor's safety plan. Safety remains the responsibility of the Contractor. Furthermore, the right of the Owner to receive and review the safety plan shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.”

**Subparagraph 10.3.3**
This paragraph is DELETED.

**Subparagraph 10.3.6**
Modify this paragraph to state: “10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense incurred.”

**Subparagraph 11.1.2**
Add to this paragraph the sentence: Insurance coverage must be for a minimum as follows: $1,000,000 per occurrence, $2,000,000 general aggregate limit and $1,000,000 aggregate products and completed operations. Automobile liability insurance in an amount no less than $1,000,000 combined Single Limit each occurrence for bodily injury and property damage.

**Subparagraph 11.1.4**
Add to this paragraph the sentence: Contractor shall cause the automobile liability covered required by the contract documents to include the Owner as additional insureds for claims caused in whole or in part of by the Contractor’s negligent acts or omission during the Contractor’s operations.

**Subparagraph 11.1.3**
Add to end of this paragraph: “Failure to provide insurance as required in this agreement is a material breach of contract entitling State to terminate this agreement immediately. All endorsements shall be provided as soon as practicable.

**Subparagraph 11.1.5**
Add a new section 11.1.5: “11.1.5 The insurance coverage listed above must meet the following additional requirements.

a. Any deductible or self-insured retention amount or other similar obligation under the
policies shall be the sole responsibility of the Contractor. The amount of any deductible or self-retention is subject to approval by the State.

b. This insurance may be in policy or policies of insurance, primary and excess, including the so-called umbrella or catastrophe form, and must be placed with insurers rated “A-” or better by the A.M. Best Company, Inc., provided any excess policy follows form for coverage. Less than an “A-” rating must be approved by the State. The policies shall be in form and terms approved by the State.

c. The State will be defended, indemnified, and held harmless to the full extent of any coverage actually secured by the Contractor in excess of the minimum requirements set forth above. The duty to indemnify the State under this agreement shall not be limited by the insurance required in this agreement.

d. A provision that any attorney who represents the State under this policy must first qualify as and be appointed by the North Dakota Attorney General as a Special Assistant Attorney General as required under N.D.C.C. § 54-12-08;

e. A provision that Contractor’s insurance coverage shall be primary (i.e., pay first) as respects any insurance, self-insurance or self-retention maintained by the State and that any insurance, self-insurance or self-retention maintained by the State shall be in excess of the Contractor’s insurance and shall not contribute with it.

f. Cross liability and severability of interest for all policies and endorsements.”

Subparagraph 11.2 Add a new paragraph to Article 11.2: “Contractor agrees to defend, indemnify, and hold harmless the state of North Dakota, its agencies, officers and employees (State), from claims resulting from the performance of the Contractor or its agent, including all costs, expenses and attorneys’ fees, which may in any manner result from or arise out of this agreement. The legal defense provided by Contractor to the State under this provision must be free of any conflicts of interest, even if retention of separate legal counsel for the State is necessary. Contractor also agrees to defend, indemnify, and hold the State harmless for all costs, expenses and attorneys’ fees incurred in establishing and litigating the indemnification coverage provided herein. This obligation shall continue after the termination of this agreement.”

Subparagraph 11.3.1 Modify this paragraph to state: “Unless otherwise provided, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder’s risk “all-risk” or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Contractor has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.”

Subparagraph 11.3.2 This paragraph is DELETED.

Subparagraph 11.3.1.3 Modify this paragraph to state: “If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.”

Subparagraph 11.3.9 This paragraph is DELETED.

Subparagraph 13.6 Remove paragraph 13.6 and replace it with: “13.6.1 Payments due and unpaid under the Contract Documents within 30 days of the due date shall bear interest from the date payment is due until the issuance of proper payment thereof. The interest rate per annum shall be
two percentage points below the Bank of North Dakota prime interest rate as set thirty days after the date payment is due.”

Subparagraph 13.7 This section, entitled “TIME LIMITS ON CLAIMS,” is DELETED.

Subparagraph 14.4.3 Delete that last portion of this one sentence paragraph, which states: “...along with reasonable overhead and profit on the Work not executed.”

Subparagraph 15.1.6 This subsection, entitled “Claims for Consequential Damages,” is DELETED.

Subparagraph 15.2 Initial Decision – throughout this section and subsections, DELETE all references to arbitration, mediation, and binding dispute resolution.

Subparagraph 15.2.5 Modify the last sentence of this section to read as follows: “The initial decision shall be final and binding on the parties but subject to litigation.”

Subparagraph 15.2.6 DELETED

Subparagraph 15.2.6.1 DELETED.

Subparagraph 15.3 This section, entitled “Mediation,” and its subsections, are DELETED.

Subparagraph 15.4 This section, entitled “Arbitration,” and its subsections, are DELETED.

Subparagraph 16 Add the following Additional Terms and Conditions:

16.1 Limitations on Appropriations and Spending Authority. Continuation of this Contract beyond June 30 of any odd-numbered year is contingent on continued legislative appropriation of funds for the purposes of this Contract. If those appropriations are not forthcoming, the State will notify the Contractor as soon as possible and the Contract will terminate on June 30 of that year. The State will not be penalized nor incur any liability because of termination of the Contract as provided above.

16.2 Termination. The State may terminate this Contract effective on delivery of written notice to the Contractor, or on any later date stated in the notice, if funding from federal, state, or other sources is not obtained and continued at levels sufficient to allow for the purchase of the commodities or services provided for in the Contract, if federal or state laws or rules are modified or interpreted in a way that the services or commodities are no longer allowable or appropriate for purchase under this Contract or no longer eligible for the funding proposed for payment of this Contract, or if any license, permit, or certificate required by law or rule, or the terms of the Contract, is for any reason denied, revoked, suspended, or not renewed.

16.3 Severability. If any term or provision of this Contract is declared by a court having jurisdiction to be illegal or unenforceable, the validity of the remaining terms and provisions shall not be affected, and, if possible, the rights and obligations of the parties are to be construed and enforced as if the Contract did not contain that term or provision.

16.4 Applicable Law and Venue. This Contract is governed by and construed in accordance with the laws of the State of North Dakota. Any action commenced to enforce this Contract must be brought and solely litigated in the District Court of Burleigh County, North Dakota.

16.5 Time of Completion. The parties agree that TIME IS OF THE ESSENCE in this project.

16.6 Spoliation. Contractor shall promptly notify State of all potential claims that arise from or result from this Contract. Contractor shall also take all reasonable steps to preserve all physical evidence and information that may be relevant to the circumstances surrounding a potential claim, while maintaining public safety, and grants to the State the opportunity to review and inspect the evidence, including the
16.8 Performance Bond. Pursuant to N.D.C.C. § 48-01.2-10, Contractor must obtain a Performance Bond. The bond must be for an amount equal at least to the price stated in the contract. The bond must be conditioned to be void if the Contractor and all subcontractors fully perform all terms, conditions, and provisions of the contract and pay all bills or claims on account of labor and materials including supplies used for machinery and equipment, performed, furnished, and used in the performance of the contract, including all demands of subcontractors. The requirement that bills and claims be paid must include the requirement that interest of the amount authorized under N.D.C.C. § 13-01-14 be paid on bills and claims not paid within ninety days. The bond is security for all bills, claims, and demands until fully paid, with preference to labor and material suppliers as to payment. The bond must run to the State, but any person having a lawful claim against the Contractor, or any subcontractor, as provided in this N.D.C.C. ch. 48-01.2, may sue on the bond.

16.9 Alternative Dispute Resolution – Jury Trial. The State does not agree to any form of binding arbitration, mediation, or other forms of mandatory alternative dispute resolution. The parties have the right to legal action to enforce available remedies. The State does not waive any right to a jury trial.

16.10 Confidentiality. Contractor agrees not to use or disclose any information it receives from the State under this Contract that the State has previously identified as confidential or exempt from mandatory public disclosure except as necessary to carry out the purposes of this Contract or as authorized in advance by the State. The State agrees not to disclose any information it receives from Contractor that the Contractor has previously identified as confidential and which the State determines in its sole discretion is protected from mandatory public disclosure under a specific exception to the North Dakota open records law, N.D.C.C. § 44-04-18. The duty of State and Contractor to maintain confidentiality of information under this section continues beyond the term of this Contract, or any extensions or renewals of it.

16.11 Compliance with Public Records Act. Contractor understands that, except for disclosures prohibited in Paragraph 16.10 above, the State must disclose to the public upon request any records it receives from Contractor under this Contract. Contractor further understands that any records that are obtained or generated by the Contractor under this Contract, except for records that are confidential, may, under certain circumstances, be open to the public upon request under the North Dakota open records law. Contractor agrees to contact the State immediately upon receiving a request for information under the open records law and to comply with the State’s instructions on how to respond to the request.

16.12 Work Product. All work product, equipment or materials created or purchased under this Contract belong to the State and must be delivered to State at State’s request upon termination of this Contract. Contractor agrees that all materials prepared under this Contract are “works for hire” within the meaning of the copyright laws of the United States and assigns to State all rights and interests Contractor may have in the materials it prepares under this Contract, including any right to derivative use of the material.

16.13 Independent Entity. Contractor shall perform as an independent entity under this Contract and not as an employee of the State for any purpose. Contractor will retain sole and absolute discretion in the manner and means of carrying out the Contractor’s activities and responsibilities under this Contract, except to the extent specified in this Contract.

16.14 Hiring Preference. Pursuant to N.D.C.C. § 43-07-20, the Contractor must give preference to the employment of bona fide North Dakota residents, as determined
by N.D.C.C. § 54-01-26, with preference given first to honorably discharged disabled veterans and veterans of the armed forces of the United States, as defined in N.D.C.C. § 37-19.1-01, who are deemed to be qualified in the performance of that work. The preference shall not apply to engineering, superintendence, management, or office or clerical work.

16.15 Nondiscrimination and Compliance with Laws. The Contractor agrees to comply with all applicable laws and rules, including those relating to nondiscrimination, accessibility, and civil rights. Contractor will timely file all required reports, make all payroll deductions, and timely pay all taxes and premiums owed, including sales and use taxes, unemployment compensation and workers’ compensation premiums. Contractor will have and keep current at all times during the term of this Contract all required licenses and permits.

16.16 Contractor’s Payment of Taxes. Pursuant to N.D.C.C. § 43-07-11.1, Contractor must file a certificate showing the Contractor has paid all applicable state taxes.

16.17 Licensed Contractor. Pursuant to North Dakota state law, the Contractor must be a licensed contractor.

16.18 State Audit. All records, regardless of physical form, and the accounting practices and procedures of Contractor relevant to this Contract are subject to examination by the North Dakota State Auditor or the Auditor’s designee. Contractor will maintain all such records for at least three years following completion of this Contract.

16.19 Prepayment. The State will not make any advance payments before performance by the Contractor under this Contract.

16.20 Payment of Taxes by State. State is not responsible for and will not pay local, state, or federal taxes. State sales tax exemption number is E-2001, and certificates will be furnished upon request by the purchasing agency.

16.21 Taxpayer Identification. The Contractor’s federal employer ID number is: __________________.
Certificate of Insurance:

- Included
- Name consistent with contract.
- General Liability - $1,000,000
- Automotive - $250,000 per person / $1,000,000 occurrence
- Professional Liability - $500,000
- Auto Insurance - not less than $1,000,000
- Worker’s Compensation & Employee Liability
- Excess/Umbrella Liability
- Additional Insured Endorsement - Certificate of Insurance Additional Insured and Waiver of Subrogation endorsement language: North Dakota State Board of Higher Education, North Dakota State University and the State of North Dakota and all its agencies are included as additional insured with waiver of subrogation on the general liability and auto liability when required by written contract. Note: The Architect/Engineer firm is not to be listed as an additional insured.
- Certificate Holder Address Matches NDSU Address

**Rev. 6/9/2014**

- NDSU ADDRESS:

  ND State Board of Higher Education
  Dba North Dakota State University
  Thorson Maintenance Center
  Dept 3200 – PO Box 6050
  Fargo, ND 58108-6050
Certificate of Insurance:
- Included
- Name consistent with contract.
- General Liability - $1,000,000
- Automotive - $250,000 per person / $1,000,000 occurrence
- Professional Liability - $500,000
- Auto Insurance - not less than $1,000,000
- Worker’s Compensation & Employee Liability
- Excess/Umbrella Liability
- Additional Insured Endorsement — Certificate of Insurance Additional Insured and Waiver of Subrogation endorsement language: North Dakota State Board of Higher Education, North Dakota State University and the State of North Dakota and all its agencies are included as additional insured with waiver of subrogation on the general liability and auto liability when required by written contract. Note: The Architect/Engineer firm is not to be listed as an additional insured.
- Certificate Holder Address Matches NDSU Address

Rev 6/9/2014

NDSU ADDRESS:
ND State Board of Higher Education
Db North Dakota State University
Thorson Maintenance Center
Dept 3200 – PO Box 6050
Fargo, ND 58108-6050

North Dakota State University
Engineer Contract Review Checklist
Review By:
- Engineer □
- Owner □
- ND AG Office

Project Name: ______________________________
Project Cost: ______________________________
Contract: - Engineer Firm Name__________________________
- Contract Form (i.e., B101-2007, etc.): * See Below For NDSU Address__________________________
- Date of Contract: __________
- Commencement Date: __________
- Completion Date: __________
- Signed Contract
- Owner Signature: Bruce A. Bollinger, VP Finance and Administration
- Signature Authorization if Contract not signed by company president.
- Amendments attached
- Name Consistent (spelling, capitalization, spacing, commas, etc.)
- Engineer’s Services Clearly Defined

- NDSU ADDRESS:
ND State Board of Higher Education
Db North Dakota State University
Thorson Maintenance Center
Dept 3200 – PO Box 6050
Fargo, ND 58108-6050
North Dakota State University

Owner/Contractor Contract Review and Checklist

Review By:
☐ Architect ☐ Owner ☐ ND AG Office

Project Name:_________________________________________________________
Project Cost:_________________________________________________________

Contract: - Contractor Firm

Name:
☐ Contract Forms: A101-2007 See right side of form for NDSU Address
☐ A201-2007 (if not in spec book)
☐ Date of Contract: __________
☐ Commencement Date: __________
☐ Completion Date: __________
☐ Owner Rep: Michael Ellingson Director Facilities Management Dept
3200 PO Box 6050 Fargo, ND 58108-6050
☐ Owner Signature: Bruce A. Bollinger, VP Finance and Administration
☐ Signed Contract
☐ Signature Authorization if Contract not signed by company president.
☐ Amendments for A101-2007 and A201-2007 attached
☐ Name Consistent (spelling, capitalization, spacing, commas, etc.)

SBHE Performance Bond:
Included: ☐ Yes ☐ No
☐ SBHE Performance Bond Form Required
☐ Name on Bond consistent with Contract.
☐ Dollar amount matches Contract.
☐ Date on bond same as or after Contract.

Acknowledgement of Attorney-in-Fact of Surety:
☐ Name consistent with General Power of Attorney.
☐ Date same as or after Contract.

Certificate of Insurance and Endorsements:
Included: ☐ Yes ☐ No
☐ Name consistent with Contract.
☐ Stop Gap Worker’s Compensation endorsed.

