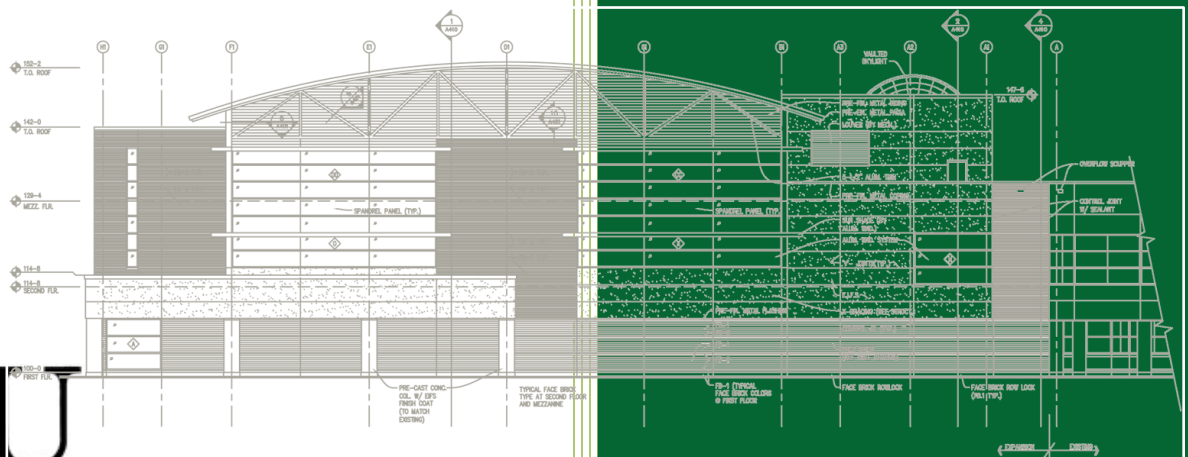


# DESIGN GUIDELINES

NDSU



Facilities Management

2/14/2025

# Design Guidelines

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Exhibit O. Contractor Certification of Non-Asbestos and Non-Lead Materials .....	O-1
Exhibit P. NDSU Telecommunications Systems Construction Practices, Standards, and Procedures.....	P-1

## Design Guidelines

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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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## Design Guidelines

### Change Log

April 29, 2016	Change Log added 03 15 00-2 – Truncated dome information added 10 11 00-3-A – Markerboard size and mounting height added 21 05 00 – Fire suppression information added 23 20 00-2, -3 – Rigid and flexible HVAC piping information added
May 3, 2016	01 00 00-3 – Sample office layouts added
May 6, 2016	26 32 00-4 – Forms for generator installation added
May 11, 2016	26 50 00-4-B – Walkway lighting redefined
May 23, 2016	09 05 00-1-A and Exhibit C – 5% spare paint removed 09 90 00-4 – Eggshell finish for hollow metal door and frames
June 24, 2016	Exhibit H - The <i>Owner/Contractor Contract Review and Checklist</i> updated
July 14, 2016	00 10 00-3 – Consultant pre-bid requirements 01 00 00-4 – Lactation Room example added 03 35 00-1-B – Broom finish for sidewalks 05 50 00-1 – Stainless steel used for railings 09 60 00-3 – Classroom flooring changed from VCT to carpet tile 22 40 00-2-B – Tempered water for emergency shower/eye wash station
October 26, 2016	03 35 11 – Concrete Floor Finishes added
November 17, 2016	Exhibit H – Changes to Contract Review and Checklist
November 22, 2016	23 07 16-1 – Insulation type and thickness changed
November 29, 2016	26 50 00-4-C – Exterior Building Lighting section added
March 16, 2017	07 10 00 – Section removed 08 50 00 – Window information added Division 10 updated 12 93 13 – Bicycle Rack information added Exhibit C amended
April 7, 2017	06 41 00 – Cabinet lock information changed
April 20, 2017	Exhibit B - Bidder Questionnaire changed
June 1, 2017	Exhibit H-12 - Builder's Risk information added
August 22, 2017	Exhibit P – Numerous changes
September 19, 2017	21 10 00 – Fire Protection System Impairment Procedure added 22 40 00-G-1, -2 – Aerator information added Division 26 – Numerous changes
October 23, 2017	05 40 00 – Studs changed from “20 gauge” to “20 gauge EQ”
November 2, 2017	08 70 00-17-L-1,2,3 – Hinge information updated
November 8, 2017	Exhibit O – “no lead” water systems changed to “lead free”
December 20, 2017	08 11 16-2-A – Manufacturer added 21 10 00 – Fire Impairment Procedure amended 22 10 00-3 – Foam Core PVC not allowed 22 30 00 – Manufacturer list updated, sewage ejector changed from pedestal to submersible
January 2, 2018	22 40 00-1-H – Water cooler changed from recessed to wall hung
January 5, 2018	00 21 00-2 - Closeout Documents Submittal information added
February 5, 2018	08 70 00-12-A – Besam model number updated
May 1, 2018	01 56 00-1-D – Construction fence signage added 22 40 00-1-G – Fiberglass shower strainer information added
May 21, 2018	01 20 00 – Change Order information amended 22 40 00-1-E-1 – Shower valve information added 23 22 02-5-B – Wye strainer for PRV added 28 30 00 – Numerous changes

## Design Guidelines

September 26, 2018	23 05 00-1-A – Heating valve connection information added 26 05 00-6, -9 – Shunt trip breaker and Unfused disconnect information added
November 29, 2018	22 05 53-2-A-1, -2 – Pipe labeling clarified 22 10 00 -3-C –
March 29, 2019	Exhibit H-11, 12 – Updates to Contract Review and Checklist
April 8, 2019	23 05 00-7-B – Mechanical access platform/ladder information added
April 23, 2019	10 28 00 – Toilet partitions changed to floor mounted 23 22 02 – Steam piping information added
April 30, 2019	01 00 00-2-G-3 – Custodial Room shelving information added
May 30, 2019	08 70 00-17-C – All roof accesses shall be monitored
August 13, 2019	03 35 00 – Concrete cracking information added
October 3, 2019	08 70 00-11 – LM and Vandlguard door option removed 01 00 00-3-D – Office Layout Examples changed
October 30, 2019	01 14 00-6 – UAS/Drone procedures added 23 09 00-4-A – Static IP address information added Exhibit A – Advertisement for Bids amended
December 18, 2019	01 60 00-1 – No sole source specifications amended
March 20, 2020	01 78 36-6, 7 – Warranty repair information updated 03 10 00-3 – Sidewalk and ramp slope information updated 08 05 00-1C – Bathroom door shall open out 08 70 00-17 – Door closures updated 10 28 00-2A – Paper towel and trash can information added 22 40 00-2 – Safety shower and eyewash station information updated 26 32 00-4 – Generator coolant sight glass
June 8, 2020	26 20 00-3-C – Shark 200 changed to Shark 250
June 23, 2020	12 30 00-5 – Teaching stations shall meet ADA
September 18, 2020	04 05 00-2, 3 – Masonry/tuckpointing information added
October 23, 2020	10 28 00-1-E, F – Toilet partition information added
November 3, 2020	01 78 44 – Stock Materials information updated
December 30, 2020	12 50 00-3 – Desktop/Keyboard area information added
January 5, 2021	00 21 00-3 – Method of Award information added
April 23, 2021	Exhibit H – Changes to Contract Review and Checklist
February 4, 2022	01 00 00-5 – Classroom design guidelines added
February 15, 2022	10 28 00-1-F – Partitions changed to be no gap 10 28 00-3 – Bathroom shelf added
June 28, 2022	03 35 00-4 – Concrete blowout repair added
July 20, 2022	23 05 00-28 – Warranty hazardous cleaning information added
September 8, 2022	01 78 44-2-F, G, H – Terrazzo, epoxy and polished concrete flooring extra stock added
October 10, 2022	Exhibit C – Closeout checklist updated
January 27, 2023	08 05 00-1-A-5 – Exit door hardware info added
June 16, 2023	10 28 00-2-B – Sanitary napkin dispenser removed
June 29, 2023	22 14 00-4, 33 46-00-6 – Storm Drain inlet information added
July 20, 2023	03 30 00-3 – Concrete strength updated
September 12, 2023	Exhibit P – Entire section updated
February 16, 2024	09 90 00 – Paint sheen and application temperature updated 08 70 00-9, 10, 11, 19 – Changes to flush bolts, mullions, exit devices and overhead stops made
March 6, 2024	23 60 00 – Quantech added to approved chillers
April 17, 2024	01 00 00-J – Provide filter pull area 23 20 00-6 – Side-stream filter to have ¾” or 1” view indicator 23 05 00-12-A – Glycol flush and fill

## Design Guidelines

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	23 30 00-7 – AHU part availability
	23 05 00-5 – BAS fire/smoke damper
	23 09 00-11 – Fume hood controls
	23 20 00-9 – Laser align pumps
	21 05 00-3 – Recessed sprinkler heads
	22 30 00-5 – Master hot water mix valve
	22 10 00-12 – Water booster skid
	22 05 00-9 – Valves for water meter
	22 30 00-3 – No lab water
	06 41 00-4-5-b – Soil traps
	12 31 00-Part 2-3-C-11-a – Soil traps
	22 30 00-4 – Soil traps
April 30, 2024	Division 26 – Numerous changes
	28 10 00-1 – CBORD replaced with Avigilon
	28 30 00-1, 3 – Protection Systems replaced with Honeywell Samewell
	28 30 00-8 – Label all fire alarm devices
May 3, 2024	08 10 00-4-A,B – Glass doors and side light changes
	08 70 00-9 – Door Position Switches
	08 70 00-17-B – Parallel Arm Closers
	12 36 00-3-A-1 – Marine edge for epoxy sink area
	22 40 00 2-B-2 – Eyewash drain into sanitary line
May 14, 2024	27 10 00 – Numerous changes
	27 10 05 – Numerous changes
May 16, 2024	32 80 00 – Pipe sleeve, controller, sprinkler heads, valves and repair work changes
December 23, 2024	32 80 00-1-C-1 – Irrigation controller updated
February 14, 2025	Varies – General Liability increased to \$1,875,000

**Definitions**

<b>Closed Interiors (Cabinetry)</b>	Any closed storage unit behind solid door or drawer fronts, sliding solid doors.
<b>Concealed Surfaces (Cabinetry)</b>	Any surface not visible after installation.
<b>Exposed Tops (Cabinetry)</b>	Any top of cabinet which is visible from an upper building level or floor such as a mezzanine.
<b>Open Interior (Cabinetry)</b>	Any open storage unit without solid door or drawer fronts and units with full glass insert doors and/or acrylic doors.
<b>Other Exposed Surfaces (Cabinetry)</b>	Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
<b>Owner</b>	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)).
<b>Semi-Exposed Surfaces (Cabinetry)</b>	Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.

## Design Guidelines

### 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](#).
- 3) Consultants – Send Ad and Plan Set via email to contractors with explanation/details of project. Provide Owner with a list of which contractors were contacted and if they intend to bid the project or not one week prior to the bid.

#### 00 21 00 Instructions to Bidders

- 1) All requested alternates shall be bid. If no change in base bid is required enter the words, “No Change”.
- 2) On the Schedule of Values the Contractor is to insert a line item called Closeout Documents Submittal equal to 5% of the contract value to ensure timely submittal of closeout documents.
- 3) The contract will be awarded on the basis of base bid or combination of base bid and such alternates that produce the most complete project as desired by the Owner within the allowable budget.

#### 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.

## Design Guidelines

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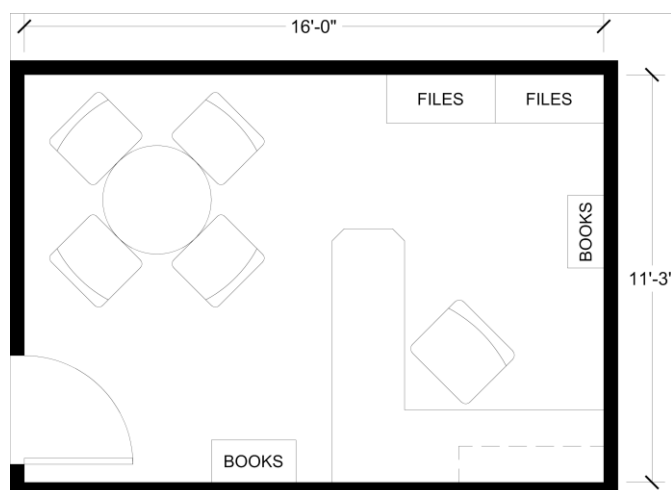
- 9) Consultants shall confer with Owner about the Americans with Disabilities Act. North Dakota Century Code § 48-02-19 requires any person preparing plans or specifications for a public building provide a statement, to be filed with the North Dakota Office of Intergovernmental Assistance, that, in 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 for Finance and Administration shall be signatory for all Contract cost change documents and Agreements. FM representative may sign for Proposal Requests or similar preliminary documents.

## Design Guidelines

### Division 01 General Requirements

#### 01 00 00 General Project/Design Requirements

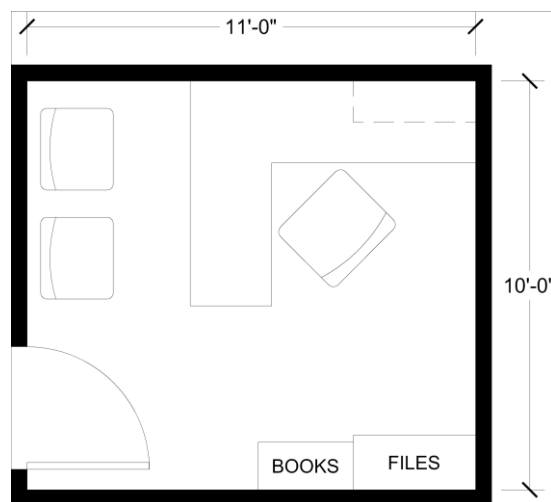
- 1) Stairwells and Stair Treads
  - A) Service and emergency exit stairwells shall be of reinforced concrete with an abrasive strip.
  - B) Emergency or other exterior stairways will not be allowed in new construction projects or renovation projects. All stairways shall be contained internally within 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 candles 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, starting 30" above floor. Verify shelving lengths with Owner.
    - 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.
  - J) Provide enough room to allow for filter replacement of AHU, CUH, etc.
- 3) Office layout examples
  - A) Below are some examples of diagrammatic office layouts shown to help visualize efficient space configuration. The office sizes shown align with the University Space Allocation Guidelines and indicate NDSU expectations.
  - B) While private offices for staff (administrative and research) and graduate students are generally preferred over modular workstations, open office systems are being increasingly utilized both in the corporate sector and on campus. Implementing a modular planning approach can provide countless layout options while preserving the flexibility of a space for changes in future programmatic requirements.
  - C) It is understood that existing buildings (especially older buildings) do not always offer uniform sized spaces and may prevent precise conformity to the Space Allocation Guidelines. Nonetheless, these layouts present a sampling of commonly used arrangements for reference in planning the use of your spaces and can be adapted to various sized rooms.



- D) Associate Dean, Director, Chair office – 180 square feet.

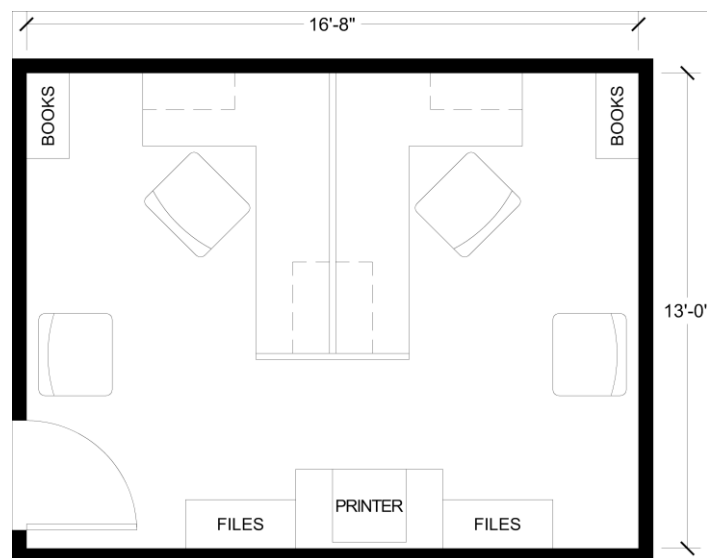
### Design Guidelines

- 1) Unit head's office is an individual, private office able to contain a desk, file cabinet(s), book shelves and a meeting area for up to four people.



- E) Full-time Faculty / Staff / Emeritus Faculty office – 110 square feet.

- 1) Full-time, professional and administrative staff and emeritus faculty office that will accommodate a desk, file cabinet, bookshelf and an area capable of holding meetings.

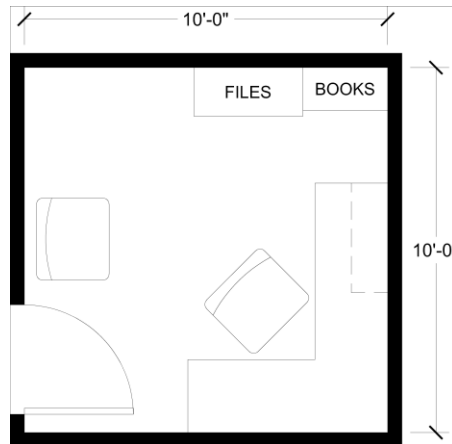


- F) Shared Staff office – 120 square feet per person

- 1) Shared offices can provide a viable option when space is limited or when staff work on similar tasks. When personnel do not require a private office work when they work with sensitive documents, a shared office may prove more secure than an open-office layout.

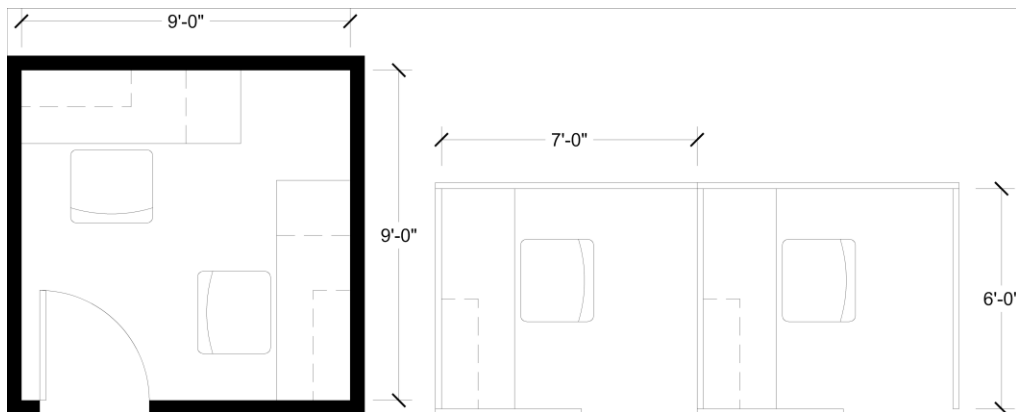


**Design Guidelines**



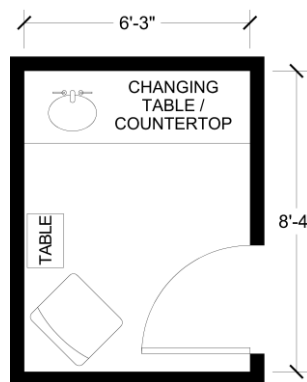
G) Post Doc – 100 square feet

- 1) Post doctorate fellows, research assistant or technician requiring the privacy and security of an individual office.



H) Scholars / Fellows / Grad associate – 40 square feet per person

- 1) Visiting scholars, Fellows and Trainee offices are assigned shared office space occupied by two or more persons depending on the type of appointment (full or part-time), program needs and existing building conditions. The figure above shows one possible layout for associates sharing a single office. Modular work stations at 7'x6' each are also an excellent option.



4) Lactation Room example

5) Guidelines for Creating and Remodeling Learning Spaces can be found at:

[https://www.ndsu.edu/fileadmin/provost/LSEC/NDSU\\_Classroom\\_Design\\_Manual.pdf](https://www.ndsu.edu/fileadmin/provost/LSEC/NDSU_Classroom_Design_Manual.pdf)

## Design Guidelines

### 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.
- 6) Unmanned Aircraft Systems (UAS) or drone flights shall follow the procedures located at the following address:
  - A) [https://www.ndsu.edu/research/for\\_researchers/unmanned\\_aircraft\\_systems/](https://www.ndsu.edu/research/for_researchers/unmanned_aircraft_systems/)

### 01 20 00 Change Order Procedures

- 1) A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:
  - A) The change in the Work;
  - B) The amount of the adjustment, if any, in the Contract Sum; and
  - C) The extent of the adjustment, if any, in the Contract Time.
- 2) When either or both additions and credits covering related work or substitutions are involved in any one change, the allowance for overhead and profit shall be calculated on basis of the net amount of cost or credit.
  - A) The allowance for overhead, bond, and profit combined, included in the total cost shall be based on the following schedule:
    - 1) For the Contractor; for added or deleted work performed by the Contractor's own forces, 10 percent of the cost.
    - 2) For the Contractor; for added or deleted work performed by the Contractor's Subcontractor, 5 percent of the cost due the Subcontractor.
    - 3) For each Subcontractor or Sub-subcontractor involved; for added or deleted work performed by the Subcontractor's own forces; 10 percent of the cost.
    - 4) For each Subcontractor; for added or deleted work performed by the Subcontractor's Sub-subcontractor, 5 percent of the amount due the subcontractor.
  - B) In order to facilitate the checking of quotations for extras or credit, all proposals, except those so minor that their propriety can be seen by inspection, shall be accomplished by a complete itemization of costs including labor, materials, and subcontracts. Labor and materials shall be itemized in the manner described above. Where major cost items are subcontract, they shall be itemized also.
  - C) In no case will a change involving over \$100.00 be approved without such itemization.

### 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

## Design Guidelines

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 (7<sup>th</sup>) 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

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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) Temporary power shall be installed following NEC Article 590.
  - B) Power will be available to the site from a near-by transformer or building and will be metered with a Contractor-provided meter.
  - C) NDSU will read the meter and bill the General Contractor accordingly; Xcel Energy will not meter nor read the meter at the site.
  - D) 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,

## Design Guidelines

- 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

## Design Guidelines

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must appear on each sign in legible characters.

D) The signs shall read:

No Trespassing

Violators will be Prosecuted

(Contractors name)

(Contact Name) – could be a foreman, supervisor, project manager, presidents name

E) Place at all entry gates, areas of egress, and every 40-50 feet along fence.

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.

F) 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) This paragraph must be included in the specifications for every project:

A) Proprietary Specification Requirements: There are no proprietary specifications in this project. No product will be sole sourced. Substitutions are allowed for all products, as long as the procedures indicated within these specifications are adhered to. Substitutions must be approved by the architect prior to acceptance.

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.

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- 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.



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- 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 with 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](#)
- 5) NDSU will charge back to the contractors and/or suppliers time spent by Owner staff investigating and diagnosing items that turn out to be warranty claims.
- 6) For warranty items that require immediate response in which the NDSU knows which warranty the item is for, NDSU will call the 24-hour call number provided by contractors. If NDSU cannot get a hold of anyone within ten minutes, NDSU will take any necessary actions to temporarily or fully correct the issue depending on the fault and will fully and accurately bill all time and material including any overtime costs to the prime contractor responsible either for the prime's work or the sub-contractor of the prime. This also includes any consequential damages that arise due to the warranty issue.



## Design Guidelines

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- 7) For warranty items that do not need immediate response, NDSU will contact the prime contractor to schedule any necessary repairs.

### **01 78 44 Extra Stock Materials**

- 1) A complete replacement set of HVAC air filters and belts provided per [23 40 00](#) must be supplied at the completion of the project.
- 2) Extra quantities of the following products shall be made available to the Owner for future use to replace damaged materials (see also [09 05 00](#))
  - A) Ceiling Tile – Minimum of 3 boxes, up to 5% needed for project with a maximum of 10 boxes
  - B) Ceramic Tile – Minimum of 2 boxes, up to 5% needed for project with a maximum of 5 boxes of each color
  - C) Carpet Tile – Minimum of 3 boxes, up to 5% needed for project with a maximum of 10 boxes
  - D) Other Flooring – Minimum of 2 boxes, up to 5% needed for project with a maximum of 5 boxes
  - E) Paint – 1 gallon of each color, unopened and labeled “For NDSU Use Only”
  - F) Terrazzo Flooring – Five gallon bucket of extra stone
  - G) Epoxy Flooring – Five gallon bucket of extra flakes
  - H) Polished Concrete – Five gallon bucket of extra aggregate

### **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.

## Design Guidelines

### 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 2%, unless otherwise directed by Owner.
- 3) The slope of walkways and ramps must exceed ADA requirements by 0.5%. The contractor is expected to use any means and methods to ensure there are no points that are greater than slopes allowed by ADA.
- 4) Deposit concrete in excess of the required depth, compacted or vibrated with as little handling to fill all voids, and finished smooth and even.
- 5) 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.
- 2) All truncated domes shall be non-painted cast iron.
  - A) Radius sidewalks shall use radius truncated domes.