Certificate of Insurance and Endorsements (Cont’d):
☐ Builder’s Risk Insurance - Full Value
☐ <$100,000 - General Liability - $250,000 occurrence / $1,000,000 aggregate
☐ >$100,000 - General Liability - $1,000,000 occurrence / $2,000,000 aggregate
☐ Auto Insurance - not less than $1,000,000
☐ Additional Insured Endorsement – Certificate of Insurance Additional Insured and Waiver of Subrogation Endorsement Language: North Dakota State Board of Higher Education, North Dakota State University and the State of North Dakota and all its agencies are included as additional insured with waiver of subrogation on the general liability and auto liability when required by written contract. Note: The Architect/Engineer firm is not to be listed as an additional insured.
☐ General Liability Endorsement
☐ Waiver of Subrogation Endorsement
☐ Certificate Holder Address - *Matches NDSU Address

Worker’s Compensation Certificate:
Included: ☐ Yes ☐ No
☐ Name consistent with Contract.
☐ Current/Active Date

Sales Tax Certificate: (NDCC 43-07-11.1)
Included: ☐ Yes ☐ No
☐ Name consistent with Contract.
☐ Current/Active Date
☐ Agreement for Storing Materials Off-site (if applicable).
☐ Company Safety Manual (for projects over $100,000).
☐ Report of Contractor’s Employees on Registered Sex Offender List

*NDSU Address:
ND State Board of Higher Education
Dba North Dakota State University
Thorson Maintenance Center
Dept 3200 – PO Box 6050
Fargo, ND 58108-6050

Rev 6/9/2014
Exhibit I. NDUS AEM – Performance-Payment Bond (00 61 00)
KNOW ALL MEN BY THESE PRESENTS: That we *1, a *2 hereinafter called “Principal” and *3 of State of *4, corporation organized under the laws of the State of *5, and duly authorized to transact business in the State of North Dakota hereinafter called the “Surety,” are held and firmly bound unto ND State Board of Higher Education Dba North Dakota State University, Thorson Maintenance Center, Dept 3200 – PO Box 6050, Fargo, ND 58108-6050, hereinafter called “Owner” in the penal sum of _______ dollars ($_________), in lawful money of the United States for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, The Principal entered into a certain contract with the Owner, dated the *4 day of , _____________, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal and all subcontractors shall well, truly, and fully perform, all the undertakings, covenants, terms, conditions, and provisions of said contract during the original term thereof, and any extension thereof which may be granted by the Owner, with or without notice to the surety, and if he shall pay all bills or claims on account of labor and materials, including supplies used for machinery and motor power equipment, performed, furnished, and used in and about the performance of said contract, including all demands of subcontractors, and has made, or will make, prior to commencement of any work by himself or itself, or any subcontractor under such contract, full and true report to the North Dakota Worker’s Compensation Bureau and Unemployment Compensation Division of the payroll expenditures for the employees to be engaged in such work, and if he, or it, has paid, or will pay the premium thereon prior to commencement of such work, and if he, or it, will pay or cause to be paid all sales and use taxes payable as a result of such contract, including use taxes due from any subcontractor under the above named Principal, and shall pay all gasoline and special motor fuel taxes used in the performance of such contract, and shall pay all motor vehicle fees required for commercial vehicles used in connection with the performance of said contract, and shall pay to the State of North Dakota all state income taxes upon income derived or to become due from such work or project, and shall fully indemnify and save harmless the Owner from all cost or damage which it shall suffer by reason of failure to do so, and shall reimburse and repay the Owner for all outlay and expense which the Owner may incur in making good any default and shall promptly make payment, including interest of the amount authorized under Section 13-01-14, NDCC, on bills and claims not paid within 90 days, to all persons, firms, subcontractors, and corporations, furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specification.
PERFORMANCE - PAYMENT BOND

(CONTINUED)

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed this the ____________ day of _____ , ______________ .

ATTEST:

(Principal) Secretary Principal

By *5 ________________________________

(SEAL)

Address

Surety

By ________________________________ Attorney-in-Fact

Address

Countersigned by:

Resident Agent

Address

*1 Correct name of Contractor
*2 A Corporation, a Partnership, or an Individual, as case may be
*3 Correct name of Surety
*4 Date of Bond, cannot be prior to date of Contract
*5 If Contractor is Partnership, all partners should execute bond.

Signatures must be acknowledged before a Notary Public
Attach copy of Power of Attorney to each Bond
ACKNOWLEDGMENT OF PRINCIPAL  
(Individual or Partnership)

STATE OF ________________________________

COUNTY OF ____________________________

On this ______ day of ________________________,  ________, before me personally appeared

______________________________
Notary Public**

(SEAL)

ACKNOWLEDGMENT OF PRINCIPAL  
(Corporation)

STATE OF ________________________________

COUNTY OF ____________________________

On this ______ day of ________________________,  ________, before me personally appeared

______________________________
Notary Public**

(SEAL)
ACKNOWLEDGMENT OF ATTORNEY-IN-FACT OF SURETY

STATE OF ________________________________  ss
COUNTY OF __________________________

On this _________ day of ___________________________, _________, before me personally appeared

known to
me to be the person who is described in and whose name is subscribed to the within instrument as the Attorney-in-Fact of

_________________________________________________________ and

acknowledged to me that subscribed name of __________________________________________

thereo as surety and his/her own name as Attorney-in-Fact.

_________________________________________________________  Notary Public**

(SEAL)

** The name of the notary must be legibly printed, stamped or typed immediately following his/her signature and the
date of expiration of his/her commission must be endorsed thereon separately from his/her seal.
Exhibit J. NDUS AEM – Insurance and Safety Requirements
INSURANCE AND SAFETY REQUIREMENTS
Architect/Engineer shall include the following in the General Conditions of the Specifications

For all capital projects or improvements, the Contractor shall procure and maintain, at a minimum, the following insurance coverage and limits during the term of the contract and through the warranty period:

Liability Insurance in a form providing coverage not less than that of standard Commercial General Liability insurance policy (occurrence form) in the following amounts:

- For all projects for which the total estimated cost exceeds $100,000: not less than $1,000,000 per occurrence, $2,000,000 general aggregate limit and $1,000,000 aggregate products and completed operations.
- For projects for which the total estimated cost is $100,000 or less: not less than $250,000 per occurrence, $1,000,000 general aggregate limit and $1,000,000 aggregate products and completed operations.

The aggregate limit shall apply separately to occurrences at the location or project to which the contract relates. The policy shall include a "stop-gap" Employers Liability endorsement to cover the employer's liability for injury to employees which fall outside the State's Workers' Compensation laws.

Automobile Liability Insurance covering all owned, non-owned and hired automobiles, trucks and trailers. Such insurance shall provide coverage not less than that of the Standard Comprehensive Automobile Liability policy in limits not less than $1,000,000 combined Single Limit each occurrence for bodily injury and property damage.

Workers' Compensation benefit limits as required by the State of North Dakota.

Other insurance deemed necessary by the Contractor, including, but not limited to, coverage on contractor's or subcontractor's equipment.

The Owner and the State of North Dakota and its agencies, officers, and employees (State) shall be endorsed on the commercial general liability policy and automobile liability policy as additional insured. Contractor shall furnish certificates of insurance and copies of the additional insured endorsements prior to commencement of the contract. Endorsements shall contain a "Waiver of Subrogation" waiving any right of recovery the Insurance companies may have against the State as well as provisions that the policies and/or endorsements may not be canceled or modified without thirty days prior written notice to the Owner, and that any attorney who represents the State under the policy must first qualify and be appointed by the North Dakota Attorney General as required under NDCC Section 54-12-08.

Contractor's insurance coverage shall be primary (i.e. pay first) as respects any insurance, self-insurance or self-retention maintained by the State. Any insurance, self-insurance or self-retention maintained by the State shall be in excess of the Contractor's insurance and shall not contribute with it.

The insurance may be in policy or policies of insurance, primary and excess, including the so-called umbrella or catastrophe form and be placed with insurers rated "A" or better by A.M. Best Company, Inc.

The State shall be indemnified, saved and held harmless to the full extent of any coverage actually secured by the Contractor in excess of the minimum requirements set forth above.

All subcontractors shall maintain the same scope of insurance required of the Contractor. The General Contractor shall ensure compliance with this requirement.

All Risk Builder's Risk insuring the interest of Owner, Contractor(s) and subcontractors of all tiers including coverage on an All Risk basis, including, but not limited to, coverage against fire, lightning, wind damage, hail, explosion, riot or civil commotions, aircraft and other vehicles, collapse and coverage available under the so-called Installation Floater. The policy(ies) for such coverage shall be secured and maintained by the General Contractor in an amount equal to the Full Completed Value of the project. Any deductible amounts under the policies shall be the sole responsibility of the General Contractor.

The general contractor's bid shall include the builder's risk premium on an amount equal to 100 percent of the base bid plus all add alternates, plus 75 percent of the base bid and add alternates for other contracts, including the architect's fee and owner provided equipment or furnishings.

Builder's risk insurance shall remain in effect until the building or project is accepted.

The State Fire and Tornado Fund shall be contacted by the institution regarding additions to or remodeling of existing buildings.
to ascertain that adequate coverage for the existing building will be in effect should damage occur due to the contractor’s work. Institutions should request permission from the State Insurance Commissioner for a State Fire and Tornado Fund waiver of subrogation prior to construction.

Contractor shall comply with the provisions of AIA Document A201 Article 10, Protection of Persons and Property, General Conditions of the Contract for Construction. Contractor shall keep informed of and comply with all federal, state and local laws, regulations and other legal requirements governing safety, health, sanitation and the performance of the contract in general. Contractor shall provide, inspect and maintain all safeguards, safety devices, protective equipment, safety programs and other needed actions reasonable necessary to protect the life, health, and property of the Contractor, subcontractors, the Owner and the State, including their employees, officers, assigns and agents, and the public, in connection with the performance of work covered by the contract.

For all projects for which the total estimated cost exceeds $100,000, Contractor shall submit to the Owner a copy of the written safety program to be used as guidelines and direction of the Contractor’s and subcontractors’ worksite activities. This program must meet all federal, state and local laws and other legal requirements and include the following minimum provisions: (1) a worksite safety policy and mission statement; (2) assigned responsibilities among management, supervisors and employees; (3) a system for periodic self-inspections, including inspection of job sites, materials, work performance and equipment; (4) a thorough accident and injury reporting and investigation process; (5) a safety orientation program including first aid, medical attention, emergency facilities, fire protection and prevention, housekeeping, illumination, sanitation, personal protective equipment and occupational noise exposure; and (6) a safety training program including safety “tool box” meetings and other systems for ongoing training, including training for employees on the recognition, avoidance and prevention of unsafe conditions.

It shall be a condition of the contract, and shall be made a condition of each subcontract entered into pursuant to the contract, that the Owner assumes no liability relating to its receipt and review of the Contractor’s safety plan. Safety remains the responsibility of the Contractor. Furthermore, the right of the Owner to receive and review the safety plan shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.
WAIVER OF SUBROGATION AND SEVERABILITY OF INTERESTS ENDORSEMENT

A certificate of insurance has been provided to North Dakota State University by the undersigned insurer on behalf of:

____________________________________________________

for the following project:

____________________________________________________

This endorsement is provided to comply with the North Dakota State Board of Higher Education waiver of subrogation requirements, and it is understood and agreed that, with respect to the insurance coverages listed on the certificate, the undersigned insured hereby waives all rights to subrogation against North Dakota State University and the State of North Dakota, its agencies, officers and employees under the insurance policies as so indicated on the certificate.

Further, where the State of North Dakota, North Dakota State Board of Higher Education or North Dakota State University is included as an additional insured, the policies as stated on the certificate of insurance shall include a cross liability or severability of interests clause in addition to the waiver of subrogation.

The undersigned also certifies that they are authorized to make this endorsement on behalf of said insurer.

Signature ___________________________  Authorized Agent for Insurer

Print Name ___________________________  Authorized Agent for Insurer

______________________________________

Date
Exhibit K. NDUS AEM – Agreement for Storing Materials Off-Site
AGREEMENT FOR STORING MATERIALS OFF-SITE

This supplemental agreement is entered into this _______________ day of ____________, between the ND State Board of Higher Education Dba North Dakota State University, Thorson Maintenance Center, Dept 3200 – PO Box 6050, Fargo, ND 58108-6050 (hereinafter called "the Owner") and ______________________________________ (hereinafter called "the Contractor") for ____________________________________________________________

WHEREAS, the Contractor desires to store certain materials off the site for use in construction of ____________________________________________________________ under contract dated ________________________________ in order to furnish better storage, and desires to obtain advances for materials properly stored on the premises of ____________________________________________________________ to the Contractor in accordance with contract provisions as if they were properly stored on the site, provided the following conditions are complied with:

1. The above described warehouse selected for off-site storage must be suitable for storage and satisfactory to the Owner;
2. Any extra expense incurred because of off-site storage shall be borne by the Contractor;
3. Storage shall be at the risk of the Contractor and the loss, damage, or destruction of any materials so stored does not relieve the Contractor of the duty to complete the contract and the Contractor shall, if necessary, replace such items at his own expense;
4. The Owner will advance to the Contractor 90% of the invoice value of the materials thus stored;
5. Payments for materials stored off the site will be made only on regular Periodical Estimates at the prescribed monthly intervals the same as for materials stored on the site;
6. All materials stored shall be adequately covered by insurance, and;
7. The consent of Surety shall be obtained and evidenced by signature hereto.

STATE BOARD OF HIGHER EDUCATION

Owner

By: ________________________________

______________________________________

Surety

By: ________________________________

Contractor

By: ________________________________

COUNTERSIGNED BY:

Resident Agent
The form for the Owner-Architect Agreement shall be AIA Document B101-2007. The following amendments shall be placed on page 17 under Article 12 SPECIAL TERMS AND CONDITIONS.

1. Delete Subarticles, 8.2.1; 8.2.2; 8.2.3; Article 8.3 ARBITRATION and Article 8.3.4 CONSOLIDATION OR JOINDER.

2. Delete Subarticle 8.2.4 and replace with, "The Owner and Architect agree that venue for all legal actions between them with respect to this Agreement shall be in the East Central District Court, Fargo, North Dakota, which Court shall have sole and exclusive jurisdiction.

3. In Subarticle 11.8.1.1 after the word "transportation", insert: ", other than regular trips from the office to the site,"

4. Amend Subarticle 11.8.1.8 by deleting the words "carried by" and inserting, in lieu thereof, the words "required by the Owner." Delete the remainder of the sentence.

5. Amend Subarticle 3.1 to include: "normal civil engineering services."

6. Amend Subarticle 13.2 to include: "NDSU has an obligation to make information available to the campus on where to get information about Registered Sex Offenders who are working on NDSU property. You are obligated to inform NDSU Campus Police, in advance of any of your employees being on NDSU property, of any such employee who is a Registered Sex Offender. This obligation includes property owned or controlled by NDSU that is at locations other than the main campus (for example, the Equine Center, Downtown Campus, Research & Extension Centers, etc.)."

7. In Subarticle 3.6.2.4 in the second sentence before the words "shall not be liable" add the words: "absent negligence".

8. Amend Subarticle 3.6.6.5 to include the following:
   - Delete first part of sentence "Upon request of the Owner and ...
   - Add "The prime Contractor's representative" following Owner.
   - Add "warranty claims" after performance.

9. Amend to delete the following sections of Subarticle 4.3.2 (.1, .2, .3,) These services shall be part of the designated services of this Agreement.

10. Add: Architect shall secure and keep in force during the term of the Agreement, from insurance companies authorized to do business in North Dakota: (1) commercial general liability, with minimum limits of liability of $1,000,000 per claim and annual aggregate limit; (2) automobile liability, with minimum limits of liability of $250,000 per person and $1,000,000 per occurrence; and (3) workers' compensation insurance as required by state law. Architect shall furnish Owner with certificates of insurance as evidence these policies are in effect.