#### 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.

### Design Guidelines

E) Slump shall not exceed four inches; when using slip forming equipment, slump shall not exceed 1 1/2 inches.

3) Properties:

Concrete type	Thickness	Strength
Bike pads	6"	4500 psi
Sidewalks	6"	4500 psi
Dumpster pads	6"	4500 psi
Streets/ Dumpster Approaches	8"	5000 psi

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) Use any means and methods necessary to saw joints in the concrete paving to prevent uncontrolled cracking.
- 2) Tool expansion joints into the wet concrete or "green sawed" within 12 hours after the concrete placement.
  - A) Placement of joints to be coordinated with Owner.
  - B) Provide broom finish for sidewalks.
- 3) Within the first year of installation, remove and replace concrete pavement where uncontrolled cracks have occurred at no cost to the Owner.
- 4) Within the first two years of installation, any surface rock pops/blowouts shall be repaired with an epoxy or grout material.

### 03 35 11 Concrete Floor Finishes

- 1) Reference Standards
  - A) ASTM C779 – Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
  - B) ASTM F609 – Standard Test Method for Using Horizontal Pull Slip Meters (HPS).
  - C) ASTM E1155 – Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2008).
- 2) Delivery, Storage and Handling
  - A) Deliver Materials in manufacturer's sealed packaging, including application instructions.
  - B) Container Label: Include Manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation and instructions for mixing and reducing.
  - C) Store materials in a clean, dry area in accordance with manufacturer's instructions.
  - D) Keep materials from freezing.
  - E) Avoid direct contact with this product as it may cause mild to moderate irritation of the eyes and/or skin.
  - F) Protect materials during handling and application to prevent damage or contamination.
- 3) Manufacturer
  - A) Prosoco or approved equal.
- 4) Concrete Floor Finish Applications
  - A) Liquid Densifier/Hardener
    - 1) Use at the following locations: At all interior locations throughout project where concrete floor is to be exposed.
    - 2) Consolideck by Prosoco, PL Premium Lithium-Silicate Sealer, Hardener & Densifier for Concrete or approved equal.
  - B) Penetrating Translucent Color Dye (Stain)
    - 1) Consolideck by Prosoco, GemTone Stain, Penetrating Translucent Color Dye for Concrete or approved equal.
    - 2) Selected Colors, or owner approved equal:
      - a) Amber
      - b) Light Roast
      - c) Desert Sand
  - C) High Gloss Clear Sealer

## Design Guidelines

- 1) Use at the following locations: Where sealed concrete, stained concrete and polished concrete floor finishes are indicated.
- 2) Consolideck by Prosoco, LS Guard, Glossy Sealer, Hardener & Densifier for Concrete or approved equal.
- 5) Accessories
  - A) Consolideck surface preparation cleaner or mechanical process to remove surface contaminants.
- 6) Examination
  - A) Verify that floor surfaces are acceptable to receive the work of this section.
  - B) Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
  - C) Notify Architect if surfaces are not acceptable. Do not begin application until unacceptable condition(s) have been corrected.
- 7) Surface Preparation
  - A) Protect adjacent surfaces not designated to receive treatment. Use polyethylene or other proven protective material.
  - B) Clean and prepare surfaces to receive treatment in accordance with manufacturer's instructions ensuring that all stains, oil, grease, form release agents, dust and dirt are removed prior to application.
  - C) Do not apply to surfaces which are frozen, dirty or have standing water. Surface must be clean, dry and absorbent. Confirm surface with a light water spray – surfaces designated for treatment should wet uniformly. If surface does not wet uniformly, use the appropriate surface preparation cleaner or mechanical process to remove remaining surface contaminants.
- 8) Surface and Air Temperatures
  - A) Verify that surface and air temperatures are as recommended by manufacturer.
    - 1) Temperatures for application should be between 40-100 degrees F.
    - 2) Do not begin product installation until required surface and air temperature conditions are met.
- 9) Densifiers and Hardeners Application
  - A) Test Application: Test a small area of each surface to confirm suitability and desired results before starting overall application. Test with the same equipment, recommended surface preparation and application procedures planned for general application.
  - B) Clean concrete of any dirt, residue or soft cut saw debris.
  - C) Ensure application equipment is clean and free of previously used materials.
  - D) Do not dilute densifier and chemical hardener.
  - E) Apply materials in accordance with manufacturer's instructions.
    - 1) Using low pressure sprayer fitted with a 0.5 gpm spray tip, apply a single coat of LS. Apply sufficient material to wet the surface without producing puddles. Use a clean soft-bristle push broom or microfiber pad to spread product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary. If surface dries immediately, apply more product. Surface should remain wet for 5-10 minutes. Adjust rate of application to eliminate puddles.
    - 2) Allow treated surfaces to dry.
    - 3) Immediately apply the specified curing compound or initiate the specified curing procedure.
    - 4) When curing process is complete, use an automatic floor scrubber equipped with cleaning pads or brushes appropriate for removal of construction soiling and surface residues. Avoid pads or brushes which may damage the finished floor. This procedure will further enhance the surface sheen produced by Consolideck LS.
- 10) Penetrating Translucent Color Dye (Stain) Application
  - A) Verify that surface temperatures are as recommended by manufacturer.
    - 1) Temperatures for application should be between 50-90 degrees F.
    - 2) Do not begin product installation until required surface and air temperature conditions are met.
  - B) Ensure application equipment is clean and free of previously used materials.
  - C) Test Application: Test a small area of each surface to confirm suitability and desired results before starting overall application. Test with the same equipment, recommended surface preparation and application procedures planned for general application.
  - D) Dilution and Mixing: As per manufacturer's recommendations.
  - E) Execute using materials, equipment and procedures specified by manufacturer, using manufacturer approved installer. Burnish concrete densifier treated floors in accordance with the following:

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- 1) Allow densifier and hardener to “cure” for a minimum of 28 days before beginning the application of polishing and staining.
- F) Application Instructions: Color (stain)
  - 1) Diamond grind and polish the surface to the equivalent of #200 grit resin diamonds.
  - 2) Clean the floor with a floor-scrubbing machine and fresh water. Let floor dry.
  - 3) Lightly wet a clean microfiber pad with the prepared stain.
  - 4) Apply the prepared stain to the clean, dry concrete floor using a low-pressure sprayer with a conical spray pattern. Wet the surface without producing puddles. Do not over apply. Use a small bucket or rag to collect drips when not spraying.
  - 5) Using the wet microfiber pad, immediately spread the spray-applied stain to ensure uniform wetting and color distribution. Continue spray-applying. Maintain a wet edge. Work the color into the surface to minimize streaks and patterns. Provide two people – one spraying and one spreading – for best results.
  - 6) Do not walk on the freshly stained surface. Let the floor dry thoroughly, 60 minutes minimum.
  - 7) Remove excess stain residue with floor scrubbing machine and fresh water. Let the wet floor dry.
  - 8) Dry-polish to the equivalent of #400 resin diamonds. Polish until all scratch patterns are gone.
  - 9) Clean the floor with a floor scrubbing machine and fresh water. Let the wet floor dry.
  - 10) Apply a single coat of Consolideck LS using a low-pressure sprayer. Apply sufficient material to wet the surface without producing puddles. Use a clean, soft-bristle push broom or microfiber pad to spread product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary. Allow treated surfaces to dry.
  - 11) Dry polish to a gloss finish.
  - 12) Sealing Stained Concrete Floor Surfaces:
    - a) Apply one (1) coat of sealer as described below in item “H” steps 1-5.
- 11) High Gloss Clear Sealer Finish Coating Application
  - A) Ensure application equipment is clean and free of previously used materials.
  - B) Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents and other impediments to adhesion.
  - C) Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
  - D) Protect adjacent non-coated areas from drips, overflow and overspray. Immediately remove excess material.
  - E) Apply with a low-pressure sprayer and a microfiber or synthetic lint free mop. Do not atomize.
  - F) Test Application: Test a small area of each surface to confirm suitability and desired results before starting overall application. Test with the same equipment, recommended surface preparation and application procedures planned for general application.
  - G) Dilute as per manufacturer’s recommendations.
  - H) Apply materials in accordance with manufacturer’s instructions.
    - 1) Lightly wet a clean microfiber pad with LS Guard and wring out excess, leaving the pad damp.
    - 2) Working from one control joint to another, apply a light, fine spray of LS Guard to a small section of the floor using a clean, pumped-up sprayer fitted with a 0.5 gpm spray tip.
    - 3) Using the damp microfiber pad and firm downward pressure, immediately spread the product to produce a thin, even coating. Spread the product as far as possible while maintaining a wet edge. Properly applied, the product dries quickly. Stop spreading once drying begins. Avoid overlapping.
    - 4) Allow to dry tack free, typically 20-60 minutes.
    - 5) Once dry, burnish produce using a high-speed burnisher fitted with a Consolideck Heat Burnishing Pad or equivalent polishing pad suitable for use on high-gloss finishes. In addition to smoothing and polishing the treated surface, high-speed burnishing heats the product to help the treatment fuse and bond with the concrete for increased durability and longevity. Surface temperature immediately behind the burnisher must achieve 90.5 degrees F.
  - I) Application Schedule
    - 1) Locations indicated as Sealed Concrete
      - a) Apply single coat and burnish as outlined above.
    - 2) Locations indicated as Polished Concrete
      - a) Apply three (3) coats for maximum gloss as outlined above, burnish between each coat.

## Design Guidelines

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- i) Note: Some locations to receive color (stain) treatment. See drawings for locations
- 12) Protection
  - A) Keep surface dry for a minimum of 48 hours after application.

### **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.
- 2) All glass and metal surfaces shall be protected during brick washing. Any damaged surfaces caused by brick washing shall be replaced by the masonry/tuckpointing contractor.
- 3) All concrete and/or masonry cutting, grinding, drilling, coring, or tuckpointing shall have a dust collection system or water spray of some type. In no case should the levels of dust exceed the OSHA maximum quantities allowed.



## Design Guidelines

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### Division 05 Metals

#### **05 40 00 Cold Formed Metal Framing**

- 1) All interior metal C-studs shall be 20 ga EQ (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 be stainless steel and not contain sharp edges with welds ground smooth.
- 2) Riser mount railing on stairs.
- 3) All railing members shall be round.

## Design Guidelines

### Division 06 Wood, Plastics, and Composites

#### 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:

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- 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 4 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) All lock hardware shall be CompX Timberline Interchangeable Lock Plug System or approved equal.
  - b) Furnish 2 keys for each lock.
  - 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:

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- i) Exposed back on fixed or movable cabinets: 3/4 inch thick plywood with the exterior surface finished.
    - ii) Flexible rail mounted cabinet backs: 3/4 inch thick plywood structurally doweled into cabinet sides and top panels.
    - iii) Removable backs: Provide removable backs for service access where shown on the project drawings.
  - 3) 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.
  - 4) Base units, except sink base units:
    - a) Full sub-top.
  - 5) 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.
    - b) If a soil trap is required, no bottom shelf shall be installed to allow for trap removal.
  - 6) Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers.
  - 7) Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
  - 8) Edging on exposed and semi exposed edges shall be 1mm PVC.
  - 9) 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.
  - 10) 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.
  - 11) Exposed ends: Faced with VGS high-pressure decorative laminate.
  - 12) Wall unit bottom: Faced with laminate.
  - 13) Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), not permitted.
- D) Drawers:
  - 1) Sides, back and sub front:
    - a) Minimum 1/2 inch thick plywood doweled and glued into sides.
  - 2) 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.
  - 3) 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.
- E) Door/Drawer Fronts:
  - 1) Use four (4) screws to fasten drawer fronts to drawer boxes.
  - 2) Core: 3/4 inch thick plywood.
  - 3) Provide double doors in opening in excess of 24 inches wide.
  - 4) Faces:
    - a) Exterior: VGS High-pressure decorative laminate.
    - b) Interior: High-pressure cabinet liner.
  - 5) Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.
- F) Shelving:

## Design Guidelines

- 1) Core material: 3/4 inch or 1 inch thick plywood.
  - 2) Exterior: VGS High-pressure decorative laminate.
  - 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.

## Design Guidelines

- 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.