Architect shall procure and maintain professional liability insurance covering liability for negligent acts, errors, or omissions in providing or failing to provide professional services, with a minimum coverage limit of $500,000. Coverage shall be in force during the terms of this Agreement and for a period of at least twelve months thereafter.

Insurance coverage may not be cancelled or modified without thirty (30) days prior written notice to Owner.

Architect agrees to indemnify, save and hold harmless the Owner and the State of North Dakota and its agencies, officers and employees, from any and all claims of any nature, including all costs, expenses and attorney's fees, which may in any manner arise out of or result from architect's negligent acts or omissions in performing work under this Agreement, except for claims arising out of the sole negligence of Owner or the State.

Architect's obligation to indemnify, save and hold harmless the State shall not be limited to the amount of insurance actually secured under this Agreement, including any insurance above the minimum required, but shall extend to the full amount on any claims, loss or damage incurred or awarded, including costs, expenses and attorney's fees.

When applicable, substitute the word Architect with the word Engineer throughout this document.
Exhibit M. NDUS AEM – Owner-Construction Manager Agreement Amendments
OWNER-CONSTRUCTION MANAGER AGREEMENT AMENDMENTS

The following terms and conditions are incorporated into AIA Document B801/CMa: Standard Form of Agreement Between Owner and Construction Manager Where the Construction Manager is NOT a Constructor:

14.1 Article 10.1 is changed to read: “This Agreement shall be governed by the laws of the State of North Dakota.”

14.2 The heading of Article 12.2 is changed to read “REIMBURSABLE EXPENSES WHEN AUTHORIZED BY THE OWNER.”

14.3 The following is added to paragraph 12.2.1 after the word “Project”: “(other than regular trips from the office to the site).”

14.4 The phrase “normally carried by the Construction Manager” is deleted from paragraph 12.2.1.4 and replaced with: “required by the Owner.”

14.5 Paragraph 12.3.1 is deleted.

14.6 In paragraph 12.3.2, the word “Subsequent” is deleted and the word “monthly” is deleted and replaced with “as funds become available.”

14.7 Construction Manager shall bond the entire cost of the project through a single bond, or through bonds supporting all bid packages and the Construction Manager’s bond for the full amount of the Construction Manager’s services.

14.8 Liability Insurance

14.8.1 Construction Manager shall secure and keep in force during the term of this contract from insurance companies, government self-insurance pools, or government self-retention funds authorized to do business in North Dakota, commercial general liability covering Construction Manager for any and all claims of any nature which may in any manner arise out of or result from this contract. The minimum limits of liability required are $250,000 per person and $750,000 per occurrence.

14.8.2 The Owner, including its officers and employees, shall be endorsed on the commercial general liability policy as additional insured. Construction shall furnish a certificate of insurance and a copy of the additional insured endorsement to the undersigned Owner representative prior to commencement of this contract. Said endorsement shall contain a “Waiver of Subrogation” waiving any right of recovery the insurance company may have against the Owner as well as provisions that the policy and/or endorsement may not be canceled or modified without thirty (30) days prior written notice to the undersigned Owner representative, and that any attorney who represents the Owner under this policy must first qualify as and be appointed by the North Dakota Attorney General as a Special Assistant Attorney General as required under NDCC § 54-12-08.

14.8.3 Construction Manager’s insurance coverage shall be primary (i.e., pay first) in respect to any insurance, self-insurance, or self-retention maintained by the Owner. Any insurance, self-insurance, or self-retention maintained by the Owner shall be excess of Construction Manager’s insurance and shall not contribute with it.

14.8.4 Any deductible amount or other obligations under the policy(ies) shall be the sole responsibility of Construction Manager.

14.8.5 The Owner will be indemnified, saved, and held harmless to the full extent of any coverage actually secured by Construction Manager in excess of the minimum requirements set forth above.
Exhibit N. Americans With Disabilities Act Accessibility Guidelines Conformance Statement
### AMERICAN WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG) CONFORMANCE STATEMENT

<table>
<thead>
<tr>
<th>Name &amp; Building Address</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>City/County</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Date Construction to Start</th>
<th>Projected Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>New Building Sq. Ft.</th>
<th>Addition Sq. Ft.</th>
<th>Alteration Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Describe Alteration:

Type of Occupancy/Use (Refer to Occupancies and Divisions defined in the International Building Code):

I certify, to the best of my professional judgment, that the plans and specifications for the above referenced building or facility conforms with the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities as adopted in North Dakota Century Code Section 54-21.3-04.1.

<table>
<thead>
<tr>
<th>Name of Design Professional</th>
<th>Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signature

Phone Number

Date

Send To: Division of Community Services

1600 East Century Avenue, Suite 2

P O Box 2057

Bismarck, North Dakota 58502-2057
Exhibit O. Contractor Certification of Non-Asbestos and Non-Lead Materials
CONTRACTOR CERTIFICATION OF NON-ASBESTOS AND NON-LEAD MATERIALS

PROJECT NAME AND LOCATION: ____________________________________________________________

BUILDING OWNER AND ADDRESS: _______________________________________________________

CONTRACTORS NAME: __________________________________________________________________

Address: _____________________________________________________________________________

Telephone No. _________________________________________________________________________

The contractor hereby certifies that he, his subcontractors, and his suppliers have used or will use only non-asbestos containing materials and non-lead paints and no lead in the water systems in the construction of this project.

by: (Signature) ________________________________ Date ________________________________

(Print Name) _________________________________________________________________________

(Print Title) _________________________________________________________________________

NOTE: “Asbestos Free” materials are not allowed on this project as the definition of “asbestos free” materials allows asbestos content up to 1%. Only non-asbestos containing materials (which have no asbestos) are allowed.
Exhibit P.  NDSU Telecommunications Systems Construction Practices, Standards, and Procedures
TELECOMMUNICATIONS & NETWORKING SYSTEMS

CONSTRUCTION PRACTICES

STANDARDS AND PROCEDURES

GUIDE
PREFACE/OVERVIEW

This document is intended as a design aid as it relates to telecommunications and networking infrastructure at North Dakota State University. The telecommunications system specified herein provides for voice, data, video and other low voltage signaling functions (such as monitoring systems, energy management as well as security systems) using twisted pair, fiber optic, and coaxial cable. The system shall provide acceptable outlets for any telecommunication device which requires connection to other devices, networks or information services serving specific and general university requirements.

Network Engineering & Operations (NEO) along with Telecommunications & Emergency Support Technologies (TEST) are responsible for the network and communications infrastructure and will provide direction and therefore shall be consulted throughout the design and construction processes.

Telecommunications and network requirements as described in this document for each area of responsibility have been reviewed and approved by representatives of that technology at both the facility and engineering level. In some cases these requirements are stated generally due to rapid changes in industry and technology. Therefore, Information Technology NEO and TEST staff must be actively involved in a review and advisory capacity from inception through construction. Design architects, engineers, and eventually, contractors are expected to propose designs and build in accordance with the guidelines outlined here.

An engineered telecommunication ‘network design’ solution is required for all major and/or minor remodeling projects as well as new construction. It is to include design specifications, product information and execution. This shall be in coordination with a BICSI design professional (Registered Communications Distribution Designer) employed by the contracted engineering firm and the NDSU RCDD.

It is the responsibility of the NDSU Telecommunications Distribution Designer (RCDD) to coordinate with other designers/engineers/architects on a building or infrastructure project (architectural, electrical, mechanical, etc.) to determine if proposed systems are compatible with the telecommunications cabling system. It is critical to coordinate between disciplines during the design phase of a project.
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SECTION 1: SCOPE

A. Description:
   1. This Section includes raceways, conduit, boxes, cable tray and Telecommunications rooms for the installation of the following as it relates to technology for both indoor and outdoor infrastructure.
      a. Voice, data & ancillary cabling System
      b. Building Automation (BAS)
      c. Energy Management (Environmental Control)
      d. Fire Alarm systems
      e. Video Distribution System (CATV)
      f. Ancillary low-voltage systems (signal & control)
      g. Underground distribution infrastructure
      h. Security & Access Systems (Card Key, CCTV/video surveillance)
         1) All security elements shall be coordinated with both Telecommunications and Facilities Management for appropriate technology and support infrastructure

SECTION 2: APPARATUS

CONDUIT SYSTEM

A. Provide conduit system:
   1. Provide minimum of ¾” conduit at each station with the exception of 'Open Office' areas Coordinate 'Open Office' areas with architect for consolidation points if necessary.

B. Raceway systems:
   1. Coordinate product and color with architect.
   2. Acceptable raceway include Wiremold 800 and 2300 or Panduit LD10 and T-45 (or approved equivalent)

C. Sleeves:
   1. Floor penetrations: 4” minimum, unless noted otherwise (With appropriate fire-stop and water seal)
   2. Wall penetrations: 2” minimum, unless noted otherwise (With appropriate fire-stop)

OUTLET BOXES

A. Two-gang, 2½” deep box with single gang mud ring.
B. Two-gang, 3½” deep masonry box.
C. Ganged outlets shall be same as individual outlets except with 2½” depth.

CABLE TRAY SYSTEM

A. Provide cable tray or basket system (see VOICE AND DATA CABLING section).
CONDUIT

A. Provide conduit in walls and inaccessible ceiling spaces.

B. Provide a raceway system with conduit routed continuously from outlet boxes to nearest accessible ceiling space, unless noted otherwise by electrical engineer or architect.

C. Ream conduit ends and bush conduit ends that do not terminate in an approved conduit fitting.

D. Install conduit with a maximum of 100 feet between pull points. Provide pull boxes in conduit run limited by distance restrictions and/or architectural challenges.

E. Install conduit with a maximum of 180 degrees of bends between pull points. Provide pull boxes in conduit runs limited by bends restrictions.

F. Locate pull boxes in readily accessible spaces. Mark the cover in permanent marker indicating the system(s) being served.

G. Sleeves:
   1. Extend up to 4” above finished floor.
   2. Extend down to the top of backboards.
   3. Extend down to 12” above racks and cable tray.

H. Underground (see section 'OUTSIDE PLANT CABLING').
SECTION 3: TELECOMMUNICATIONS ROOMS AND WIRE CENTERS

A. Size based on usable square footage of serving area. *(Exhibit ‘A’)*
   1. <5000 sq. ft. 10 ft. x 8 ft.
   2. 5000 sq. ft. – 8000 sq. ft. 10 ft. x 9 ft.
   3. 8000 sq. ft. – 10,000 sq. ft. 10 ft. x 11 ft.

B. Minimum ceiling height is 8 ft. above finished floor.

C. Drop or false ceilings tiles shall not be installed.

D. Open structure ceiling shall provide the same environmental conditions as a closed ceiling structure.

E. Telecommunications spaces shall not be located below final grade unless preventive measures against water infiltration are employed. The design and installation of water and drain lines should be avoided in telecommunications spaces.

F. The Telecommunications rooms should not be shared with mechanical, building maintenance or electrical conditioning or distribution facilities and other equipment that may produce EMI.

G. The Telecommunications room should have adequate HVAC that will maintain a temperature of 67° - 75° and a relative humidity level of 30% - 55%, maintained 24 hours per day and 365 days a year.
   1) 1 Rack 6500 BTU / Hr. Max .5 Ton of HVAC 4,874 de-rated BTU / Hr.
   2) 2 Racks 13,000 BTU / Hr. Max 1 Ton of HVAC 9,750 de-rated BTU / Hr.
   3) 3 Racks 19,500 BTU / Hr. Max 1.5 Ton of HVAC 14,625 de-rated BTU / Hr.

   Note: Based on 16 Amps (de-rated) per rack

   16A X 120VAC = 1920 Watts per Rack X 3.4 = 6528 BTU per Hr. per Rack

H. Minimum floor loading of 50 lbs per sq. ft.

I. Access to building ground in each Telecommunications room (install grounding bus bar). A grounding bar measuring 12” long by 2” wide by ¼” thick with pre-drilled ¼” holes shall be installed. The ground bar shall be connected to the main building ground using #6 or greater AWG copper wire.

J. All cable trays and racks are to be grounded to the main building ground using #6 or greater AWG copper wire. Rack-mounted electrical outlets must be grounded to the rack ground in addition to any other NEC, State, or local building code grounding requirements.

K. Minimum lighting of 500 LUX (50 ft. candles measured 1 meter above finished floor).

L. Provide perimeter overhead cable trays (basket or ladder) + intersections (12”) to adequately route cables between walls and racks *(Exhibit ‘A’)*.

M. Locate Telecommunications rooms as close as possible to the center of the serving area to ensure that the longest cable run does not exceed 280 feet.

N. Efforts should be made to collapse all Telecommunications infrastructure to a single Telecommunications room when possible. When this is not feasible (to ensure 280’ limitation), provide riser and distribution diagram to NDSU for approval.

O. Provide a 100 amp electrical branch sub-panel attached to emergency power generator to serve each MDF/IDF and coordinate location with the NDSU project personnel (all circuits clearly labeled).

P. Provide 2 - 20 amp (non-switched/dedicated branch) double duplex electrical outlets on each of two walls, one on opposite walls from dedicated sub-panel. Power may need to be extended to equipment racks if installed in the center of the space. Verify method with owner.

Q. Provide 1 – 20 amp (non-switched/dedicated branch circuits) to each ‘two post’ equipment racks. *(Exhibit ‘B’)*
R. Three walls shall be lined with 4’ x 8’ x ¾” AC grade or better plywood (~2” – 4” AFF); Plywood surface should be painted with 2 coats of gray fire retardant enamel.

S. A dry sprinkler system or chemical suppression should be considered for fire suppression

T. All Telecommunications rooms including Entrance facilities should be secured with either card access, keyed to the campus grand master or other NDSU approved method to properly ensure a secured space.

U. 36” wide entrance door opening outward for each Telecommunication room.

V. Coordinate room layout and elevations with NDSU Network Engineering & Operations.

W. Any vertical or horizontal distribution channel that will be mounted directly to the plywood will be done by NDSU Network Engineering & Operations. See section on VOICE AND DATA CABLING for rack mounted distribution.
SECTION 4: ANCILLARY TELECOMMUNICATIONS APPLICATIONS

A. Facilities Management & Telecommunications shall be consulted with reference to the following technologies and/or applications during the design phase.

1. Security:
   a. Card-Key access (The Telecommunications & Emergency Support Technologies – TEST shall be consulted for design criteria, product and execution)
   b. Video Surveillance (The Telecommunications & Emergency Support Technologies – TEST shall be consulted for design criteria, product and execution)

2. Metering: (Facilities Management)
   a. Electrical
   b. Steam (condensate)
   c. Parking lot

3. Controls & Monitoring:
   a. HVAC systems (Trane / Johnson Controls).
   b. Irrigation.

4. Emergency Communication:
   a. Blue Light Emergency Telephone for either ‘tower’ or ‘wall’ mount. All equipment provided by owner through NDSU Telecommunications and Emergency Technologies - 2 Cat 5e from nearest MDF/IDF to telephone location(s) - (2 Cat. 6a can be substituted as approved by owner)
   b. Elevator emergency call.
   c. Fire Alarm (Simplex)

B. Information Technology Services (ITS) and the Telecommunications Department should be consulted with reference to the following technologies and/or systems.

1. Classroom technology: (Refer to Classroom Technology Design Doc.)
   a. Clustering positioning of internet access.
   b. Teaching technologies (projector, sound, etc.). See ‘Classroom Technologies’ section’
   c. Special Power or environmental requirements including lighting.
   d. Cable distribution methods within classroom
   e. Video Conferencing.
   f. Architectural – seating configuration, window coverings etc.)

2. Reserved or dedicated area for ITS/Telecommunication support:
   a. Server consolidation room. (see ‘Server Room’ section)
   b. Area for technical support staff.