## Design Guidelines

### 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
  - A) Roof Drains: Drains shall be maintained at the current elevations with insulation sump to drain.
  - B) 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.
  - C) 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.
  - D) 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.
  - E) Re-burners must be utilized with all tar kettles to minimize noxious fumes.
  - F) 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.
  - G) Existing surface areas, hard and landscaped surfaces, shall be protected.
  - H) 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.
  - I) Water stop is required where a vertical wall meets with a horizontal slab.

#### 07 10 00 Dampproofing and Waterproofing

- 1) Nothing in this section.

#### 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 manufacturer's six-inch cover strip.
- 4) Perimeter and curb fastening shall use the manufacturer's 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 manufacturer's stamp.
- 7) Fully adhered and mechanically fastened roof membranes are preferred for flat surfaces.



## Design Guidelines

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- 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.

## Design Guidelines

### 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.
    - 5) Exit only doors shall not have hardware on the exterior side.
  - 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. If it isn't possible for bathroom door to open out, review with Owner. 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.
  - A) All doors shall have a minimum of a mid-rail. There shall be no full light glass interior or exterior doors.
  - B) All sidelights shall have a horizontal mullion at door strike height.
- 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.

## Design Guidelines

- 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 eggshell 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 surface mounted vertical latches shall be fourteen (14) gauge steel plate at top and bottom of doors.
  - 6) 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.
  - 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.

## Design Guidelines

- 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 within 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, Northland Glass and 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) Frame finishes shall be clear anodized, dark bronze anodized, black anodized or custom color with approval by Owner.
    - 3) Brush-type weather stripping is to be installed where door meets frame.
    - 4) Exterior sidelight frames are to be glazed with 1" tempered insulated low-E glazing wherever possible to reduce energy loss.
    - 5) 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) 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.
    - 2) 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.

## Design Guidelines

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- 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 or approved equal.

### **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) All windows shall be Architectural Window/AW class, NAFS-08.
- 2) Windows to meet AAMA 910 Life Cycle Testing.
- 3) In air-conditioned buildings, provide fixed windows unless approved by Owner. Where installed, movable sash units shall be lockable.
- 4) Specify windows that have integral weather-stripping and thermal break. Provide testing to meet AAMA standards as an option at the Owner's request.
- 5) Windows with an internal core of wood is to be used in historical renovation only.
- 6) A dark anodized aluminum clad window is preferred. Finish to meet AAMA 611-98 Architectural Class I.

## Design Guidelines

### 08 70 00 Hardware

- 1) The following is a basis of design and not a proprietary spec.
- 2) 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.
- 3) Owner, supplier, installer and contractor shall review proper hardware installation methods and the procedures for receiving and handling hardware. At completion of installation, written certification that hardware items were installed according to conference recommendations shall be provided.
  - A) Inspect and discuss electrical rough-in and other preparatory work performed by other trades.
  - B) Review sequence of operation for each type of electrified door hardware.
  - C) Review and finalize construction schedule and verify availability of materials.
  - D) Review required testing, inspecting and certifying procedures.
- 4) Verify with Owner if factory authorized door hardware supplier shall perform a final inspection of installed door hardware. A report shall be provided to state whether work complies with, or deviates from, the specifications and requirements, including whether door hardware is properly installed, operating and adjusted.
- 5) Door hardware consultant shall inspect integrated electronic and access control hardware. A report shall state whether install work complies with, or deviates from, the specifications and requirements, including whether electronic and access control hardware is properly installed and performing according to system operational descriptions.
- 6) Verify with Owner if factory authorized door hardware service representative shall train Owner's maintenance personnel to adjust, operate and maintain door hardware and door hardware finishes.
- 7) Finishes and base materials
  - A) Except where indicated otherwise, hardware finishes shall be applied over base metals as specified in the following finish schedule:

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

- 8) 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 one and a half (1-1/2) 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:

## Design Guidelines

- 1) Stanley Security Solutions Incorporated or approved equal will be supplier of electrified power transfer hinges.
- 2) Electrified hinges will be ten through wire type
- 9) Door Position Switches
  - A) Door Position Switches shall be Concealed type, located at the top of the door near the lead edge.
- 10) Flush Bolts
  - A) All flush bolts shall be constant latching.
  - B) Use fire pins for fire doors.
- 11) 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, constant latching 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:
 

<b>Von Duprin</b>
KR4954
KR9954
- 12) Exit Devices
  - A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers:
 

<b>Von Duprin</b>
XP98 Series
QEL 98
996-17
990
RX, LX
  - 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) Trim shall be a classroom function set in the night latch position.
    - 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.
- 13) Locks and Latches
  - A) Acceptable manufacturers Grade 1 or approved equal and respective manufacturers' part/model numbers:
 

<b>Best</b>	<b>Schlage</b>
93K 14D	ND Series Sparta
  - 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.

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- 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.
- 14) 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.
- 15) Pulls, Push Plated, and Push Bars
- A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers.

Item	Hiawatha	Burns
1" dia. Pull	HG111	M26D
1" dia. Push Bar	HG114	M422
Push/Pull Plate	200F	54
1" Pull	523A	25B

- 16) Coordinators
- A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers.

Ives
COR

- 17) Door Closers
- A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers.

LCN
4040 XP

- B) All closers shall be mounted parallel arm using EDA arm.
  - C) When reveal is less than 3" use 4040XP-30 bracket.
  - D) When cush 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.
  - H) Cast Iron
- 18) Low Energy Automatic Operators
- A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers.

Besam
SW200I

- B) 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.
  - G) Headers must be side load only.
  - H) Equipment must be installed by an AAADM Certified Technician
- 19) Kick Plates and Mop Plates



## Design Guidelines

- 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.
- 20) Door Stops
- A) Interior Doors
    - 1) Overhead stops shall only be used on interior doors with no closers.
  - B) Exterior Doors
    - 1) Overhead stops shall not be used for exterior doors. Provide recessed mount guard post 36" tall placed in concrete at the lead edge of door to work as a door stop (Curran CE-910-1-S or approved equal).
- 21) 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.
- 22) Threshold, Gasketing, and Weather-strip
- A) Acceptable manufacturers or approved equal and respective manufacturers' part/model numbers.

Item	National Guard	Reese	Pemko
Thresholds	425E	S205A	171A
Gasketing	5050	797B	S88D
Weather-strip	700NA	755A	2891APK
Drip Strip	16A	R201A	346A
Sweeps	B606A	964A	18061CP
Astragal	600A	964A	18061CP

- 23) 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) All roof accesses shall be monitored.
  - D) No electric strikes
  - E) 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.
  - F) 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.
  - G) The card access hardware will be installed by owner.
  - H) Egress sensors in handle/crash bar where possible.
  - I) Door contact sensor in hinge or door strike where possible.
  - J) Latch contact sensor in lockset where possible.
  - K) At double doors, the non-reader door will have powered hardware and door contacts.

## Design Guidelines

L) Electronic Access Systems Hardware

1) Cylindrical Electrified Lockset

Item	Manufacturer	Part/Model Number
Lockset	Best	93KW7DEU – 14D – RQE
Power Supply (Single Lock)	Best	8WCON
Power Supply (Multiple Locks)	Altronics	Supervised power supply/charger 115 VAC 60Hz input 24 VDC output @ 10A 16 fused outputs 2 sealed lead-acid batteries, 12AH
Power Transfer (Hinge)	Stanley Security Solutions	CE-10-CS-FBB199 4-1/2X4-1/2 26D

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

2) Exit Device or approved equal with Latch Retraction

Item	Manufacturer	Part/Model Number
Exit Device	Von Duprin	QEL-LX-RX-XP98L-996L-17
Power Supply	Von Duprin	PS904-BB-2RS
Power Transfer (Hinge)	Stanley Security Solutions	CE-10-CS-FBB199 4-1/2X4-1/2 26D

- a) Verify power supply locations with architect & electrical engineer. Verify per manufacturers guidelines.
- 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

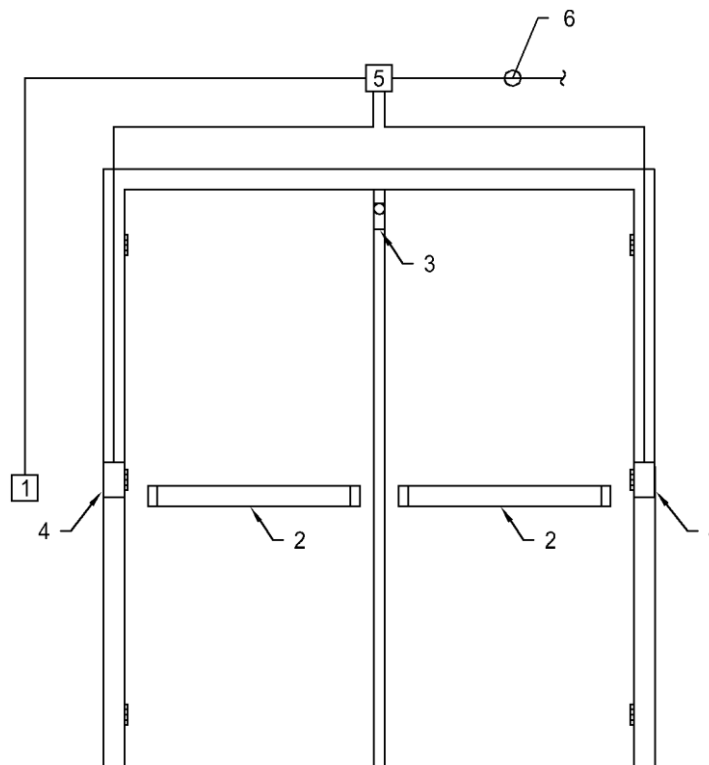
Item	Manufacturer	Part/Model Number
Exit Device	Von Duprin	LX-RX98L-E996L-17
Power Supply	Von Duprin	PS904-BB-2RS
Power Transfer (Hinge)	Stanley Security Solutions	CE-10-CS-FBB199 4-1/2X4-1/2 26D

- 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. Verify per manufacturers guidelines.
- 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.
- e) Verify options board with manufacturer.

## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR DOUBLE CARD ACCESS MONITORED DOORS WITH EXIT DEVICES

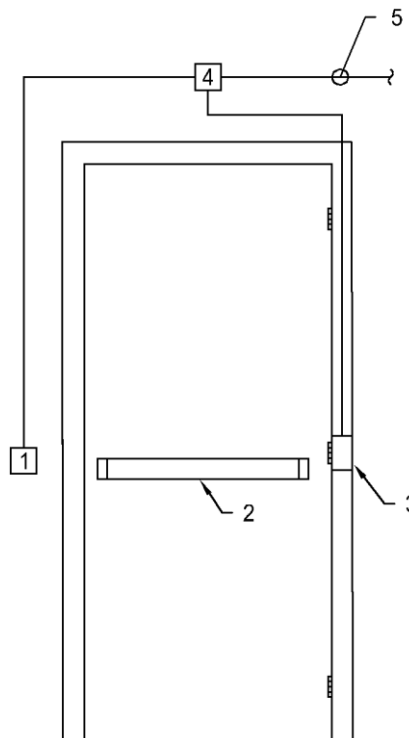
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #5 for future use. Blank cover supplied by Electrical Contractor.
2. Exit devices with request to exit and/or latch monitoring provided by hardware supplier. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information.
3. Keyed, removable mullion provided by hardware supplier.
4. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #5. See "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" or "Card Access Preparation Detail for Electrified Hinges in Wood Doors" for more information.
5. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
6. One-inch conduit home run from #4 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE CARD ACCESS MONITORED DOORS WITH EXIT DEVICES

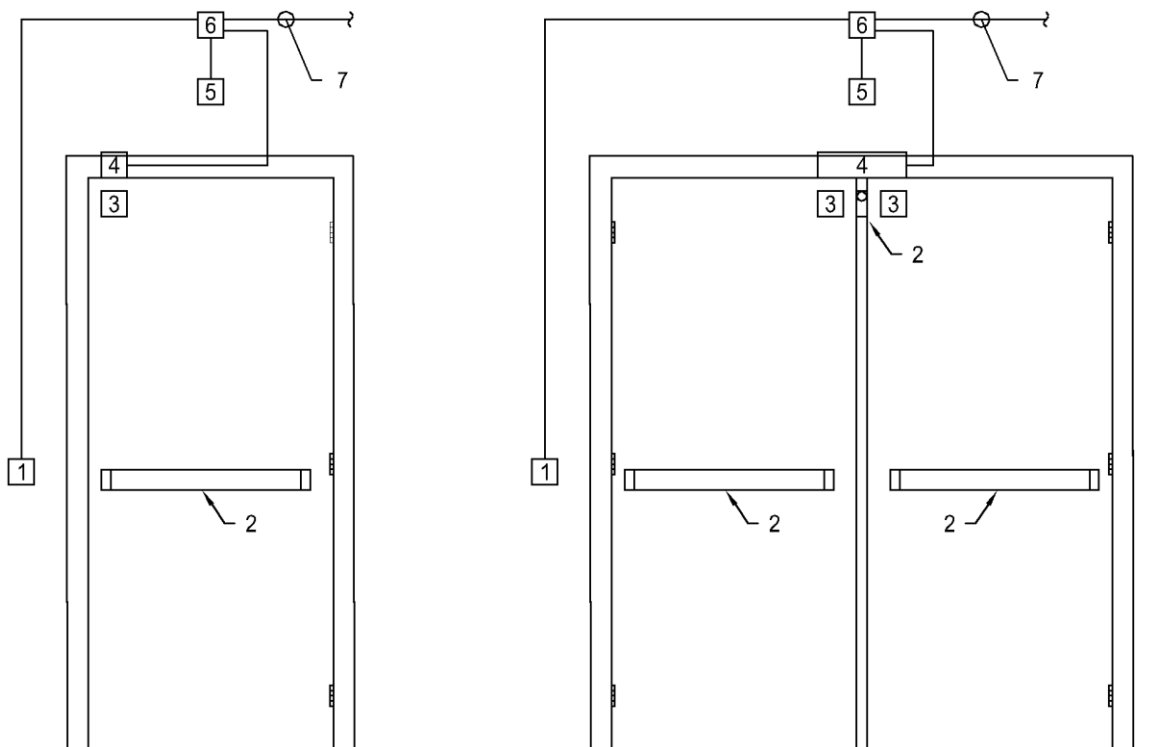
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #4. Blank cover supplied by Electrical Contractor.
2. Exit device with request-to-exit and latch monitoring provided by the hardware supplier. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information.
3. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #4. See "Card Access Preparation Detail or Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" or "Card Access Preparation Detail or Electrified Hinges in Wood Doors" for more information.
4. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
5. One-inch conduit home run from #4 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE OR DOUBLE CARD ACCESS READER DOORS WITH MAGNETIC LOCK(S)

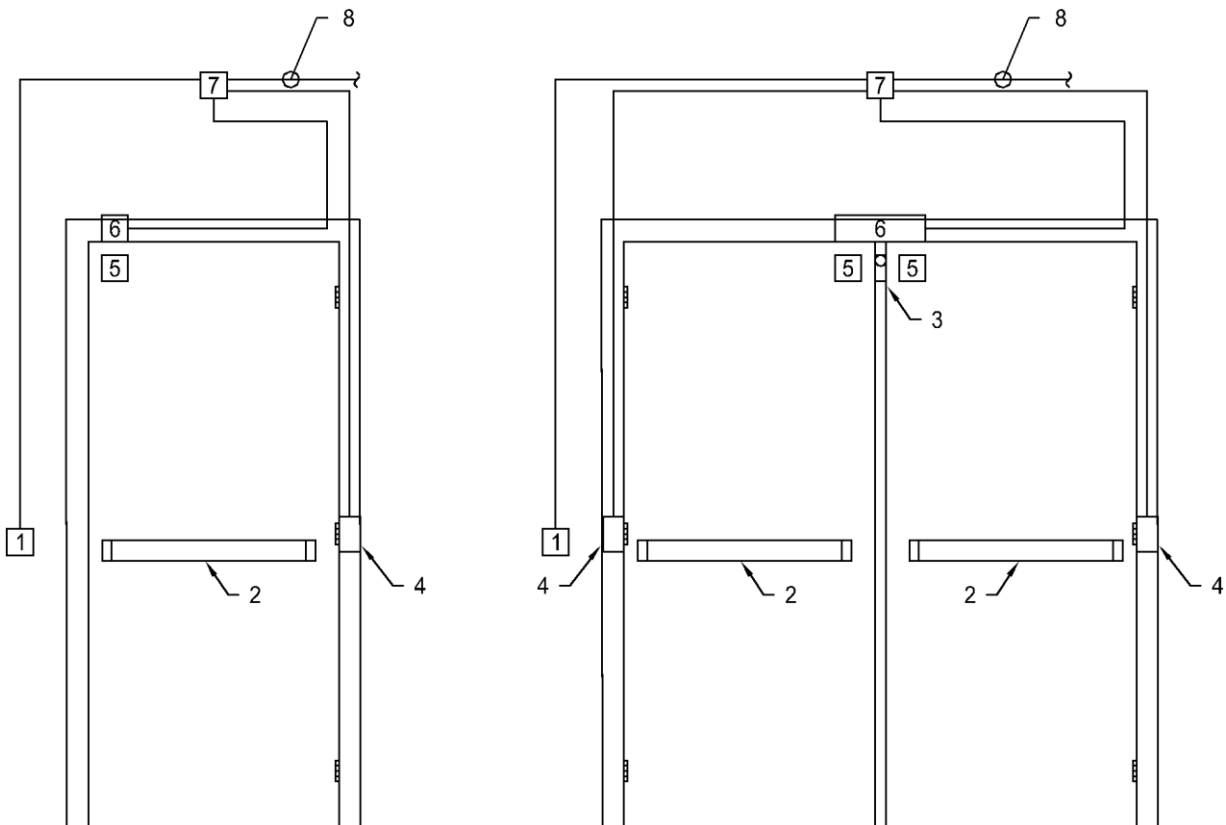
- 1) Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #6.
  - 2) Other locking hardware and/or locking accessories provided by hardware supplier. Locking hardware includes, but is not limited to, cylindrical locks, mortise locks, exit devices and mullions.
  - 3) Electrified Magnetic Lock provided with latch bond monitoring contacts, door positioning monitoring contacts and supplied by the hardware supplier. See "Card Access Preparation Detail for Magnetic Locks" for more details.
  - 4) Electrified junction box located in head of door frame above location magnetic lock is to be mounted with a 3/4" EMT conduit connected to #6. This box and connecting conduit should be attached to door frame.
  - 5) Low voltage junction box for request to exit switch provided by hardware supplier with 3/4" conduit to #6.
  - 6) Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
  - 7) One-inch conduit home run from #6 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
- Electrified magnetic lock power supplies are to be mounted in squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
  - All conduits must comply with electrical codes for bend radii and have appropriate pull boxes.
  - Magnetic hold opens on card access doors must be connected to card access system so that hold opens only operate when door is unlocked. Depending on code requirements, they may also need to be tied into fire alarm system.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE OR DOUBLE CARD ACCESS MONITORED DOORS WITH EXIT DEVICES THAT DON'T HAVE REQUEST TO EXIT AND/OR DOOR LATCH MONITORING

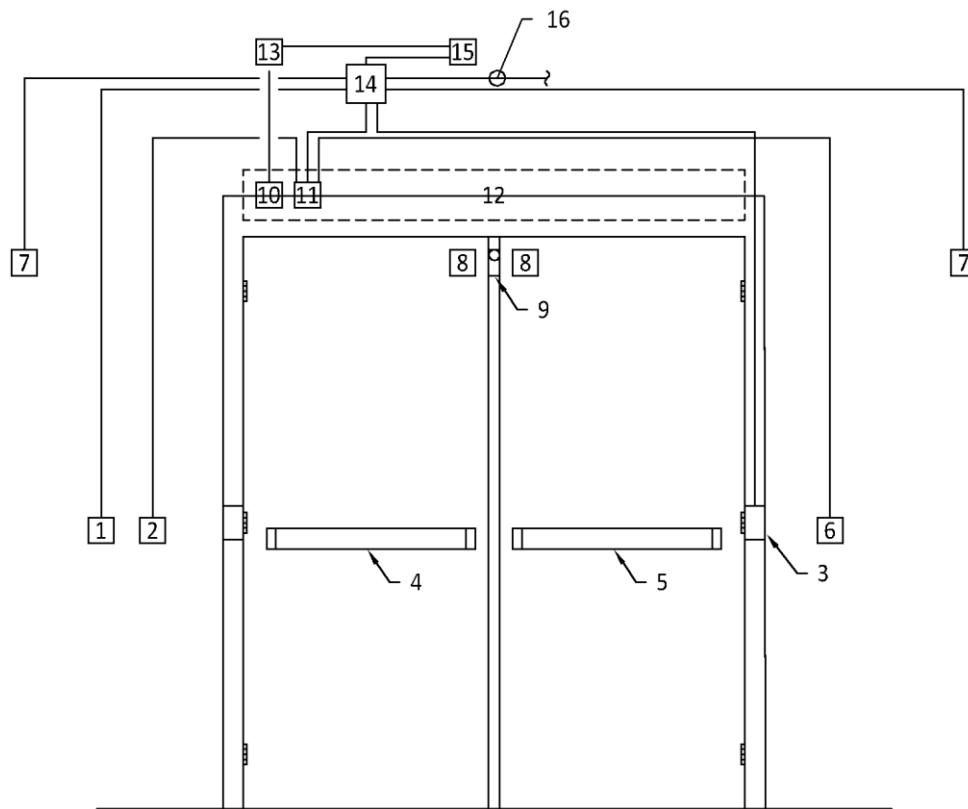
- 1) Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #7 for future use. Blank cover supplied by Electrical Contractor.
- 2) Exit device(s) *without* request to exit and/or latch monitoring provided by hardware supplier. Complete door prep as if exit device(s) are electrified exit devices with request to exit and/or latch monitoring. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information.
- 3) Keyed, removable mullion provided by hardware supplier.
- 4) Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #7. See "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" or "Card Access Preparation Detail for Electrified Hinges in Wood Doors" for more information.
- 5) Flush mounted magnetic monitoring switch. Make certain that preparation holes in door(s) and frame are not too large and are circular in shape to ensure proper fit of magnet and magnetic switch. Magnetic switch(es) may not be glued in place. See manufacturer's instructions for more information.
- 6) Electrified junction box located in head of door frame above location magnetic lock is to be mounted with a 3/4" EMT conduit connected to #7 This box and connecting conduit should be attached to door frame.
- 7) Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
- 8) One-inch conduit home run from #7 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.



**HANDICAPPED OPERATOR PREPARATION DETAIL FOR A DOUBLE DOOR WITH OR WITHOUT CARD ACCESS**

- 1) Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #14. On doors without card access, this junction box and conduit can be omitted.
- 2) Four-inch square touchpad junction box centered at 42" above finished floor on the non-secure side of the wall with a 3/4" conduit to #11.
- 3) Standard electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #14. See "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors for more information.
- 4) Exit device with latch retraction provided by the hardware supplier. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information. Electric strikes will not be accepted without written approval from Owner.
- 5) Exit device on the second leaf of the pair of doors is to be electrified only if the door is an active door under the card access system or both doors are controlled by handicapped operators. Whether the door is active or inactive, the preparation is the same. See #4 for more information.
- 6) Four-inch square touchpad junction box centered at 42" above finished floor on the secure side of the wall with a 3/4" conduit to #11.
- 7) Magnetic hold-open junction box if applicable with a 3/4" conduit to #12.
- 8) Magnetic hold-open hardware attached to door if applicable.
- 9) Keyed removable mullion provided by hardware supplier.
- 10) Electrical junction box located behind handicapped operator with a conduit to #13.
- 11) Low voltage 4" square junction box located behind the handicapped operator with 3/4" conduit to #14.
- 12) Outline of the handicapped operator. Verify the location with the supplier to ensure that the electrical and low voltage junction boxes will be hidden by the handicapped operator header. Verify with Owner if the operator cover should extend across the entire head of the door. If so, the closure for the inactive door should be a top jamb mounted closure and installed inside handicapped operator cover.
- 13) Electrical junction box located on the secure side of the wall, in suspended ceiling space when possible with a conduit to #15.
- 14) Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible with a 3/4" conduit to #15.
- 15) Exit device power supply located on the secure side of the wall, in suspended ceiling space when possible as close to the door as possible, mounted vertically. Mounted location must allow for obstruction-free access. Exit device power supply is to be connected to #13 and #14 by conduit.
- 16) One-inch conduit home run from #14 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.