3. UPS, isolated neutral or power conditioning requirements:
SECTION 5: GENERAL
DESCRIPTION

A. This section includes standards, methods and procedures for interior and exterior technology systems

QUALITY ASSURANCE

A. Technology work shall be in accordance with the following codes and agencies:

1. National Electrical Code (NEC)
2. Occupation Safety and Health Administration (OSHA).
4. Americans with Disabilities Act (ADA).

B. Material and Installation Standards: Material shall be new and shall conform to the standards where they have been established for the particular material and installation. Publications and Standards of the organizations listed below apply to materials and installation specified in this document.

1. Underwriters’ Laboratories, Inc. (UL).
2. Telecommunications Industry Association (TIA)
3. National Electrical Manufacturer Association (NEMA).
4. Institute of Electrical and Electronic Engineers (IEEE).
15. ANSI/TIA/EIA-568-B.3 - Optical Fiber Cabling Components.
19. ANSI/TIA/EIA-607 — Commercial Building Grounding and Bonding Requirements for Telecommunications.
20. ANSI/TIA/EIA -758-A – Customer owned OSP Telecommunications cabling standard
CONTRACTOR QUALIFICATIONS
A. A minimum of 5 years experience in the installation and service of voice/data cabling communications systems on projects of comparable size and scope.
B. A minimum of 5 years experience in the installation and service of Outside Plant Cabling System on projects of comparable size and scope.
C. Registered Communications Distribution Designer (RCDD) certified by the Building Industry Consulting Service International (BICSI).
D. Installation personnel trained in the proper installation of extended performance data and voice cable, prior to start of project.
E. Installation personnel trained in the proper installation of outside plant cabling, prior to start of project.

SUPERVISION
A. Installations shall be made by persons licensed and skilled in the trade and shall be done under the supervision of a BICSI Registered Communications Distribution Designer (RCDD), approved BICSI certified installer or NDSU approved equivalent.

DRAWINGS
A. The Electrical/System drawings should indicate/include the arrangements of telecommunication apparatus including elevations, floor plan and riser diagram.

SUBMITTALS
A. Shop Drawings and Product Data:
   1. Submit for review by the Architect, NDSU representatives (Facilities Management and Telecommunications) & Director, Network Engineering & Operations, shop drawings and product data of materials and equipment to be incorporated in the project.

OPERATION AND MAINTENANCE DATA AND INSTRUCTIONS
A. Printed Material: Provide required printed material for binding in operation and maintenance manuals.
B. Instructions for NDSU Personnel:
   1. Provide a representative to instruct NDSU’s designated personnel in any systems or applications relating to installed technology for this project.

SECTION 6: PRODUCTS
MATERIALS
A. Materials shall be new.
B. Furnish materials specified or as indicated on the drawings.
C. Materials of the same type shall be the products of one manufacturer.
D. UL listed materials shall bear UL label. ETL listed materials shall bear ETL label. ETL label shall be accepted in lieu of UL when the UL testing standards have been followed.
SUPPORTING DEVICES

A. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
SECTION 7: EXECUTION

PRODUCT STORAGE AND PROTECTION
A. Handle materials in accordance with manufacturer’s standards and supplier’s recommendations, and in a manner to prevent damage to materials.
B. Provide areas for general storage. Provide temperature and/or humidity controls where applicable.
C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials.

FIRESTOPPING
A. Apply fire stopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating per requirements.

DEMOLITION
A. Protect existing equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality and functionality.
B. Reroute cabling as required to serve equipment not in the demolition area (coordinate with Network Engineering & Operations).
C. Clean all equipment removed before reinstallation.

CLEANING AND PROTECTION
A. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are not damaged at time of completion.
B. Clean elements with dry compressed air (less than 15 PSI) and vacuum the interior of all enclosures.

SERVICE OUTAGES
A. Technology work requiring interruption of Telecommunications and/or Networking service, which would adversely affect the normal operation of the other portions of NDSU, shall be done at a time other than normal working hours. Normal working hours shall be considered 7:30 a.m. to 6:00 p.m., Monday through Friday. See IT/ECI/NEO policy on weekly maintenance scheduling or contact Network Engineering at 231-7181.
B. Schedule work requiring interruption of Telecommunications and/or Networking service two weeks prior to actual shutdown. Submit schedule in writing indicating extent of system to be interrupted, date and time when interruption is intended to occur, and date & time service will be restored. Schedule shall be subject to the approval of the Architect and NDSU.
C. Cancellation: NDSU reserves the right to cancel or change the scheduling of any outage up to 24 hours before the approved starting time.
SECTION 1: GENERAL

SUMMARY

A. The Voice and Data Cabling System includes: (consult with Network Engineering for proper cable rating)

1. Category 6-Augmented (Cat 6a, Plenum rated) horizontal cabling permanent link for voice and data (new buildings) Verify with Network Engineering
2. Category 5e (Cat 5e, Plenum rated) horizontal cabling permanent link for voice and data (legacy buildings) Verify with Network Engineering
3. Category 3 twisted-pair backbone cabling (Plenum rated) for voice.
4. Multimode & Singlemode fiber backbone cabling for data.

B. Support the following network technologies:

1. Analog Voice Circuits.
2. Digital Voice Circuits.
3. Ethernet 10/100Base-TX, 100BASE-FX, 1000Base-LX, 1000Base-SX and 1000Base-TX standards and 10GBase-xx.
4. Voice over IP e/w PoE (VoIP).
5. Wireless technologies @ 2.4 GHz & 5.0 GHz, PoE (Consult Network Engineering)

C. Includes mounting elements, cabling, connectors, terminal equipment, cable management and identification.

D. Manufacturer’s warranty for a period of 10 years for proper operation of any communications protocol designed to operate over the specified cabling system.

E. Documentation of the voice, video, security and data cabling system.

F. Tested and documented for reference by the NDSU Network Engineering & Operations & Telecommunications staff.

SUBMITTALS

A. References:

1. Provide 3 references of projects of comparable size and scope that have been completed within the last 3 years.

B. Shop Drawings/Product Data:

1. Neatly bound in a three ring binder, identify the project, the site, system, date and vendor name on the cover.

2. Consisting of, but not be limited to the following items:
   a. Title sheet showing the Contractor’s name, address, phone number and date submitted.
   b. Materials list showing quantity, manufacturer and description of each item being furnished.
   c. Elevations of racks and terminal blocks.
   d. Riser diagrams showing distribution equipment.
   e. Catalog sheets with complete technical data for each item being furnished.
   f. Confirmation that products are registered components for the manufacturer’s warranty.

C. As-Built Drawings: (Hard copy + digital media (CAD))

1. Two sets including revised shop drawing and product data showing the final configuration of the system, final layouts of terminal boards and cabinets, drawings showing cable routes, and test results.
DESCRIPTION

A. The voice and data cabling system shall be a premises distribution system consisting of horizontal cabling and backbone cabling for voice and data (Data = office data jacks, wireless jacks, BAS, building & access security).

B. The voice and data cabling system shall support the future installation and connection of the following equipment (Electronic equipment provided by NDSU unless otherwise specified).
   1. Active data equipment mounted in MDF/IDF racks.
   2. Telephone equipment (remote VoIP/PBX cabinet) at the Voice/Data Backboards or mounted in MDF/IDF racks.
   4. Workstation telephones and wall telephone outlets.
   6. CCTV cameras and switching & recording equipment.
   7. BAS control units

C. Patch cord installation and cross-connect cable provided and installed by NDSU Network Engineering & Operations.

D. All terminations shall be TIA-568B standard

SECTION 2: PRODUCTS

MANUFACTURERS

A. Supply products, defined as part of the horizontal cabling system configuration, by a single manufacturer and listed cable partner.
   1. Panduit Network Connectivity Group.
      a. Communication outlets (jacks) at NDSU shall be Panduit Mini-Com series rated for either Cat 5e or 6a

B. Cable: Partnered with the System Manufacturer.
   1. Belden Wire & Cable Company
   2. Berk-Tek, Inc.
   3. CommScope Inc. (Video coaxial cable)
   4. General Cable
   5. Mohawk/CDT
   1. NDSU approved equivalent

C. Mounting Elements:
   1. B-Line (Cable Support)
   2. Carlon (Innerduct)
   3. Chatsworth (racking & cabinets)
   4. Erico (Cable Support)
   5. Hoffman
   6. Ortronics
   7. Siemons
8. Panduit
9. AT&T
10. NDSU approved equivalent

D. Grounding:
1. B-Line
2. Harger Lightning Protection Inc.
3. Thomas and Betts
4. NDSU approved equivalent

TWISTED PAIR CONNECTORS AND TERMINAL EQUIPMENT
A. Cross Connect 110 Termination Panel (Backbone & Cat. 5e only): Modular array of IDC terminal blocks arranged to terminate cables and permit interconnection between Cat 5e cables. (No patch panels are used for Cat 5e in NDSU wire closets unless specifically detailed)
   1. IDC Type Termination, using modules designed for punch-down caps.
   2. IDC Termination Block Modules: Integral with connector bodies. Five pair connecting blocks for backbone cabling.
   3. Four pair connecting blocks for horizontal cabling.
   4. Labeling: Designation strip with black machine printed lettering on white background and clear plastic cover integral to the cross connect panel.
   5. Mounting: Backboard unless indicated otherwise.

B. Voice Jacks: Category 5e for legacy buildings or 6a for new buildings (consult with owner)
   1. 8 position modular.
   2. Panduit Mini-com series
   3. RJ-45 receptacle units with integral IDC-type terminals.
   4. Non-keyed
   5. Color International White (IW)
   6. T568 ‘B’ termination

C. Data Jacks: Category 5e for legacy buildings or 6a for new buildings (consult with owner)
   1. 8 position modular.
   2. Panduit Mini-Com series
   3. RJ-45 receptacle units with integral IDC-type terminals.
   4. Non-keyed
   5. Color Orange (Or)
   6. T568 ‘B’ termination
D. Workstation Outlets/Faceplates (Panduit Mini-Com series)

1. Wall (Exhibit ‘C’)
   a. Multiple jack inserts.
   b. Single gang faceplate.
   c. Faceplate: Plastic.
   d. Color: Coordinate with Architect.
   e. Labeling: Black machine printed lettering on white background.

2. Surface raceway:
   a. Multiple jacks.
   b. Single gang faceplate.
   c. Faceplate: Plastic.
   d. Color: Coordinate with Architect.
   e. Labeling: Black machine printed lettering on white background.

3. Ceiling: (Wireless AP & CCTV video)
   a. Single jack
   b. Mount in single faceplate.
   c. Faceplate: Stainless steel or approved equal
   d. Labeling: Black machine printed lettering on white background.

E. Voice Wall Outlets:

1. Single jack
2. Mount in single faceplate
3. Faceplate: Stainless steel with mounting posts for wall mount telephone

TWISTED PAIR CABLES

A. UTP Horizontal Cable:

1. Voice:
   a. Category 5e for legacy buildings and 6a for new buildings (verify with owner)
   b. Four thermoplastic-insulated individually twisted pairs of conductors.
   c. 24 AWG, color-coded.
   d. Jacket colors: White
   e. Plenum rated

2. Data:
   a. Category 5e for legacy buildings and 6a for new buildings (verify with owner)
   b. Four thermoplastic-insulated, individually twisted pairs of conductors.
   c. 24 AWG
   d. Jacket color: Blue
3. All terminations shall comply with the TIA-568B standard

e. Plenum rated

<table>
<thead>
<tr>
<th>Pin T568A Pair</th>
<th>T568A Color</th>
<th>Pin T568B Pair</th>
<th>T568B Color</th>
<th>Pins on plug face (socket is reversed)</th>
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<tbody>
<tr>
<td>1 3 2</td>
<td>tip</td>
<td>1</td>
<td>white/green stripe</td>
<td>1</td>
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<td>8 4 4</td>
<td>ring</td>
<td>8</td>
<td>brown solid</td>
<td>8</td>
</tr>
</tbody>
</table>

Note: This is from left to right, with the plastic latching tab facing away from the viewer.
B. Voice Twisted pair Backbone Cable:
   1. Category 3
   2. Multi-pair (Pair counts provided by NDSU, Network Engineering & Operations).
   3. Thermoplastic-insulated, individually twisted pairs of conductors.
   4. 24 AWG
   5. Jacket color: Gray or white
   6. Plenum rated

**FIBER-OPTIC CONNECTORS AND TERMINAL EQUIPMENT**

A. Cable Connectors:
   1. Quick connect.
   2. Insertion loss not more than 0.7 dB.
   3. Duplex-type ‘SC’ connectors with self-centering alignment (Multimode & Singlemode)

B. Patch Panel:
   1. Modular panels housing multiple-numbered duplex cable connectors.
   2. Permanent Connection: Permanently connect one end of each connector module to installed Fiber Optic cable.
   3. 12 modular panel locations per patch panel.
   4. 6 fiber connectors per modular panel. (12 fiber connector modules may be used for special conditions)
   5. Provide adequate modular panels and fiber connectors to terminate all strands specified by NDSU Network Engineering & Operations.

**FIBER-OPTIC CABLES**

A. Cables:
   1. Multi-Mode.
      a. 62.5/125 um diameter tight-buffered optical fiber.
      b. Fiber counts (Specified by NDSU Network Engineering & Operations).
      c. Dual window, 850 nm and 1300 nm.
      d. Maximum attenuation — 3.5 dB/km at 850 nm, 1.5 dB/km at 1300 nm.
      e. Listed types: OFNP
   2. Single-mode:
      a. 8.7 to 10 um diameter tight-buffered optical fiber.
      b. Fiber counts (Specified by NDSU Network Engineering & Operations).
      c. Dual window, 1310 nm and 1550 nm.
      d. Maximum attenuation — 1.0 dB/km at 1310, 1.0 dB/km at 1550 nm.
      e. Listed types: OFNP
MOUNTING ELEMENTS

A. Data Racks: (Exhibit ‘B’)
   1. Freestanding two post
   2. Modular-steel units designed for Telecommunications equipment support.
   3. Approximate Module Dimensions: 84 inches high by 22 inches wide.
   4. Rails tapped on ETA spacing.
   5. 19” mounting width.
   6. Finish: Baked-polyester powder coat (Black).
   7. Vertical Cable Management at the end of each row of racks and between each rack.
   8. Horizontal cable management at the top and bottom of each rack.

B. Rack Cable Management
   1. Front vertical:
      a. 3” - 6” width
      b. Full height of rack
   2. Front horizontal:
      a. 3½” minimum width.

C. Plywood Backboard:
   1. ¾” Class A-D exterior grade plywood.
   2. Painted with two coats of marine gray fire retardant enamel.
   3. Apply on minimum of three walls unless indicated otherwise.

D. Innerduct: Ribbed or smooth wall duct with pull string that meets appropriate fire rating for the space installed.

E. Cable Support
   1. J-Hooks
   2. D-Rings
   3. Bridle Rings
   4. Cable Tray
      a. Type: Telco Style Ladder or basket
      b. High tensile tubular steel
      c. Width: 12” - wall 2”-3”
      d. Cross-Rung Spacing: 9” for ladder style
      e. Minimum Fitting Radius: 33”
      f. 12” wide, 3” bend radius cable drop outs.
      g. Bonding conductors for each section of tray.
CABLE DOCUMENTATION - DATA
A. The Contractor must provide cable documentation files. The files shall be windows compatible either spreadsheet (Excel). The files shall identify:
   1. Station type: voice & data
   2. Cable type and tested performance.
   3. Location of outlet
   4. Location of associated cable IDF or MDF (i.e. other end of the circuit)

IDENTIFICATION PRODUCTS
A. Cable Markers: Vinyl wraparound adhesive tape markers, machine printed with black lettering on white background.
B. ½” wide vinyl adhesive tape machine printed with ⅜” high black lettering on white background.
C. Black permanent marker.

SECTION 3: EXECUTION

INSTALLATION
A. Provide 1 voice jack (5e for legacy buildings, 6a for new buildings) and 1 data jack (5e for legacy buildings, 6a for new buildings) at each workstation unless noted otherwise at industry standard height (12” from center) unless noted otherwise (verify with owner)
   A1. Provide 1 data jack for each location required for CCTV (video), security access & wireless (WiFi)
   A2. A telecommunication outlet providing voice services only intended for wall phone use shall be installed in accordance with the standards of the Americans with Disability Act (ADA) requirements.
B. Maximum length of any cable run shall not exceed 280 feet (jack to wire-closet termination (permanent link)
C. Provide hanger hardware in pathways where appropriate maintaining hanger spacing at a minimum of 48” – 60” for the entire length of the run
D. Provide continuous lengths of cable from termination to termination (no splices allowed)
E. Install non-armored fiber optic cabling in raceway and/or cable tray.
F. Terminate cabling as appropriate at both ends per specification for either category 5e or 6a
G. Install cable without damaging conductors, shield, or jacket.
H. Do not bend cable in handling or in installing to smaller radii than minimums recommended.
I. Pull cables without exceeding cable manufacturer’s recommended pulling tensions.
   1. Pull cables simultaneously if more than one is being installed in the same raceway.
   2. Use pulling compound or lubricant if necessary.
   3. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cable or raceway.
J. Cabling within Closets and Enclosures: Provide adequate length of conductors. Train cables to terminal points. Provide tie wraps or Velcro to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommendations.
K. Comply with EIA/TIA-569 rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources.
GROUNDS

A. Ground equipment racks, raised flooring and cable tray to Telecommunications Grounding Busbar.

B. Bond cable shields, screens and drain conductors to Telecommunications Grounding Busbar.

C. Telecommunications Grounding Busbar: In Equipment Room, Telecom Rooms and service entrance (EIA/TIA-607-A).

D. Access to building ground in each Telecommunications room (install grounding Bus bar). A grounding bar measuring 12” long by 2” wide by ¼” thick with pre-drilled ¼” holes shall be installed. The ground bar shall be connected to the main building ground using #6 or greater AWG copper wire.

E. All cable trays and racks are to be grounded to the main building ground using #6 or greater AWG copper wire. Rack-mounted electrical outlets must be grounded to the rack ground in addition to any other NEC, State, or local building code grounding requirements.

CONDUIT

A. Conduits shall be bonded and grounded in accordance with ANSIJ-STD-607-A.

B. All EMT conduit stubbed into spaces as part of the horizontal cabling shall be ¾” – Conduit for risers shall be sized accordingly with at a minimum or 100% of additional capacity

C. Each conduit terminating in an telecommunications box shall have a plastic bushing installed at the end of the run to protect the cable

D. Maximum conduit fill requirements for station and riser cable

E. Based on straight runs only (no bends)
   1. Internal diameters are based on manufactures standard for rigid metal conduit
   2. De-rate conduit capacity accordingly for bends

<table>
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Sample cable outside diameters (in) per BICSI
INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

A. Mount connectors and terminal equipment hardware on backboards. *(Exhibit ‘A’)*

B. Group connecting hardware for cables into separate logical fields (voice, data, surveillance, BAS, etc.). Consult with Network Engineering prior to initiating termination process.

C. Use ‘110’ hardware to terminate Cat 5e voice and data cables entering the Telecommunications room meeting or exceeding Category 5e specifications.

D. Use ‘110’ hardware to terminate Cat. 3 rated voice risers.

E. Use Cat 6a rated patch panels appropriately sized to terminate voice and data cables entering the Telecommunications room meeting or exceeding Category 6a specifications *(do not use 110 hardware)*

IDENTIFICATION

A. **Workstation Outlet:**

   1. Label type: Vinyl Adhesive Tape.
   
   2. Label each end of each cable utilizing the following label format. *(Exhibit ‘D’)*

      a. Format: Room Number - Faceplate sequence number (clockwise) - Cable Function & sequence #
      
      b. Example: RRRR-nnn-X#
      
      c. Where:

         1) ‘RRRR’ = Room number
         2) nnn = Faceplate Number (01-99 ➔ Clockwise around room or area)
         3) Cable Function & jack number on faceplate (‘D’=Data, ‘V’=Voice, ‘W’=Wi-Fi #=sequence number on faceplate)

B. **Voice & Data Horizontal Cables:**

   1. Label type: Vinyl Adhesive Tape.
   
   2. Label each end of each cable utilizing the following label format. *(Exhibit ‘D’)*

      a. Format: Workstation Room Number - Faceplate Number - Cable Function & sequence #
      
      b. Example: RRRR-nnn-X#
      
      c. Where:

         1) ‘RRRR’ = Room number
         2) nnn = Faceplate Number (01-99 ➔ Clockwise around room or area)
         3) Cable Function & jack number on faceplate (‘D’=Data, ‘V’=Voice, ‘W’=Wi-Fi #=sequence number on faceplate)

   3. Label cables within outlet boxes
   
   4. Label each cable within 4-6 inches of each termination
C. Cross Connect 110 hardware & Cat 6a patch panels
   1. Label type: Designation Strip (Cat 5e and/or 6a)
      a. Label twisted pair backbone cable terminations with the Telecommunications Room Name at the opposite end of the terminated cable and the pair count.
      b. Label voice and data horizontal cable terminations with the Workstation Room Number and Faceplate ID.

D. Fiber Optic Patch Panels:
   1. Label type: Designation Strip.
   2. Label the designation strip for each connector identifying the Telecommunications Room at the opposite end and the strand count in the Fiber Optic Cable.
WIRELESS

Wireless Design and Installation Standards (Note: NDSU Network Engineering staff will install WAP hardware upon being notified that circuit testing has been completed by the contractor.

A. General

1. The wireless standards below are for indoor design only. Outdoor specifications are not included and shall be consulted with NDSU prior to designing for outdoor/green spaces.

2. The following are general guidelines only and each space shall be evaluated separately based on architecture and mechanical design.

   a. The approved Vendor for Wireless Access Points (WAP) is Cisco.

B. Wireless Design

1. High density areas, such as classrooms, auditoriums, meeting rooms, study areas, multipurpose areas and housing facilities, should be designed for capacity.

C. Guidelines when designing for capacity:

   1. Auditorium and/or meeting rooms with 100 or less seats require 1 WAP per 20 seats
   2. Auditorium and/or meeting rooms with more than 100 seats require 1 WAP per 25 seats
   3. Engineer shall provide NDSU with proposed planning prints showing proposed WAP locations

D. Guidelines when designing for coverage:

   1. Partially open environment with low impact barriers (e.g. walls/partitions made of wood or synthetic materials). WAP located to cover a radius of 75 feet.
   2. Closed environment with moderate impact barriers (e.g. floor-to-ceiling walls made of brick, sheetrock plaster, tile) WAP located to cover a radius of 40 feet.
   3. Obstructed environment with high impact barriers (e.g. Machinery, metal reinforced concrete, building materials made of metal, elevator shafts, mechanical areas) WAP located to cover a radius of 20 feet.

E. NDSU will utilized Power-over-Ethernet (802.11af/at) No 110v. required

F. Design should consider off-setting WAP’s between floors (consult with owner for best practice)

G. WAP service outlets/jacks shall be mounted in a visible and accessible location. If outlets are installed above drop ceiling, those locations should be clearly indicated on the ‘Electrical/System’ prints or as-builds
TESTING
A. Voice and Data Horizontal Cables:
   1. Test 100% of voice and data horizontal cables for performance to TIA/EIA-568-B.1 & 2, category 5e and 6a, permanent links.
   2. Replace and retest any cable that fail to pass the performance requirements.
   3. Record the results of each test with cable identification and provide as a section in the as-built drawings.
B. Voice Backbone Cables:
   1. Test 100% of backbone copper cable pairs for: continuity, shorts between conductors, reversed pairs, split pairs, and transposed pairs.
   2. Re-terminate and retest any pair that fails. Replace the backbone cable if the total number of failed pairs in the cable exceeds 2% of the total number of pairs in the cable. Label bad pairs that fail after re-termination and retesting if the total number of failed pairs in the cable does not exceed 2% of the total number of pairs in the cable.
C. Fiber Optic Backbone Cables:
   1. Test 100% of backbone fiber strands for performance to TIA/EIA-568-B.1 & 3.
   2. Test multi-mode backbone links in at least one direction at both operating wavelengths of 850 nm and 1300 nm.
   3. Test single-mode backbone links in at least one direction at both operating wavelengths of 1310 nm and 1500 nm.
D. Replace and retest any cables with fiber strand(s) that fail to pass the performance requirements.
SECTION 1: GENERAL

SUMMARY
A. The Outside Plant Cabling System includes:
   1. Multimode and Singlemode fiber optic backbone system for data & voice.
   2. Category 3 backbone cabling system for voice, telemetry and signal/control.
   3. Buried 4” conduit including innerduct.
   4. A secure telecommunications service entrance room (minimum 8’ x 10’)
B. Support the following network topologies:
   1. Analog Voice Circuits.
   2. Digital Voice Circuits.
   3. T-1 / T-3
   4. Ethernet 10/100BaseTX, 100 BASE FX, 1000Base LX, 1000Base SX, 1000Base TX, 10Gbase-SR/LR standards
   5. DS3
   6. OC3 → OC192
C. Manufacturer’s warrantee for a period of 10 years for proper operation of any communications protocol designed to operate over the specified cabling system.
D. Tested and documented for reference by NDSU Network Engineering & Operations & Telecommunications.

EXISTING CONDITIONS
A. Maintenance holes and conduits as indicated on drawings provided by NDSU upon request

SUBMITTALS
A. References:
   1. Provide 3 references of projects of comparable size and scope that have been completed within the last 2 years.
B. Shop Drawings/Product Data:
   1. Neatly bound in a three ring or comb type binder, with protective covers. Identify the project, the site, system date and vendor name on the cover.
   2. Consisting of, but not be limited to the following items:
      a. Title sheet showing the Contractor’s name, address, phone number and date submitted.
      b. Material list showing quantity, manufacturer and description of each item being furnished.
      c. Elevations of racks and terminal blocks.
      d. Riser diagrams showing distribution equipment and pathways.
      e. Catalog sheets with complete technical data for each item being furnished.
      f. Confirmation that products are registered components for the manufacturer’s warranty.
C. Operation and Maintenance Manual
   1. As-Built Drawings:
NORTH DAKOTA STATE UNIVERSITY
OUTSIDE PLANT CABLELING SYSTEM

(a) Two sets: including bid submittals, revised shop drawing’s and product data showing the final configuration of the system, final layouts of terminal boards and racks, drawings showing site plan with cable routes, and test results.
DESCRIPTION
A. The outside plant cabling system is an exterior cabling system consisting of backbone cabling, terminations, buried duct system, service entrance room and testing for voice and data.

GENERAL
A. Conduit shall be Polyvinyl-Chloride (PVC) Schedule 40 or 80 for underground installations and Galvanized Rigid Steel for riser applications.
B. Multi-cell type innerduct or 3 – 1 ¼ “ innerduct shall be installed in at least one 4” duct for each run
C. The minimum depth of a trench shall be at a minimum of 36” from adjacent grade to allow for cement slurry or concrete cap, fill and top soil. *(See Exhibit ‘E’)*
D. All conduit placed in trenches shall be encased with either concrete or cement slurry to a thickness of no less than 4” above top row of conduits
E. Boring depth shall be at a depth of 36”
F. All installed conduits shall be cleaned with a flexible mandrel and brush.
G. All metallic conduit and sleeves shall be reamed and brushed
H. All unused underground conduits and innerduct shall have minimum of a 2500 lb. mule tape installed
I. The end of the conduit that enters through the building exterior wall shall be sealed with Link-Seal and plugged with expandable duct plugs
J. Warning tape shall be placed above conduit on all conduit runs
K. No single conduit/duct run shall be longer than 600’ with no more than two 90 degree bends between pulling points.
L. NDSU maintains an extensive underground steam tunnel distribution system. This infrastructure can be used for the delivery of telecommunications and network infrastructure providing approval is granted by NDSU.
M. Contractor shall ensure that all NDSU policies, guidelines and construction methods are adhered to in utilizing the NDSU steam tunnel for distribute telecommunications and network infrastructure.
N. It is the contractors responsibility to coordinate the location of all subsurface utilities (gas, electrical, water, sewer, etc.) 48 hours prior to initiating any work
O. To protect pedestrian and vehicular traffic it is the contractor’s responsibility to provision appropriate barricades and alternate routes. All activities for this task shall be coordinated with the NDSU campus police (231-8998)

P. Reference the NEC for separation requirements

SECTION 2: PRODUCTS
MANUFACTURER
A. The products shall be supplied by a single manufacturer:
   1. Panduit Network Connectivity Group or NDSU approved equivalent.
B. Mounting Elements:
   1. Systems Manufacturer list above.
   2. APW — Wrightline
   3. Chatsworth
   4. Hoffman
   5. Homaco
6. Ortronics
7. Link-Seal
8. NDSU approved equivalent.

C. Cable: Partnered with the System Manufacturer:
   1. Belden Wire & Cable Company.
   2. Berk-Tek, Inc.
   3. CommScope, Inc.
   4. General Cable
   5. Mohawk/CDT

D. Primary Protection Devices:
   1. Avaya
   2. Circa
   3. NDSU approved equivalent.

E. Underground Conduits:
   1. Carlon
   2. Hubbell
   3. Arnco
   4. Or equals

TYPICAL UNDERGROUND MANHOLE/HANDHOLE CONFIGURATION
A. For reference only (not construction) Exhibit ‘F’ & ‘G’
MOUNTING ELEMENTS

A. Data Racks:
   1. Freestanding (two post)
   2. Modular-steel units designed for Telecommunications terminal support.
   3. Approximate Module Dimensions: 84 inches high by 22 inches wide unless noted otherwise.
   4. Rails tapped on EIA spacing.
   5. 19” mounting width
   6. Finish: Baked-polyester powder coat (Black).
   7. Vertical Cable Management at the end of each row of racks and between each rack.
   8. Horizontal cable management at the top and bottom of each rack.

B. Cable Management:
   1. Front vertical:
      a. 3” - 6” width
      b. Full height of rack
   2. Front horizontal:
      a. 3½” minimum width
   3. Maintenance hole racking

C. Plywood Backboard:
   1. ¾” Class A-D exterior grade plywood
   2. Painted with two coats of marine gray fire retardant enamel
   3. Apply on three walls unless indicated otherwise

UNDERGROUND CONDUIT SYSTEM

A. Materials:
   1. 4” Schedule 40/80 rigid PVC conduit (UL 651)
   2. 1¼” innerduct
   3. Concrete or slurry (slurry compound approved by Director, Network Engineering)
   4. Entrance seal (Link Seal or equal)
   5. Underground Conduit spacers

B. Execution (Exhibit ‘E’)
   1. Provide three 4” PVC conduits between the proposed building entrance and the nearest Telecommunications maintenance hole or access facility (consult Network Engineering & Operations).
   2. Open trench, encase conduits in concrete or slurry.
   3. Install spacers to ensure 2” – 3” space between conduits (every 8 - 10 ft.).
   4. Populate one of the three 4” conduits with 3 - 1¼” smooth wall innerduct.
5. All conduit and innerduct shall have either a pull rope or mule tape (minimum 2500 lb’s) installed and tied off at each end for future installations.
6. All ducts shall be sealed watertight at all building and vault penetrations.