## Design Guidelines

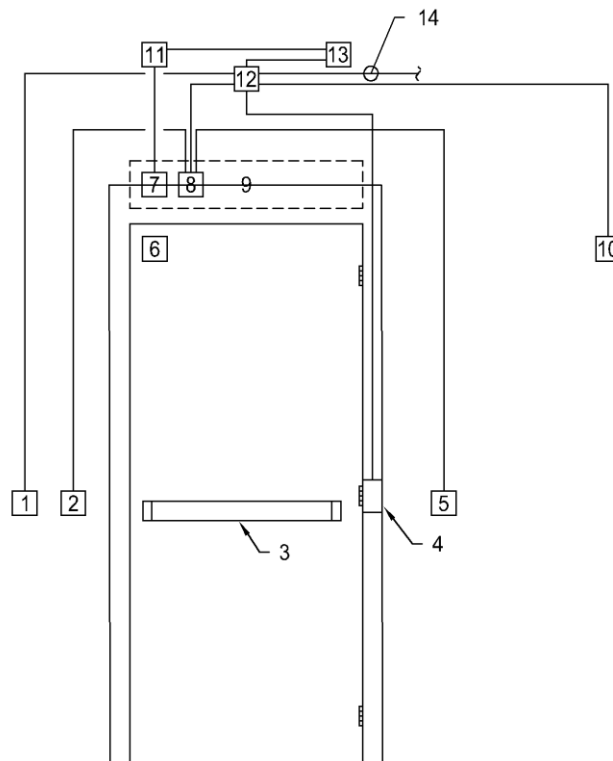




## Design Guidelines

### HANDICAPPED OPERATOR PREPARATION DETAIL FOR A SINGLE DOOR WITH OR WITHOUT CARD ACCESS

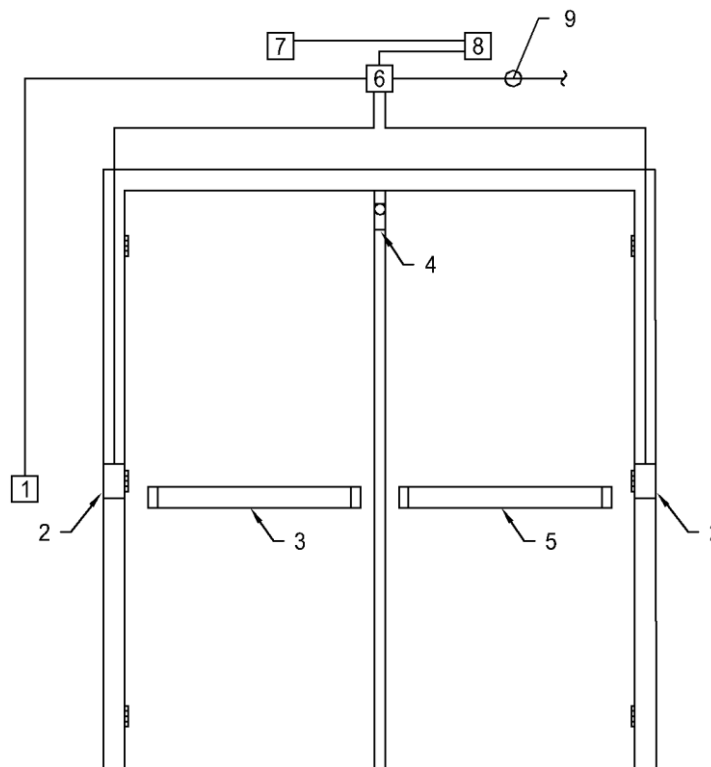
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #12. On doors without card access, this junction box and conduit can be omitted.
2. Four-inch square touchpad junction box centered at 42" above finished floor on the non-secure side of the wall with a 3/4" conduit to #8.
3. Exit device with latch retraction provided by the hardware supplier. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information. Electric strikes will not be accepted without written approval from Owner.
4. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #12. See "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information.
5. Four-inch square touchpad junction box centered at 42" above finished floor on the secure side of the wall with a 3/4" conduit to #8.
6. Magnetic hold-open hardware attached to door if applicable.
7. Electrical junction box located behind handicapped operator with a conduit to #11.
8. Low voltage 4" square junction box located behind the handicapped operator with 3/4" conduit to #12.
9. Outline of the handicapped operator. Verify the location with the supplier to ensure that the high and low voltage junction boxes will be hidden by the handicapped operator header.
10. Magnetic hold-open junction box if applicable with a 3/4" conduit to #12.
11. Electrical junction box located on the secure side of the wall, in suspended ceiling space when possible with a conduit to #13.
12. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible with a 3/4" conduit to #13.
13. Exit device power supply located on the secure side of the wall, in suspended ceiling space when possible as close to the door as possible, mounted vertically. Mounted location must allow for obstruction-free access. Exit device power supply is to be connected to #11 and #12 by conduit.
14. One-inch conduit home run from #12 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR DOUBLE CARD ACCESS READER OR TIMED DOORS WITH EXIT DEVICES

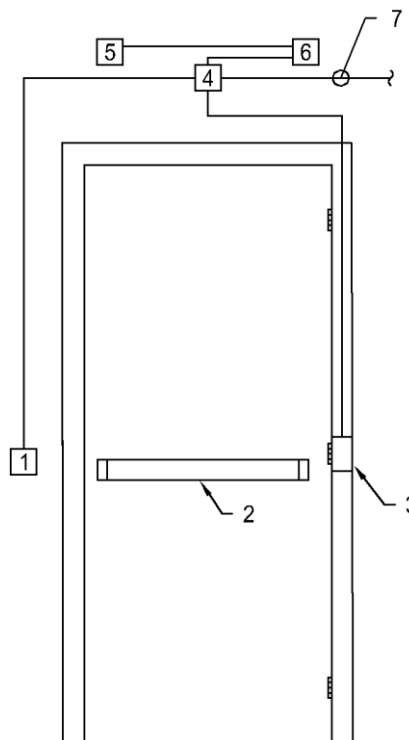
- 1) Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #6. This junction box and conduit can be omitted when both doors are timed doors.
  - 2) Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #6. See "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors" for more information.
  - 3) Electrified exit device provided by the hardware supplier. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information.
  - 4) Keyed, removable mullion provided by hardware supplier.
  - 5) Exit device on the second leaf of the pair of doors is to be electrified only if the door is an active door under the card access system. Whether the door is active or in active the preparation is the same. See preparations mentioned in #3 for more information.
  - 6) Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible with a 3/4" conduit to #8.
  - 7) Electrical junction box located on the secure side of the wall, in suspended ceiling space when possible with a conduit to #6. If exit device has an electrified trim, this junction box can be omitted.
  - 8) Exit device power supply located on the secure side of the wall, in suspended ceiling space when possible as close to the door as possible, mounted vertically. Mounted location must allow for obstruction-free access. Exit device power supply is to be connected to #6 and #7 by conduit. If exit device has an electrified trim, the power supply should be located in squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
  - 9) One-inch conduit home run from #6 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
- All conduits must comply with electrical codes for bend radii and have appropriate pull boxes.
  - Magnetic hold opens on card access doors must be connected to card access system so that hold opens only operate when door is unlocked. Depending on code requirements, they may also need to be tied into fire alarm system.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE CARD ACCESS READER OR TIMED DOORS WITH EXIT DEVICES

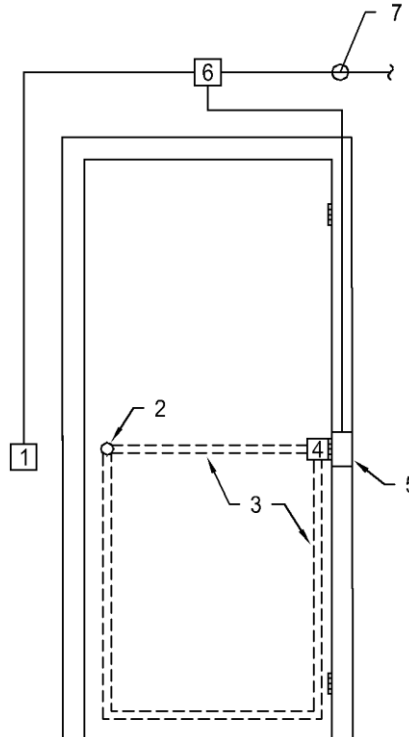
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #4. This junction box and conduit can be omitted for timed doors.
  2. Electrified exit device provided by the hardware supplier. See either "Card Access Preparation Detail for Exit Devices in Wood Doors" or "Card Access Preparation Detail for Exit Devices in Hollow Metal and Aluminum Doors" for more information.
  3. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #4. See "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" or "Card Access Preparation Detail for Electrified Hinges in Wood Doors" for more information.
  4. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible with a 3/4" conduit to #13.
  5. Electrical junction box located on the secure side of the wall, in suspended ceiling space when possible with a conduit to #6.
  6. Exit device power supply located on the secure side of the wall, in suspended ceiling space when possible as close to the door as possible, mounted vertically. Mounted location must allow for obstruction-free access. Exit device power supply is to be connected to #4 and #5 by conduit. If exit device has an electrified trim, the power supply should be located in squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
  7. One-inch conduit home run from #4 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
- All conduits must comply with electrical codes for bend radii and have appropriate pull boxes.
  - Magnetic hold opens on card access doors must be connected to card access system so that hold opens only operate when door is unlocked. Depending on code requirements, they may also need to be tied into fire alarm system.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE CARD ACCESS READER DOOR WITH CYLINDRICAL LOCKS

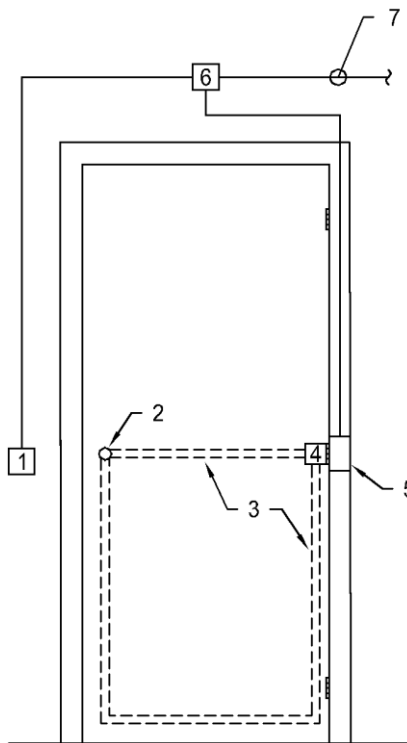
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #6.
  2. Electrified cylindrical lock provided by the hardware supplier. See either "Card Access Preparation Detail for Cylindrical Locks in Wood Doors" or "Card Access Preparation Detail for Cylindrical Locks in Hollow Metal and Aluminum Doors" for more information.
  3. Minimum of 1/2" diameter path or conduit (depending on door composition) between #2 and #4.
  4. Area of door that is prepped for electrified hinge. See either "Card Access Preparation Detail for electrified Hinges in Wood Doors" or "Card Access Preparation Detail for electrified Hinges in Hollow Metal and Aluminum Doors and Frames" for more information.
  5. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #6. See "Card Access Preparation Detail for Electrified Hinges in Wood Doors" or "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" for more information.
  6. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
  7. One inch conduit home run from #6 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
- Electrified cylindrical lock power supplies are to be mounted in squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.
  - All conduits must comply with electrical codes for bend radii and have appropriate pull boxes.
  - Magnetic hold opens on card access doors must be connected to card access system so that hold opens only operate when door is unlocked. Depending on code requirements, they may also need to be tied into fire alarm system.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE CARD ACCESS MONITORED DOOR WITH CYLINDRICAL LOCKS

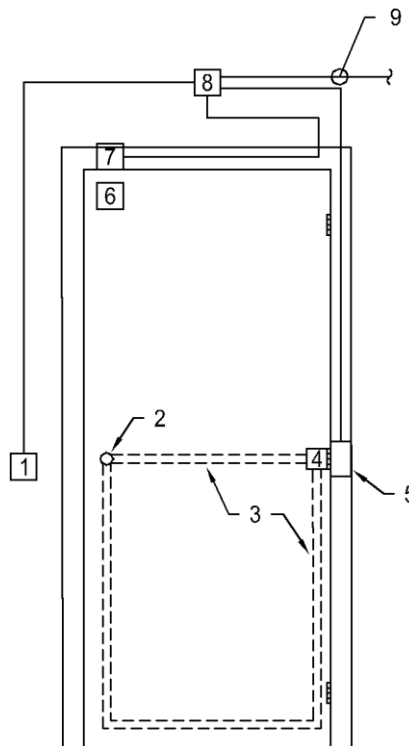
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #6. Blank cover supplied by Electrical Contractor.
2. Cylindrical lock with request to exit provided by the hardware supplier. See either "Card Access Preparation Detail for Cylindrical Locks in Wood Doors" or "Card Access Preparation Detail for Cylindrical Locks in Hollow Metal and Aluminum Doors" for more information.
3. Minimum of 1/2" diameter path or conduit (depending on door composition) between #2 and #4.
4. Area of door that is prepped for electrified hinge. See either "Card Access Preparation Detail for Electrified Hinges in Wood Doors" or "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" for more information.
5. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #6. See "Card Access Preparation Detail for Electrified Hinges in Wood Doors" or "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" for more information.
6. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
7. One-inch conduit home run from #6 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SINGLE CARD ACCESS MONITORED DOOR WITH A CYLINDRICAL LOCK THAT DOESN'T HAVE A REQUEST TO EXIT SWITCH