TWISTED PAIR BACKBONE UNDERGROUND CABLES
A. Conductors:
   1. Twisted pairs
   2. Solid copper, 24 AWG
   3. Polyethylene insulation
   4. Pair counts specified by NDSU Network Engineering & Operations / Telecommunications
B. Color coded pairs and binder groups
C. Type ANMW (Bell System)
D. Flooded compound core
E. Jacket: black, polyethylene

SPLICING APPARATUS
A. Approved 25 pair splicing modules (AT&T or 3M)
   1. All mods shall be filled and capped
   2. All mods shall be labels as to binder color and count
   3. Fold-back method is preferred and splice case sized appropriately
   4. All splice cases (with the exception of FO) shall be filled with re-enterable encapsulate when sealed.

COPPER CONNECTORS AND TERMINAL EQUIPMENT
A. Cross-Connect 110 Panel: Modular array of IDC terminal blocks arranged to terminate building cables and permit interconnection between cables and equipment.
   1. IDC type, using modules designed for punch-down caps.
   2. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks.
   3. Arrange to terminate building cables and permit interconnection between cables and equipment.
   4. Five pair connecting blocks for backbone cabling.
   5. Labeling: Designation strip with black machine printed lettering on white background and clear plastic cover.
   6. Mounting: Backboard unless indicated otherwise
B. Cross-Connect ‘110’ Cable Management:
   1. Mounting: Backboard unless indicated otherwise
   2. Distribution rings or equal (sized appropriately)
PRIMARY PROTECTION
A. 110 connectors
B. Enclosed
C. Plug in protector modules with:
   1. Heat coils; Populate with C4B1S
   2. In-Service test points
D. Mounting: (Wall)

FIBER OPTIC UNDERGROUND CABLES
A. 62.5/125 Multi-Mode cable:
   1. 62.5/125 micrometer diameter loose tube optical fiber.
   2. Fiber counts provided by NDSU Network Engineering & Operations / Telecommunications.
   3. Dual window, 850 nm and 1300 nm.
   4. Minimum bandwidth—500 MHz-km at 1300 nm, 200 MHz-km at 850 nm.
   5. Maximum attenuation —1.5 dB/km at 1300, 3.5 dB/km at 850 nm.
   6. Water blocking compound over the core.
   8. Jacket marking indicating manufacturing code, strands, date and length.

B. Single-mode cable:
   1. 8.7 to 10 micrometer diameter loose tube optical fiber.
   2. Fiber counts provided by NDSU Network Engineering & Operations / Telecommunications.
   3. Dual window, 1310 nm and 1550 nm.
   4. Maximum attenuation —0.5 dB/km at 1310, 0.5 dB/km at 1550 nm.
   5. Water blocking compound over the core.
   7. Jacket marking indicating manufacturing code, strands, date and length.

C. Cable Duct: Smooth wall duct e/w with pull string shall meet fire ratings CMP as it applied for the space installed.
   1. Manufacturer: Arnco, Carlon or equal.
FIBER CONNECTORS AND TERMINAL EQUIPMENT

A. Cable Connectors:
   1. Quick connect
   2. Insertion loss not more than 0.7 dB
   3. Duplex-type ‘SC’ connectors with self-centering, axial alignment mechanisms.

B. Rack Fiber Patch Panel:
   1. Modular panels housing multiple-numbered duplex cable connectors.
   2. Permanent Connection: Connect one end of each connector module to installed cable fiber.
   3. 12 modular panel locations per patch panel.
   4. 6 fiber connectors per modular panel.
   5. Provide adequate modular panels and fiber connectors to terminate the cables indicated.
   6. Rear horizontal Cable Management.
   7. Labeling: Designation strip with black machine printed lettering on white.
   8. Verify with owner as to ‘wall’ or ‘rack’ mounted arrangement.

CABLE MANAGEMENT & DOCUMENTATION

A. The Contractor shall provide cable management files. The files shall be windows compatible (Excel)

B. The files shall identify:
   1. Cable type and tested performance.
   2. Location of termination point.

IDENTIFICATION PRODUCTS

A. Cable Markers: Vinyl wraparound adhesive tape markers, machine printed with black lettering on white background.

B. ½” wide vinyl adhesive tape machine printed with ⅜” high black lettering on white background.

C. Black permanent marker.

CABLE SUPPORT

A. J-Hooks

B. D-Rings

C. Bridle Rings
SECTION 3: EXECUTION

INSTALLATION

A. Install cabling in conduit and cable tray.
B. Terminate cabling at both ends.
C. Provide innerduct for non-armored fiber optic cable installations.
D. Install cable without damaging conductors, shield, or jacket.
E. Do not bend cable in handling or installing to smaller radii than minimums recommended.
F. Pull cables without exceeding cable manufacturer’s recommended pulling tensions.
   1. Pull cables simultaneously if more than one is being installed in the same raceway.
   2. Use pulling compound or lubricant if necessary.
   3. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.
G. Secure and support cable at intervals not exceeding 48 inches.
H. Comply with EIA/TIA-569 rules for separating unshielded copper communication equipment cables from potential EMI sources.
I. Verify cable placement within ducts with owner to preserve duct space.
J. Coordinate the routes with other buried and underground utilities on campus
K. Install a minimum of 2 - 20 amp 120 VAC circuits in service entrance room (verify location with owner).

FACILITIES SEPARATION

A. All plastic underground conduit shall be kept at a minimum of 8 feet from any steam or condensate lines unless approved by the Director of Network Engineering. When crossing is necessary the design shall specify a transition to ENT on either side of the intersection. As added protection, the engineer may specify additional pipe insulation be installed.
B. If the necessary separation cannot be met, the contracted telecommunications engineer is charged with designing a solution that is acceptable to the university and meets all local, state and federal codes. University project manager and design engineer will sign off prior to starting any work.
INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

A. Mount connectors and terminal equipment hardware on backboards, and racks unless otherwise indicated.

B. Provide adequate length of conductors. Train cables to terminal points with no excess. Provide tie wraps or Velcro to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommendations.

IDENTIFICATION

A. Cables:
   1. Label each end of each backbone cable with the building name or maintenance hole at the opposite end of the terminated cable and the total strand count or pair count within the cable.

B. Fiber Patch Panels:
   1. Label fiber patch panel connector designation strip for each connector identifying the telecom room at the opposite end of the cable (IACC → Fiber MDF).

C. Cross Connect ‘110’ Panels:
   1. Label twisted pair backbone cable termination with the pair count on the MDF in IACC. Coordinate this activity with Network Engineering or the NDSU Telecommunications department.

TESTING

A. Voice Backbone Cables:
   1. Test 100% of backbone copper cable pairs for: continuity, shorts between conductors, reversed pairs, split pairs, and transposed pairs.
   2. Re-terminate and retest any pair that fails. Replace the backbone cable if the total number of failed pairs in the cable exceeds 2% of the total number of pairs in the cable. Label bad pairs that fail after re-termination and retesting if the total number of failed pairs in the cable does not exceed 2% of the total number of pairs in the cable.

B. Fiber Optic Backbone Cables:
   1. Test 100% of backbone fiber strands for performance to TIA/EIA-568-B.1. Test multi-mode backbone cables in at least one direction at both operating wavelengths of 850 nm and 1300 nm in accordance with TIA/EIA-526-14A, One Reference Jumper. Test single-mode backbone cables in at least one direction at both operating wavelengths of 1310 nm and 1500 nm in accordance with TIA/EIA-526-7, One Reference Jumper.
      a. Replace and retest any cables with fiber strand(s) that fail to pass the performance requirements
SECTION 1: GENERAL

SUMMARY
A. Support for the distribution of broadband signals from CATV provider video headend (IACC)
B. Include outlets, cable and termination devices for connection to CATV distribution system.
C. Cable service contract provided by NDSU.

CONTRACTOR QUALIFICATIONS
A. Installation personnel trained in the proper installation of coaxial CATV grade broadband cable.

SUBMITTALS
A. Product Data:
   1. Neatly bound in a three-ring or comb type binder, with protective covers. Identify the project system, date and vendor name on the cover.
   2. Consisting of, but not limited to, the following items:
      a. Title sheet showing the contractor’s name, address, telephone number, and date submitted.
      b. Material showing quantity, manufacturer, and description of each item being furnished.
      c. Catalog sheets with complete technical data for each item being furnished.

REFERENCES
A. Comply with:
   1. The rules, regulations, and technical standards in the FCC Rules (including leakage)
   2. The standards and practices of the Cable Access Television and Closed Circuit Television Industries.

DESCRIPTION
A. Cable broadband television distribution system with an operating bandwidth of 5 MHz to 550 MHz as follows:
   1. Coaxial cable backbone distribution from the entrance facility to each Telecommunication room.

SECTION 2: PRODUCTS

MANUFACTURERS
A. System Cable:
   1. CommScope
   2. Belden
B. Manufacturer and model numbers listed to set standard requirements.
EQUIPMENT — CABLE
A. Distribution and Drop Cable:
   1. RG-6/U type cable
   2. Center conductor of copper clad steel with foam dielectric, shield consisting of alternating layers of aluminum braid.
   3. Plenum rated
   4. Products:
      a. Belden—1695A
      b. CommScope — 2227 K or V
      c. Approved Equal

EQUIPMENT
A. Outlet faceplate:
   1. Single gang stainless steel plate or approved other
   2. Integral to Panduit faceplate.
B. Outlet connector:
   1. Leviton ‘F’ connectors

MOUNTING ELEMENTS
A. Cable Support:
   1. J-Hooks
   2. D-Rings
   3. Bridle Rings

SECTION 3: EXECUTION
INSTALLATION
A. Use proper crimping tool for each type of termination. Replace terminations that fail.
B. Include final tightening with a wrench for installation of ‘F’ connectors to devices.
C. Observe factory installation guidelines for pulling tension and bending radius for cables.
D. One continuous piece cable between each system device.
E. Terminate the ends of each distribution branch.
F. Label terminations with adhesive labels. Code labeling to identify the run. Terminate coaxial cable using Type ‘F’ fittings. Size fittings to fit the cable.
LABELING (building distribution)
A. Label each end of each cable utilizing the following label format
   1. Format: Room Number – Faceplate sequence number (Clockwise) – Cable Function & sequence #
   2. Example: RRRR-nnn-X#
   3. Where:
      a) ‘RRRR’ = Room Number
      b) Nnn = Faceplate Number (01-99) Clockwise around room or area
      c) Cable Function & jack number on faceplate (‘C’)

TESTING
A. Test each distribution and drop cable for continuity and shorts between conductors.
PREFACE

The primary focus of this document is to provide the audio/visual (AV) designer a set of basic requirements (a guide), broken down into nine elements each playing a critical role in integrating technology into the classroom. Each element should be discussed in detail with the architect, electrical engineer and HVAC engineer.

Prior to initiating any design and/or engineering, the NDSU Classroom Technology Manager (CTM), shall be consulted with respect to the issues and concerns outlined in this document.

Melissa Stotz, CTM  
231-6158 (office)  
Melissa.Stotz@ndsu.edu e-mail or CT Representative

Classroom technologies and applications currently supported are: high end video projection, integrated sound system (program and voice reinforcement), student response system, A/V switcher, control system, computer, document camera, VCR, video conferencing equipment, and interactive board/panel.

Key design elements are as follows:

1. Cable Infrastructure Distribution Methods
2. Data & Voice Networking
3. Electrical
4. HVAC
5. Lighting
6. Architectural
7. Seating
8. Audio & Video
9. Projection Screen/Podium

Cable Infrastructure Distribution Methods:

The following are acceptable methods of cable distribution for supporting the AV system.

- Cable trays (prefer wire style)
- J – Hooks (owner approved)
- EMT Conduit (consider current and future fill factor)
- Provide pull boxes when 270° of bend is reached.
- Surface/perimeter Raceway
- Access flooring systems
- Under-floor duct systems (prefer for new construction)

Floor boxes & Conduit:
When possible, use floor boxes with under-floor duct distribution to extend cable end-points to equipment (podium). Size the cable channels with a minimum of an additional 50% overhead of projected fill (future proof).
For greater flexibility, NSDU Classroom Technology prefers an overhead (above drop ceiling) electrical and telecommunications distribution system that utilizes 3 - 6”x6”x5’ gutters, one placed center-front, one placed at the mid-center of the room and one placed center-rear. The three gutters are interconnected via 2 –2”, 3 – ¾” and 3 – ½” conduits. The gutter at the front of the room shall be attached to a vertical chase in the wall to provide a path to the under-floor distribution. (See owner for exact details).

Consider using a raised/floating floor throughout the room or just in the instructor’s area if room is sloped. Alternatively, construct an appropriate trenching system which allows flexibility.

Verify with CTM the type and placement of cable between podium and projector.

Ensure proper separation between communications and electrical cables. Provide separate conduits for AV cabling and data & voice structured cabling.

Where wall-mounted AV outlet/connectors are the only feasible method of cable distribution (e.g. cannot use an under-floor method); mount the box at the same height as the other service outlets, devise method to extend cables to podium if necessary, and provide cover plate with appropriate connectors per owner specifications.

Every effort should be made to minimize any EMI generated from adjacent infrastructure (mechanical rooms, electrical room, RF sources etc.).

**Data & Voice Networking:**

Provide the following data circuits in each AV area or room:

- 3 – Cat 6a at the podium
- 2 – Cat 6a on front wall
- 2 – Cat 6a on each side wall
- 1 – Cat 6a at each ceiling mounted projector
- 1 – Cat 6a at non-obstructed location on ceiling for wireless AP (prefer rear-center)
- 2 – Cat 6a in the equipment storage room
- 1 – wall mounted telephone at room ingress/egress

See ‘Telecommunications Construction Practices’ for detailed information on routing, terminations, labeling and testing.

**Electrical:**

Provide 20 Amp - 120 V circuits to the following locations:

- 1 circuit to each ceiling mounted projector (See Audio & Video below); install 4’ of flexible conduit
- 2 circuits inside the podium at the front of the AV room (isolated neutral); double duplex each outlet
- 2 circuits on the front wall positioned 2 ft. from the side wall
- 1 circuit at the rear wall – center
- 1 circuit at powered screen (if installed)
- Check with CTM about providing outlets at student seating (laptops)

All equipment located in the presenter podium shall be intercepted from the electrical outlet with either a power conditioner or UPS rated at a minimum of 1500 VA. (Provided by project)
HVAC:

It is essential that the AV and ancillary systems located in these areas are protected from effects of temperature and humidity.

AV rooms should be kept at an environmental state similar to or identical to a telecommunications equipment room. Keep in mind that a concentrated heat load will be generated at each ceiling mounted projector and by the equipment located within the enclosed (ventilated) podium.

- 68° - 75 ° F
- 40% - 55% humidity

Background noise within the room should be a consideration when designing the HVAC for this area as it can affect speech and presentation quality.

HVAC system components that are of a concern are:
- Fans – motor vibrations
- Diffusers – Whistling and can also cause the swaying of projector screens
- Ducts – can carry noise from other parts of the building
  - Air velocities should be kept less than 300 ft. per second
  - Consider acoustically lining duct work
- Mechanical room equipment (pumps, chillers)

Lighting:

Effective architectural lighting can and does simultaneously influence video presentation quality, visual comfort and participant interaction.

Proper design and engineering for lighting is beyond the scope of this document. However, based on experience gained from previous installations, the following should be considered:

- Plan for at least 2 main room light zones in each room (larger rooms may need more).
- Plan each zone to run parallel to the front wall.
- Plan middle (if any) and rear zones using multi-tube light fixtures.
  - Half or ‘greater than half’ of each fixture tubes are to be tied to the front zone and manually controlled on/off by switches at all entry/exit doors, and podium area.
  - The remaining tubes are to be manually controlled to dim or turn off lights with switches only at podium area.
  - Alternative: All lights of fixtures come fully on with the front fixtures when activated at the door plus allowing independent control at the instructor station of the front fixtures and the back fixtures. These back fixtures would then be entirely dimming at the instructional area.
- Plan for the instructor to adjust all the lighting levels from near the teaching podium.
- Light switches also installed at room entrance(s).
- DO NOT place any ceiling light fixtures within 7’ of any projection screens.

Types of lighting:
- General lighting
  - Provide necessary illumination for general use of this space
- Task lighting
  - Provide lighting for horizontal work surfaces such as; counter tops, desks, tables or podium.
CLASSROOM TECHNOLOGY

- Focal lighting
  Vertical lighting for the presenter (lighting for camera use)
  Dimming, directional and adjustable fixture over the presenter – with no spill or wash on the screens
- Marker/white boards (avoid glare)
- Projection/Videoconferencing lighting
  Must minimize direct light from falling on the screen to achieve maximum contrast

NDSU does not typically use rear projection (Consult with CT)

The CTM should be consulted about inserting lighting controls or sensors into the lighting system.
- Preset control systems
- Central control systems
- Manual dimmers
- Occupant sensors

Types of lighting source and fixtures are at the discretion of the design engineer to ensure quality AV presentations, videoconferencing and class interaction.

Architectural:

Room environment (see HVAC & Lighting above)
When sizing an AV room, the length to width ratio should not be sized greater than 2:1; preference would be given to length (2): width (1).
Interior columns for support beams should be avoided.
Obstruction of student view of writing surfaces, projection screen, and instructor/podium should be avoided.

Powered screen operation (see Projection Screen/Podium). (Provided by project)

Support spaces may be required such as:
- Equipment storage room (secured area)
- Storage closet (for non equipment items)

Architect should consider selecting building materials (floor, ceiling, walls or furniture) to minimize echo and reverberation for better room acoustics to ensure quality voice reinforcement and/or videoconferencing quality.

Room ceiling height should be no less than 9’6” above finished floor. The larger the room the higher the ceiling to accommodate larger screen images. Minimum required ceiling height is determined by calculating the screen height (furthest seating distance/6) then add 3’6” (the minimum distance the screen is from the floor). Minimum screen size to be used in a classroom should be 10.7’W x 6’H.

NDSU prefers lighter wall covers.

High gloss or polished work surfaces (desk, tables etc.) should be avoided.

Window placement must eliminate sun or daylight from shining or glaring on projection screen or writing surface.
Window coverings must be opaque and capable of eliminating outside light from reaching the projector screen and/or writing surfaces. (Provided by project)

Seating:

The seating layout has to be designed to provide optimal viewing and listening. The optimum viewing area is determined by the size of the video display, location and orientation within the room. As a measure to ensure optimal viewing from the rear of the room, use a factor of 6. The acceptable distance that the furthest viewer can be from the display is 6 x the height of the display (6 x H). Conversely, the display or image size should be at least 1/6th the distance from the furthest viewer (H / 6).

The closest viewing is 1 x width of the image (1 x W).

The optimal viewing angle for off-axis viewing is considered to be 45° horizontally to each side of the center axis of the display.

Avoid a vertical viewing angle greater than 35° from the perpendicular to the top of the projection screen.

Note viewing angles and dimensions on plan to allow exact placement in field.

Design should incorporate adequate space for comfortable ingress and egress of the room and aisle space between chair rows (30” – 36”).

Audio & Video:

Unless otherwise noted, all A/V equipment installed in the teaching podium will be selected and installed by the CTM.

Depending on room size and usage, more than one ceiling mounted projector and projection screen may be required. (Consult CTM)

Placement of the supporting infrastructure for each projector (e.g. mounting bracket and ceiling support) will be based on the size of the room, size of the screen(s), and the type of technology being utilized. Coordinate exact location with CTM.

ROUGH PRELIMINARY PLANNING RULE to aid preliminary conduit placement - the projector is centered about 1-1/2 to 2-1/2 x screen width from the screen, except when special lenses are fabricated for a special need.

Construction documents must indicate that the CTM must be consulted prior to installing the projector infrastructure for exact location which is dictated by the projector model.

Projector lens must align with the top of each projection screen. If installation of the projection screen allows this, the following mounting bracket manufactured by Bretford needs to be installed: TPMUNI2, Flush Ceiling Mount. If the installation of the projector screen requires the projector to be lowered, then the Bretford TPMUNI4, Extension Ceiling Mount, needs to be installed (this bracket will lower the projector a minimum of 2’ to a maximum of 3 ½’).
Provide rigid structural support for Ceiling mounted projector. It must be able to support up to 50 lbs unless otherwise specified by CTM.

Sound reinforcement requirements for each classroom must be discussed and approved by CTM. Approved equipment, installation, and programming will be provided by project (unless otherwise specified). Appropriate cabling must be installed to the locations (instructor podium, sound closet, etc) specified by CTM.

Considerations in designing an adequate sound reinforcement system for a classroom:

- SPL of at least 90 dB A-weighted at each seat
- < 1% THD
- Program reinforcement
- Voice reinforcement

Wall plates with appropriate in/out jacks will be specified by CTM according to classroom needs.

Owner will generally purchase and install switchers and microphones (unless otherwise specified).

Provide a ¾” conduit from the front gutter above the ceiling to either side of the front of the room for future technologies. Attach a single-gang electrical box at the other end of the conduit run. Locate electrical box on-center, 2 ft. below ceiling and 2 ft. from side wall. Provide cover plate at each location and coordinate color with the architect.

All equipment other than in-house sound system, speakers and ceiling mounted projector will be installed at or within the podium.

**Projection Screens/Podium:**

NDSU CTM will coordinate and communicate projection screen specifications with the architect and electrical engineer.

Generally: (consult with CTM for specifics)

- The minimum screen size used in a classroom would be 10.7’ W x 6’ H (16:9 formats). Maybe larger depending on classroom size.
- Seamless, matte white finish.
- Side tension rods preferred (to maintain vertical stability of screen).
- Heavy black backing recommended.

Instructor podium will be furnished by the owner. Dimensions are 36” W x 30” D. CTM should be consulted on placement of podium.
DATA CENTER/SERVER ROOM DESIGN/INFRASTRUCTURE CONSIDERATIONS

The scope of this document is limited to spaces that host sensitive network/computer/telephony equipment and the communications equipment used to provide internal and external connectivity. Although the primary extent of this document is to focus on the space providing information technology, it may influence the design of other building services (e.g., electrical, lighting, security and HVAC). The design and final layout of this area must be able to accommodate the flexible routing of electrical power and telecommunications cabling with excess space to support equipment changes with minimal disruption.

The following are key elements for consideration in the design:

- Room sizing and physical location
- HVAC
- Electrical
- Grounding & bonding infrastructure
- Server Room rack layout
- Floor type and loading
- Fire, smoke detection alarm and suppression
- Telecommunications cabling and pathways
- Physical Security
- Architectural

**Room sizing and physical location:**

Programming for these facilities is still underway, so for the purpose of this document it will be assumed (based on current requirements) that the size of this room will be as follows: width between 18 ft. and 22 ft. and the length between 24 ft. and 28 ft. (432 sq. ft. - 616 sq. ft.). This room shall be located at a minimum of 3 ft. above finished grade. Preferable location is the 2\textsuperscript{nd} floor or above.

If this room is to be used as both a Server/Telephony Room and as the primary wire center (MDF) than a minimum 616 sq. ft. shall apply (this is the preferred method). Reference the NDSU Network Services document ‘Telecommunication Systems – Construction Practices’ for wire-center (MDF) design. Due to TIA distance limitations and performance specifications using cat. 6a, and security, this room should be located with a proximity to the building core. This will also help to avoid heat gain from windows and exterior wall surfaces. Location should avoid areas that are adjacent to mechanical rooms that could emit EMI from fan motors, elevator motors etc...

Projected number of equipment (server) cabinets shall be a consideration. The minimum physical dimension of each cabinet is 23” (width) x 36” (depth) x 80” (height).
HVAC Considerations:

Air filtration, Cooling (dehumidification) and Humidification, Heating and Distribution.

The HVAC system shall be self-contained system using ‘Hot Isle/Cold Isle’ or a 12” raised floor as the distribution system. Best method for return air shall be determined by the HVAC engineer.

The equipment located in this room requires the HVAC system to be fully operational 24 hours per day, 365 days a year. The system shall be designed for continuous operation in the event of a power outage with the ability to gracefully transition to and from an emergency generator.

The HVAC system should be tuned to maintain positive air pressure with respect to surrounding areas.

Owner shall be consulted on local/remote alarm and monitoring systems
It is estimated that each equipment rack (when fully populated) will produce anywhere from 4000 to 7000 BTU per hour. The system should be designed to allow for a 20% overhead due to human presence and other support apparatus (UPS, test equipment, etc.).

<table>
<thead>
<tr>
<th>Environmental Factor</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>64º F to 75º F</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>30% to 55%</td>
</tr>
<tr>
<td>Heat dissipation</td>
<td>4000 to 7000 BTU per hour per cabinet</td>
</tr>
</tbody>
</table>

Electrical Considerations:

It is assumed that this facility will have a standby generator on premise that is sized appropriately to provide continuous power for all services including HVAC, IT servers/storage devices, all communications and telephony gear located in this room.

Due to the mission critical nature of this room, it should have its own feed from the transfer switch to the Server Room UPS and terminate in its own electrical panel in the Server Room.
Projected loads for equipment requiring protection have yet to be determined, however based on previous measurements, a UPS with a rating of 50 - 80 kva should be sufficient.
Owner should be consulted as to preferred method of providing UPS services either via battery or fly wheel.

This service will be distributed under a raised flooring system to each rack location and to a minimum of 2 locations on each exterior wall. A separate feed from the building emergency generator panel should be provided to maintain adequate emergency lighting and HVAC. All other service outlets and lighting in this room can be designed around the other building distribution methods.

Sharing or daisy-chaining any branch circuit conductors or receptacles should be avoided. Each designated location should have its own dedicated branch circuit.
NORTH DAKOTA STATE UNIVERSITY
DATA CENTER – SERVER ROOM DESIGN

**UPS Service & location**
- Equipment cabinet’s: 3 – 20 amp circuits (under each cabinet)
- Wall service: 3 – 20 amp circuits on each wall

**Generator**
- HVAC, pumps etc.: (3 phase – 100 amp?) To be determined by electrical engineer

**Requirement**

**Grounding and bonding infrastructure:**

All telecommunications equipment and raceways shall be properly grounded in accordance with ANSI/TIA/EIA 607, NFPA 70 (National Electrical Code) and all other state and local applicable codes and regulations.

A copper bus bar shall be installed under the raised floor connected to the building entrance service ground. Acceptable Manufactures: ERICO 1/4” x 4”x 20” insulated copper ground bar or equivalent.

All equipment cabinets, cable trays, power conditioning equipment, cable sheaths and entrance conduits shall be bonded to the grounding bus bar using a minimum of a #6 awg insulated stranded copper wire.

A complete signal grounding grid for maintaining equal potential over a broad band of frequencies shall be installed on the raised floor system.

**Server Room Rack layout – Guide only**

Once a suitable location has been selected for the electrical and environmental equipment within this space, the equipment racks/cabinets shall be arranged in two rows of seven with the front of each cabinet facing inward. The two rows of cabinets will be provisioned as close to the center of the room as possible while maintaining a minimum of 6 feet of separation between the two rows and a minimum of 30 inches working clearance at the rear of the cabinets to facilitate equipment maintenance.

In the event that this space will serve a dual purpose (Server Room and MDF) the two rows of cabinets may have to be shifted to accommodate MDF services. Consult with Network Engineering for exact provisioning.
Floor type and Loading:

A raised flooring system shall be provisioned for this space to provide a HVAC plenum and flexible distribution of both the electrical and permanent telecommunications infrastructure.

The flooring system shall have a minimum height (cavity) of 12 inches utilizing a pedestal type system with 2 ft. x 2 ft. floor panels.

Floor panels can be wood core with a 1/16th inch high pressure laminate finish (color by architect).

30% of required floor panels shall be perforated with dampers to allow for air distribution.

Minimum floor loading shall be 300 lb. /ft².

Fire, Smoke detection, Alarm and Suppression:

The fire and smoke alarm/monitoring system shall be connected to the university specified system for this building. Coordinate the layout of fire protection systems with the equipment and overhead cable tray to avoid obstructing sprinklers, access to the alarm or other protective measures.

Preferred fire suppression method is utilizing a dry pipe sprinkler system or chemical to prevent water damage. Preferred method of smoke detection is High Sensitivity Air Sampling.

Telecommunications Cabling and Pathways:

The Server Room will need access to the primary building backbone and the WAN infrastructure. Therefore if the Server Room is not co-located with the MDF, install 24 strands of multimode and 24 strands of singlemode fiber optic cable from the building MDF to an owner designated cabinet or wall location in the Server Room.

Overhead cable tray (12” x 3” wire-tray) shall be installed starting at the cable entrance in the Server Room and routed above the cabinets in such a fashion that allows bulk cable routing of ‘any cabinet to any cabinet’. Tray shall be placed at a minimum of 12” below drop ceiling.

In the event the MDF is co-located within the Server Room, extend the cable tray to that wall.
Physical Security:

The Server Room will have restricted access and therefore shall have card-key access at all ingress points.

Security cameras will be placed at strategic locations (entry & exit) within the Server Room to monitor physical traffic. (to be determined at design)

All walls in the Server Room need to be of a permanent construction and need to extend to the structure ceiling (upper deck) to prevent access over a wall.

Architecture:

At least one door to the Server Room shall be 42 inches in width and 7 ft. high to allow for transfer of large equipment in and out of the Server Room. Location of door should be considered to provide unobstructed access in and out of the Server Room (i.e. allowing for tight turns from a corridor or narrow hallway) If code permits, door should open outward to provide additional usable space and be of the same fire rating as the walls of the Server Room.

Ceiling shall be of the drop in style with a minimum height of 9 ft. from the finished floor. The tile finish selected should minimize dust and be light colored to enhance to room lighting.

The Server Room should not be located adjacent or below any area that may be a potential water hazard (i.e. restrooms, custodial sinks etc.).

Electrical lighting should be coordinated with the equipment layout (overhead cable trays) to minimized obstructed lighting and potential EMI.

Note: This is intended to be a guide only. Specific design details shall be a collaborated effort by all stakeholders.
Exhibit ‘B’

Typical Rack Configuration

¾” EMT to dedicated 100 amp electrical panel in wire closet

Note:
Patch panels for Cat 6a terminations Voice and Data

4 11/16-inch square by 2 1/8 inch deep junction box, duplex

Two 20 amp dedicated branch circuits

NEMA 5-20 R spade receptacles 15 inches AFF

One in each rack facing the rear

Switch Gear

Bus Bar

Min. #6 Gnd.

UPS #1
2200va

UPS #2
Telecommunications Symbols
Configurations

The following is not an exhaustive depiction. Only to reflect some of the possible/more typical configurations.

Single voice or data shall have a single jack location on the faceplace.

NOTE: Each jack within each faceplate shall be appropriately labeled as to the service. (See ‘Faceplate Labeling)
**Faceplate Labeling Scheme:**

RRRR-nnn-X#

Where RRRR = Room number (Note: Use NDSU assigned room numbers)
nnn = Faceplate sequence number within room *(Clockwise)*
X# = ‘D’-Data, ‘V’-Voice, ‘W’-Wi-Fi, ‘C’-CATV(coax)
# Jack sequence number within faceplate
Telecommunications
Duct Bank Cross Section

Notes:
Spacer's shall be placed every 10' to ensure 2" - 3" spacing between conduit's for the length of run.