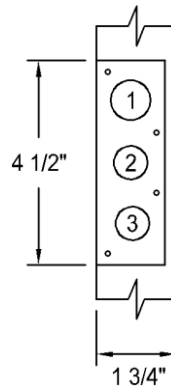
1. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #8 for future use. Blank cover supplied by Electrical Contractor.
2. Cylindrical lock without request to exit switch provided by the hardware supplier. Complete door prep as if cylindrical lock in an electrified lockset with a request to exit switch. See either "Card Access Preparation Detail for Cylindrical Locks in Wood Doors" or "Card Access Preparation Detail for Cylindrical Locks in Hollow Metal and Aluminum Doors" for more information.
3. Minimum of 1/2" diameter path or conduit (depending on door composition) between #2 and #4. Complete door prep as if cylindrical lock as a request to exit switch.
4. Area of door that is prepped for electrified hinge. Complete door prep as if cylindrical lock as a request to exit switch. See either "Card Access Preparation Detail for Electrified Hinges in Wood Doors" or "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" for more information.
5. Electrified hinge junction box located behind the electrified hinge with a 3/4" EMT conduit connected to #8. See "Card Access Preparation Detail for Electrified Hinges in Wood Doors" or "Card Access Preparation Detail for Electrified Hinges in Hollow Metal and Aluminum Doors and Frames" for more information.
6. Flush mounted magnetic monitoring switch. Make certain that preparation holes in door(s) and frame are not too large and are circular in shape to ensure proper fit of magnet and magnetic switch. Magnetic switch(es) may not be glued in place. If magnet is mounted into a piece of wood or other material, the wood or other material should be attached to door. See manufacturer's instructions for more information.
7. Electrified junction box located in head of door frame above location magnetic lock is to be mounted with a 3/4" EMT conduit connected to #8 This box and connecting conduit should be attached to door frame.
8. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
9. One-inch conduit home run from #8 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details. All conduits must comply with all electrical codes for bend radii and have appropriate boxes.



## Design Guidelines

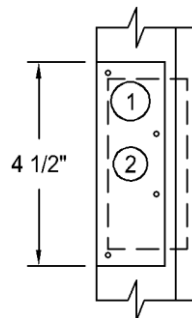
### CARD ACCESS PREPARATION DETAIL FOR ELECTRIFIED HINGES IN WOOD DOORS

1. Minimum of 7/8" diameter hole with a minimum depth of 2".
  2. Minimum of 3/4" diameter hole with a minimum depth of 4". This hole should also connect to the concealed path to the cylindrical lockset or exit device.
  3. Minimum of 3/4" diameter hole with a minimum depth of 4". Hole is to be centered between the bottom two hinge screws and in line with the center of the other preparation holes.
- Verify the center location of the holes from Stanley CECS installation instructions.
  - Follow manufacturer's instructions and comply with building codes when preparing all card access related work for all current and future card access doors.



### CARD ACCESS PREPARATION DETAIL FOR ELECTRIFIED HINGES IN WOOD FRAMES

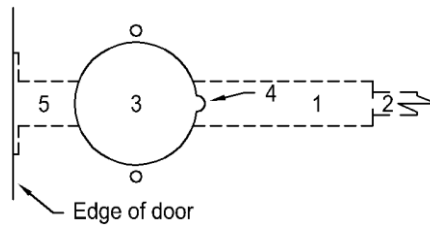
1. Minimum of 7/8" diameter hole with a minimum depth of 2".
  2. Minimum of 3/4" diameter hole with a minimum depth of 4". This hole should also connect to the concealed path to the cylindrical lockset or exit device.
  3. Single gang, 1 1/2" deep electrical box recessed into wood framing installed by electrical contractor before door frame is installed. Center of box should be in line with the center of the electrified hinge. Verify the height of the electrified hinge with the general contractor. The box should also be connected to the 3/4" conduit that is attached to the low voltage, 4" square, extra deep junction box.
- Verify the center location of the holes from Stanley CECS installation instructions.
  - Follow manufacturer's instructions and comply with building codes when preparing all card access related work for all current and future card access doors.



## Design Guidelines

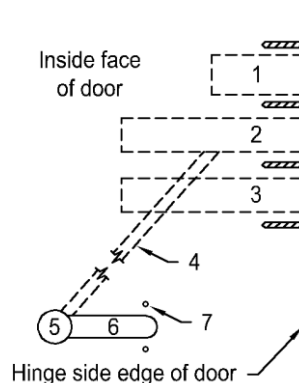
### CARD ACCESS PREPARATION DETAIL FOR CYLINDRICAL LOCKSETS IN WOOD DOOR

1. Minimum of 1" diameter hole extending a minimum of 4" beyond the back of the cylindrical lockset preparation.
2. Minimum of 1/2" diameter path between the lockset and electrified hinge.
3. Standard cylindrical latch bolt preparation.
4. Standard electrified cylindrical lockset preparation.
5. Standard 2 3/4" latch-bolt preparation.



### CARD ACCESS PREPARATION DETAIL FOR EXIT DEVICES IN WOOD DOORS

1. Minimum of 7/8" diameter hole, with a minimum depth of 2".
  2. Minimum of 3/4" diameter hole, with a minimum depth of 4".
  3. Minimum of 3/4" diameter hole, with a minimum depth of 4". Hole to be in line with other prep holes and centered between the bottom 2 hinge screws.
  4. Minimum of 1/2" diameter path from #2 to the area behind the exit device.
  5. Minimum of 3/4" diameter hole from the exit device side face of the door to #4.
  6. Minimum of 1/2" deep by 1/2" wide groove from #5 to exit device manufacturers specified locations for the entry card access wires to the exit device.
  7. Hinge side mounting holes for the back of the exit device. These shall be through-bolted in all applications.
- Verify the center location of the holes from Stanley CECS installation instructions.
  - Follow manufacturer's instructions and comply with building codes when preparing all card access related work for all current and future card access doors.
  - If exit device manufacturer requires a larger path anywhere in prep from hinge to exit device, comply with manufacturer's requirements.

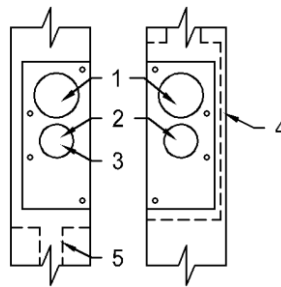




## Design Guidelines

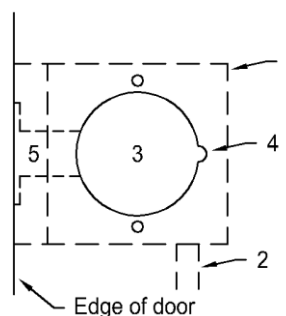
### CARD ACCESS PREPARATION DETAIL FOR ELECTRIFIED HINGES IN HOLLOW METAL AND ALUMINUM DOORS AND FRAMES

1. Minimum of 1" diameter burr-free hole.
  2. Minimum of 3/4" diameter burr-free hole.
  3. Minimum of 3/4" diameter path between the exit device and the hinge should be connected to this location. No conduit should be necessary; the open style should be sufficient. For cylindrical locket applications, this path needs to be 1/2" EMT.
  4. Electrical box with 3/4" conduit stub up 6" above top of frame.
  5. Door electrical box for connecting 1/2" conduit for cylindrical lock applications. Electrical box is optional for exit device and aluminum door applications.
- Verify the center location of the holes from Stanley CECS installation instructions.
  - Electrical box and conduit are to be welded to the frame for all hollow metal frame applications. For aluminum frames, the box and conduit should be connected to the steel angle hinge support.
  - Unless authorized by Owner, all electrified hinges are the be 4 1/2"x4 1/2" Stanley CECS hinges.
  - Mud boxes should not be installed behind the hinge supports that have card access electrical boxes attached to them.
  - Ensure that there is a minimum of 1 1/2" clearance between the back of the hinge bracket and the inside of the electrical box.
  - Follow manufacturer's instructions and comply with building codes when preparing all card access related work for all current and future card access doors.



### CARD ACCESS PREPARATION DETAIL FOR CYLINDRICAL LOCKSETS IN HOLLOW METAL AND ALUMINUM DOORS

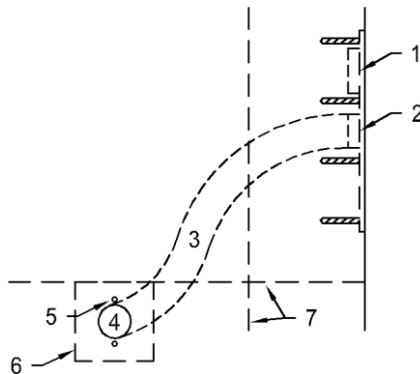
1. Ensure that lock support allows for enough room for extra wire, connectors and temperature control module.
2. Minimum of 1/2" diameter EMT between the lockset and electrified hinge.
3. Standard cylindrical latch bolt preparation.
4. Standard electrified cylindrical lockset preparation.
5. Standard 2 3/4" latch-bolt preparation.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR EXIT DEVICES IN HOLLOW METAL AND ALUMINUM DOORS

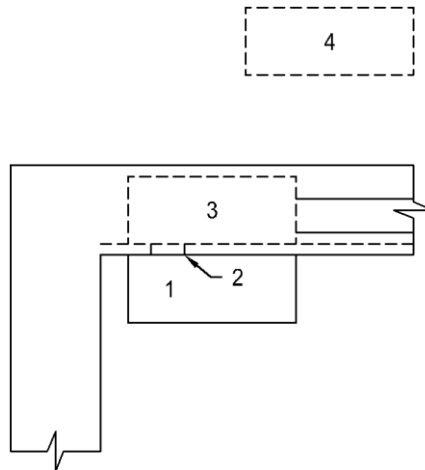
1. Minimum of 1" diameter burr-free hole.
  2. Minimum of 3/4" diameter burr-free hole.
  3. Minimum of 3/4" diameter path from #2 to the area behind the exit device hinge side mounting holes.
  4. Minimum of 3/4" diameter hole through the exit device side face of the door at the manufacturer's specified location for the entry of card access wires at the hinge side end of the exit device.
  5. Hinge side mounting holes for the back of the exit device. These shall be through-bolted in all applications.
  6. Steel reinforcement in hollow metal doors for hinge side exit device attachment.
  7. Possible steel reinforcement inside door with #3.
- Verify the center location of the holes from Stanley CECS installation instructions.
  - Follow manufacturer's instructions and comply with building codes when preparing all card access related work for all current and future card access doors.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR MAGNETIC LOCKS

1. Electrified magnetic lock provided by hardware manufacturer. This lock will be provided with latch bond and door position monitoring contacts. Mount magnetic lock according to manufacturer's instructions.
  2. Minimum of 3/4" diameter burr-free hole. See magnetic lock manufacturer's instructions for location.
  3. Electrical junction box located in head of door frame above location magnetic lock is the mounted with a 3/4" EMT conduit stubbed up 6" above head of door frame. This box should be installed by door frame manufacturer.
  4. Request to exit junction box located above center of door either in wall or mounted to suspended ceiling. Coordinate location with owner electrician and/or locksmith.
- Electrical box and conduit are to be welded to a reinforcement steel plate for all hollow metal frame applications. For aluminum frames, the box and conduit should be connected to a steel plate running along the entire head of door. Steel plate is not only to attach electrical box and conduit but also a reinforcement plate for mounting the magnetic lock and the closure's parallel arm shoe.
  - Follow manufacturer's instructions and comply with building codes when preparing all card access related work for all current and future card access doors.
  - Hardware supplier is responsible for supplying any shims required to mount magnetic lock.