NDSU Landscape & Grounds should be consulted as to grass type and density for restoration.
Typical Manhole Configuration

Exhibit ‘F’

- 30” Type ‘A’ Cast Iron Frame & lid H-20 loading
- Not to scale
- Min. 4: black dirt
- Min. 3 course Of Brick or rings In Chimney
- 3 ft. minimum
- MH to MH 6 - 4” PVC
- MH to Bld. 3 - 4” PVC
- Concrete/Slurry Encased
- T-slot Channel Racking
- 3 ft. minimum
- 12’
- 6’ - 6”
- Sump
- Ground Rod
- Pulling eye
- 3 - Duct Config.
- 6 - duct Config.

North Dakota State University (NEO)
**Notes:**

1. Top of lid shall be 4" above finished surrounding grade and tapered 18" out from rim
2. Refer to Facilities Management specifications for locations in sidewalk and/or parking lots
3. Ensure adequate soil compaction
4. RUS, DOT and ASTM approved
BACKBOARD

A plywood sheet mounted to the wall where telecommunications distribution equipment is installed. The backboard must be three-quarter (¾)-inch thick A-C grade fire retardant plywood, mounted with the “A” side exposed. The backboard must be coated with two coats of light colored, non-conductive fire retardant paint (battleship gray).

BACKBONE CABLEING

Backbone cable is defined as a major service cable that is used to interconnect various buildings on a campus, connect equipment rooms to telecommunications rooms within a building, or connect one telecommunications room to another within the same building. Backbone cables are typically large capacity (high pair-count) copper cables, or fiber optic cables.

BEND RADIUS

The maximum radius that a cable can be bent to avoid physical or electrical damage or cause adverse transmission performance.

BONDING

The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely to ground any current likely to be imposed.

BUS

An electrical connection which allows two or more wires to be bonded together.

BUSBAR

A copper bar, drilled and tapped, to allow the bonding together of wires or cables.

CABLE PAIR

Each telecommunications circuit is made up of two copper wires, or a pair of wires. Traditional analog telephone service uses one-pair of wires. Some modern digital telephone systems and most computer networks operate over two or four pairs of wires. The ANSI/TIA/EIA-568-A standard requires a four-pair cable to each work-area modular jack.

CABLE PLANT

A term which refers to the physical connection media such as optical fiber cable or copper cable (See Telecommunications Infrastructure).

CABLE PULL TENSION

Stated by the manufacturer as the maximum limit at which the cable’s performance characteristics are altered, experiencing electrical or mechanical degradation. Also known as maximum recommended installation load (MRIL).

CABLE TENSILE STRENGTH

The limit point where the cable is pulled apart.

CATV (COMMUNITY ANTENNA TELEVISION)

CATV is commonly referred to as “cable TV.” In the traditional sense, CATV is a master antenna that receives television signals, and distributes the signal over cables to a limited geographical area, such as a campus, or neighborhood (community). NDSU facilities receives bulk cable TV signal from a local service provider for a subscription fee and is redistributed from the head-end (see head-end).

CCTV (CLOSED CIRCUIT TELEVISION)
CCTV is a system where one or more cameras send a television signals to television monitors at another location in the same building or campus (typically surveillance)

NORTH DAKOTA STATE UNIVERSITY
GLOSSARY

CROSS-CONNECT (XC)
A cross-connect, or cross-connection, is where individual cable pairs or fiber optic strands from two different cables are connected together with jumper wires or optical stands. An XC is intended to be easily reconfigured, as opposed to a cable splice which is permanent.

DEMARC
The point of demarcation between the service provider and the customer. The services are then cross-connected to the customer’s cable for distribution throughout the facility. See Telecommunications Service Entrance Facility.

DISTRIBUTION FRAME
A structure with terminations for connecting the cabling of a facility in such a manner that interconnections or cross-connections may be readily made
  a) Main – when the structure is located at the entrance facility or main cross connect and serves the building or campus.
  b) Intermediate – when the structure is located between the main cross-connect and the telecommunications room.

ELECTROMAGNETIC INTERFERENCE (EMI)
Electro Magnetic Interference is a signal distortion directly related to a foreign signal being imposed through coupling onto a transmission path to which the foreign signal is not physically connected.

ENTRANCE ROOM/FACILITY/SPACE
A space, wall or location in which public and private service cables, to include antennae, enter a building and continue to the equipment or telecommunications room or space
Note – An entrance room or space may also serve as an equipment or telecommunications room.
Equipment room (telecommunications): A centralized space for telecommunications equipment that serves the occupants of the building.

FACILITY CONTROL AND MONITORING
It is becoming increasingly common for heating, ventilation, air conditioning, power distribution, and water distribution/monitoring systems to be computer controlled. These computer-controlled systems can be networked on the same LAN, or the same telecommunications infrastructure, as the traditional data services.

FIRE AND LIFE SAFETY
As with Facility Control and Monitoring systems, Fire and Life Safety systems such as smoke detectors, sprinkler systems, and fire alarms are increasingly becoming computer controlled and networked. These systems can also communicate over the common telecommunications infrastructure.

GROUND
A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth

GROUNDING, BONDING, AND ELECTRICAL PROTECTION
Proper grounding and bonding serves three very important purposes. First, from a life safety aspect, the ground connection insures that voltages from a malfunctioning system are routed directly to ground to prevent an electrocution hazard to people who may come in physical contact with the system. Secondly, from a telecommunications standpoint, grounding and bonding of telecommunications equipment and systems is an important measure for controlling electromagnetic interference (EMI).
Ungrounded systems can pick up energy that is radiated from another electrical source, such as a large electric motor, an arc welder, or a large copy machine. If this energy is absorbed into the telecommunications system, it can result in annoying interference on the signal, or at worst, corruption and loss of critical data. Thirdly, the telecommunications ground may be used as a reference voltage for electronics equipment. The telecommunications ground potential must be consistent to insure reliable system performance.

NORTH DAKOTA STATE UNIVERSITY GLOSSARY

**GROUNDING ELECTRODE**

The metallic component that is placed in the earth to form the electrical connection with the earth. A grounding electrode is usually a metal rod at least eight (8)-feet long driven into the earth. Refer to NFPA 70, Article 250, Part H for acceptable electrical service grounding electrodes.

**HANDHOLE**

A small cast concrete or fiberglass box placed in an outside plant conduit run as an access point to facilitate pulling cable into the conduit. A structure similar to a small maintenance hole in which it is expected that a person cannot enter to perform work.

**HEAD END**

In a CATV system, the head end is a term that refers to the electronics equipment that receives the television signals from the local provider, and distributes them over copper and/or fiber optic cables.

**HORIZONTAL DISTRIBUTION CABLING**

Horizontal distribution cable is defined as the cable that routes from the telecommunications room to the work area. Generally, these cables are routed horizontally on the same floor of a building, as opposed to a backbone or “riser” cable that may route vertically in a building. Occasionally, a telecommunications room will also serve the floor above and/or below. In this case, the cables routing from the telecommunications room to a work-area on the floor above or below are still considered to be horizontal distribution cabling.

**INFRASTRUCTURE**

The ISP and OSP pathways, spaces, cable plant, and associated electronic devices comprising the low voltage signaling systems including but not limited to voice, data, building controls, security etc. A collection of those telecommunications components excluding equipment, that together provides the basic support for the distribution of all information within a building or campus.

**INNERDUCT**

Typically, a nonmetallic pathway within a pathway. Also known as sub duct.

**INSIDE PLANT (ISP)**

That part of the telecommunications infrastructure that is contained within a building.

**INTERMEDIATE CROSS-CONNECT (IC)**

A point where a backbone cable originating from the Main Cross-connect (MC) is cross-connected to another backbone cable routing to the final destination. The IC is usually located in a Telecommunications Room.

**INTERMEDIATE DISTRIBUTION FRAME (IDF)**

A term referring to the Intermediate Cross-connect (IC).

**JUMPER WIRE**

A short length of wire used to route a circuit by linking two cross-connect points (data or voice)

**LOCAL AREA NETWORK- (LAN)**

The LAN is the network that interconnects all data services for a building or campus. There may be one or more LANs in any given
building or campus depending on the network architecture.

**NORTH DAKOTA STATE UNIVERSITY**

**GLOSSARY**

**MAINTENANCE HOLE (MH)**

A concrete box/structure placed in an outside plant conduit run as an access point to facilitate pulling cable into the conduit. Maintenance holes are large enough for a service technician to enter and work on the cabling. OSHA regulates the safety aspects of working in maintenance holes. NDSU has policies governing work in maintenance holes. “Manhole” is becoming an obsolete term. See Handhole.

**MAIN CROSS-CONNECT (MC)**

The Main Cross-connect is the point where all telecommunications services are cross-connected to the building or campus backbone cables for distribution to other buildings, and ultimately, to the users work-area. The MC is usually located in the Main Telecommunications Equipment Room (ER). IACC Room 12

**MAIN DISTRIBUTION FRAME (MDF)**

A term referring to the Main Cross-connect (MC).

**MAIN TELECOMMUNICATIONS EQUIPMENT ROOM (ER)**

The Main Telecommunications Equipment Room is the central location on a campus or in a building where major telecommunications equipment is located. The ER typically contains the telephone switching equipment (PBX). At NDSU’s campus, the ER is in IACC Room 12

**MAXIMUM RECOMMENDED INSTALLATION LOAD (MRIL)**

Stated by the manufacturer as the cable strength or maximum cable pull tension (aka tensile load or strength). It is based on the conductor strength within the cable sheath.

**NEMA**

National Electrical Manufacturers Association.

**OUTSIDE PLANT (OSP)**

The part of the telecommunications infrastructure that is outside. OSP usually refers to an underground conduit system, direct buried cable, or aerial cable.

**PATCH CORD**

A short length of telecommunications cable with modular plugs on each end used to connect between a modular jack and a work-area device such as a telephone or computer, or to connect between a modular IDC block and an electronics device in the Telecommunications Room or Equipment Room.

**PATCH PANEL**

A panel mounted in an equipment rack in the Telecommunications Room or Equipment Room containing modular jacks. The telecommunications room or ER end of the horizontal distribution data cable is terminated at the patch panel. Patch cords are used to connect work-area devices to network switches located in the telecommunications room or ER.

**PATHWAY (OR CABLE PATHWAY)**

A raceway, conduit, sleeve, or reserved location for the placing and routing of telecommunications cable.

**PBX**

Private Branch eXchange. A large, full feature telephone switching system that usually serves a large building or campus.
PLENUM
A compartment or chamber to which one or more air ducts are connected and that forms Also type of heat resistance cable jacket

NORTH DAKOTA STATE UNIVERSITY
GLOSSARY

POP
Point-of-Presence. The physical location where a service provider delivers telecommunications service. See MPOP, Demarc, and Telecommunications Service Entrance Facility.

PORT
Typically a point of connection located on a piece of telecommunications for data equipment.

PRIMARY PROTECTOR (OR PROTECTOR BLOCK, OR PROTECTOR PANEL)
A device interconnected to the telecommunications service providers’ access line, or to each end of an outside plant campus distribution copper cable, to protect the connected equipment and personnel from over-voltage and/or over-current conditions. Hazardous voltages and currents are shunted to ground through the protector block.

PULL-BOX
A box, located in an inside plant cable pathway, intended to serve as an access point to facilitate pulling cable through the conduit.

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER (RCDD)
The internationally recognized professional designation of Registered Telecommunications Distribution Designer (RCDD) is presented by BICSI a Telecommunications Association to its members that have proven their ability through on the job experience and having passed a thorough exam.

RFI
Radio Frequency Interference is a signal distortion directly related to a foreign radio signal being imposed through coupling onto a transmission path that the foreign radio signal is not physically connected to.

RACEWAY
A metal or plastic channel used for loosely holding telecommunications or electrical cables. See Pathway.

RISER CABLE
A term referring to backbone cable typically vertical

ROUTER
A device that connects multiple networks, and routes data traffic from one network to another

SECURITY SYSTEMS
Security systems such as intrusion alarms, remote door locks, and magnetic strip identification cards may be computer controlled and networked. Many of these systems have proprietary components, but many can be networked on the common telecommunications infrastructure and shall be taken into consideration in any design.

SPlice
A permanent joining of conductors (copper or glass) from separate cables

SPlice Box
A box, located in a pathway, intended to house a cable splice.
**Splice Closure**

A device used to enclose and protect a cable splice (typically referred to in UG applications)

**Star Topology (or Star Distribution)**

A topology where all phones and computers in a given area are wired directly to a central service location in the telecommunications room (Star topology is the standard wiring topology at NDSU)

NORTH DAKOTA STATE UNIVERSITY

GLOSSARY

**Sweep**

A conduit bend that meets ANSI/TIA/EIA-569-A bend-radius requirements forming a gentle arc rather than a sharp bend.

**Switch**

An electronic device that interconnects networked data devices (computers or other network enabled devices) through port-to-port switching.

**Telecommunications Bonding Backbone (TBB)**

The grounding conductor (cable) that interconnects the Telecommunications Main Grounding Busbar (TMGB), Telecommunications Grounding Busbar (TGB), various telecommunications equipment, equipment racks, and cable shields to the building’s electrical service grounding electrode.

**Telecommunications Room (TR)**

The Telecommunications Room is a location in each building, or each floor of a building, where backbone cables transition to horizontal distribution cables. The TR may also contain certain items of network electronics equipment such as switches or routers. A large building, with large floors, may have multiple TRs on a floor. Depending on the size of the building, a TR may be a separate room, or it may be simply be a cabinet containing telecommunications equipment.

**Telecommunications Grounding Busbar (TGB)**

In buildings with multiple Telecommunications Rooms, each telecommunications room is equipped with a TGB. All of the TGBs in the building are bonded together, and to the Telecommunications Main Grounding Busbar (TMGB), with the Telecommunications Bonding Backbone (TBB).

**Telecommunications Infrastructure**

The telecommunications infrastructure is defined as the pathways, spaces and cabling necessary to support the signaling between telecommunications devices. The infrastructure must be designed to support the known present, and reasonably certain future, signaling requirements of the telecommunications systems. With the rapid advances in telecommunications technology, the telecommunications cabling will likely require replacement or upgrade several times over the life of a building, with an average life expectancy of 8 to 15 years. Therefore, the design of the pathways and spaces has a major impact on the cost of future cabling upgrades.

**Telecommunications Main Grounding Busbar (TMGB)**

A Busbar placed in a convenient and accessible location in the Entrance Facility (EF), Equipment Room (ER), and all Telecommunications Rooms. All telecommunications equipment, equipment racks, protector blocks, metallic cable shields, and exposed noncurrent-carrying metal parts of information technology equipment are bonded to the TMGB, which is then bonded by means of the Telecommunications Bonding Backbone (TBB) to the main electrical service grounding electrode.

**Telecommunications Service Entrance Facility (EF)**

The Telecommunications Service Entrance Facility is the point where the telecommunications service enters the building. The EF may contain electronics equipment and line protection equipment required by the service provider. The EF may be combined with the Main Telecommunications Equipment Room, or the EF may be an outdoor pedestal or cabinet near the street. Other terms that are used in conjunction with the EF include:

1. Demarc – The point of demarcation between the service provider and the customer. This is actually a cable termination block where the service provider’s cable terminates, and is cross-connected to the customer’s cable. It is usually located in the EF.
2. POP – Point-of-Presence. The physical location of the demarc.