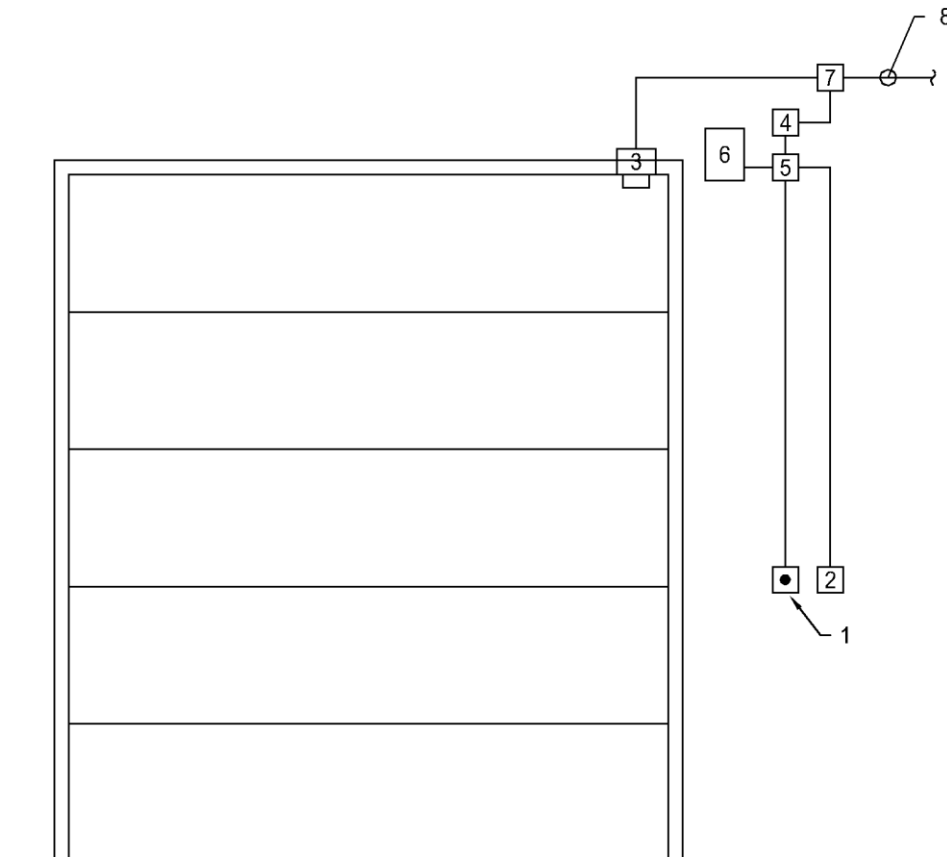


## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR OVERHEAD CARD ACCESS MONITORED DOOR

1. Best key operated momentary dual direction door control switch for inside operation attached to a junction box centered at 42" above finished floor on the non-secure side of the wall with a 3/4" conduit to #5.
2. Card reader junction box centered at 42" above finished floor, on the non-secure side of the wall and with a 3/4" conduit to #5 for future use. Blank cover supplied by Electrical Contractor.
3. High security surface mounted magnet monitoring switch with manufacturer supplied metallic conduit routed to #7.
4. Low voltage junction box located next to door operator's low voltage control box for future connection and with a 3/4" EMT conduit to #7.
5. Overhead door operator's low voltage junction box with a 3/4" EMT conduit connected to #4.
6. Overhead door operator's motor.
7. Low voltage 4" square extra deep junction box located on the secure side of the wall, in suspended ceiling space when possible.
8. One inch conduit home run from #7 to the squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details.

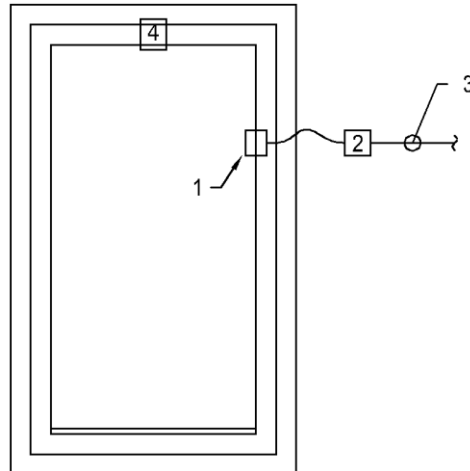
- All conduits must comply with all electrical codes for bend radii and have appropriate pull boxes.
- Follow manufacturer's instructions and comply with building codes for the installation of overhead doors.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR CARD ACCESS MONITORED ROOF HATCHES

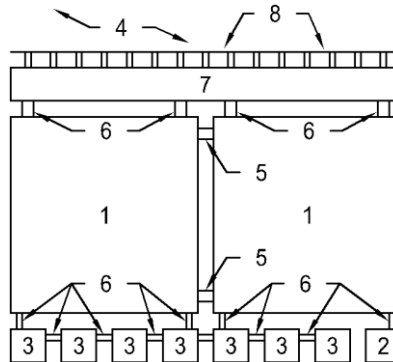
1. High security surface mounted magnet monitoring switch with manufacturer supplied metallic conduit routed to #2.
2. Low voltage, 4" square junction box. Ensure box is located so conduit from #1 will reach junction box.
3. Three-quarter inch conduit home run from #2 to squadron room. See "Card Access Preparation Detail for Squadron Equipment" for more details. All conduits must comply with all electrical codes for bend radii and have appropriate pull boxes. Electrical contractor may elect to install (2) 18 gauge, 4 conductor cables instead of card access cable specified for the project.
4. Roof latch with padlock compatible with Best core.



## Design Guidelines

### CARD ACCESS PREPARATION DETAIL FOR SQUADRON EQUIPMENT

1. Squadron cabinet(s) supplied and mounted by owner's electrician.
  2. Squadron power supply supplied by owner and installed by electrical contractor.
  3. Electrified cylindrical lock, electrified exit device lever trim, and/or magnetic lock power supplies if applicable. These power supplies are supplied by hardware supplier and installed by electrical contractor.
  4. All squadron equipment to be mounted on a 3/4" piece of gray painted plywood provide by electrical contractor. Size plywood to allow of future expansion.
  5. Large conduit provided and installed by the electrical contractor to connect large J box or wire trough to squadron cabinet (minimum of 3" EMT)
  6. Low voltage connecting conduits (min of 1" EMT)
  7. Large junction box or wire trough provided and installed by the electrical contractor to terminate all of the #8s.
  8. 1" conduit home runs from each of the card access doors terminated into #7.
- All material (conduit, connectors, plywood, large junction box, or wire trough) to connect squadron cabinet will be provided and installed by the electrical contractor.
  - All card access related power supplies are to be on dedicated emergency circuit and preferably on dedicated generator emergency circuits where available.
  - Provide an extra loop of 10' beyond entry of cars access squadron cabinet.
  - Clearly label cables on both ends with description of location including door number.
  - All conduits are to be EMT. No flexible conduit will be accepted.
  - Extra card access wire is to be left in the squadron room.



## Design Guidelines

### 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 in quantities shown in [01 78 44](#) for future use to replace damaged materials.
  - 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. Use 2'X2' lay in acoustical ceiling tile with beveled edges 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) Carpet tile shall be used in classrooms, student rooms, etc., with a minimum four inch vinyl base.
- 4) Restroom flooring shall be a poured, seamless epoxy surface or ceramic tile and shall extend up wall to a height of 4".
- 5) 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

## Design Guidelines

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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.
- 3) When applying wood paneling over drywall or plaster, place joints on the center of stud and off the drywall joint to accommodate nailing.
- 4) A hard-wearing washable surface shall be provided on walls in classrooms, especially beneath instructional boards.
- 5) 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 eggshell paint grade shall be 100% Acrylic Latex. Verify with SDS that the paint contains not less than 30% solids.
- 4) Eggshell paint shall be used for hollow metal doors and frames.
- 5) Surface temperature shall not be less than 60° Fahrenheit for paint or stain application.
- 6) Varnish shall be a polyurethane composition for durability and quick drying periods. A compatible sealer is to be used on all varnished surfaces. Two finish coats of varnish shall be applied. Fill nail holes before final coat.



## Design Guidelines

### 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.
  - A) Markerboard to be a minimum of 4'-0" tall, mounted at 3'-0" above finished floor.
- 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

- A) Provided and installed by Owner.

#### 10 14 00 Signage

- 1) Room and wayfinding signage provided and installed by Owner.
- 2) 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
- 3) No logo or discipline signa is to be installed or applied to a building's exterior.
- 4) 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.
- 5) 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.
- 6) For building Plaque requirements, see [Exhibit E-12](#).

#### 10 28 00 Toilet and Bath Accessories

- 1) Toilet and bath partitions
  - A) Toilet partitions shall be floor mounted and urinal partitions shall be wall mounted.
    - 1) All partitions shall use manufacturer's torx drive fasteners.
  - B) All hardware shall be manufacturer's heavy duty aluminum.
  - C) Latch and keepers shall be surface mounted, bolt-type.
  - D) Standard manufacturer's stainless steel hinges may be used on steel partitions; stainless steel piano hinges are to be used on solid-polymer partitions.
  - E) Partitions shall be 69" tall or manufacturers high/tall version.
  - F) Partitions with no gaps shall be provided.
- 2) Dispensers
  - A) NDSU will supply liquid soap dispensers, surface mounted paper towel dispensers and waste paper containers. Items shall be installed by contractor.
    - 1) The paper towel dispensers are 14.65" H x 13.26" W x 8" D.
    - 2) The trash cans are 18.25" H x 12.5" W x 16.25" D.
    - 3) Review the best possible location for these items to maintain ADA compliance in all restrooms.

## Design Guidelines

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- B) The contractor shall furnish the following restroom accessories made of stainless steel with a No. 4 satin finish:
  - 1) Surface mounted two-roll toilet paper dispensers, one per toilet stool (Impact Products Model 2501)
  - 2) Partition mounted sanitary napkin receptacles, one per women's stall (Rubbermaid Model 6140)
  - 3) Surface mounted channel frame mirror sized to cover china basin(s) without a break
- C) Verify current product with the Owner's Associate Director.
- 3) Shelving
  - A) Where possible, a shelf near the bathroom entrance shall be provided.

### **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.

## Design Guidelines

### 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):
 

<b>Brand</b>	Hunter Douglas
<b>Material</b>	.008 Gauge Aluminum
<b>Slat Size</b>	1"
<b>Color</b>	#002 Alabaster
<b>Style</b>	"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.
- 5) Casework used for teaching stations shall be ADA compliant.

#### 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):

## Design Guidelines

- 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
    - 6) B456-03(R2009) Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
    - 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
    - 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,

## Design Guidelines

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- 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.
  - 3) Expansion Bolts: Fed Spec. A-A-55615. Do not use lead or plastic shields.
  - 4) Nuts: Fed Spec FF-N-836. Type III, Style 15 where exposed.
  - 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.

## Design Guidelines

- 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.
    - a) If a soil trap is required, no bottom shelf shall be installed to allow for trap removal.
  - 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:

## Design Guidelines

- 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 1/2" 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.



## Design Guidelines

- 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/BHAMA 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.

## Design Guidelines

- 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 cm<sup>3</sup>) 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	Methylethyl Keytone
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:

## Design Guidelines

- 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

## Design Guidelines

- 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.
    - 1) Countertops around sinks shall have a marine edge to stop water from running away from sink.

### 12 50 00 Furniture

- 1) Reference "Architectural Graphic Standards Tenth Edition", American Institute of Architects, when designing workstations.
  - 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".
- 3) Desktop Corners/Keyboards
  - A) Straight areas for keyboards shall be a minimum of 26" wide.
  - B) Rounded inside corners shall not be used.

### 12 60 00 Multiple Seating

- 1) Classroom Furniture: Fixed auditorium seating shall have a retractable desk top that is easily placed out of the

## Design Guidelines

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way and a spring-loaded seat that will close automatically as manufactured by “American Seating”, “Irwin” or approved equal.

### **12 93 13 Bicycle Racks**

- 1) Permanent bike racks shall be similar to Kay Park Recreation Corp - Model 1102C, 10' double vertical side load, galvanized tube frame - brown coated, 18 space.

## Design Guidelines

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### 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) All door finishes and casings shall be stainless steel unless otherwise approved. Consult with Owner's representative regarding walls, floor and ceiling finishes.
- 8) 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.

## Design Guidelines

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### **Division 15 Reserved**

This division is reserved for future use.

### **Division 16 Reserved**

This division is reserved for future use.

### **Division 17 Reserved**

This division is reserved for future use.

### **Division 18 Reserved**

This division is reserved for future use.

### **Division 19 Reserved**

This division is reserved for future use.

### **Division 20 Reserved**

This division is reserved for future use.



## Design Guidelines

### Division 21 Fire Suppression

#### 21 05 00 Common Work Results for Fire Suppression

- 1) Where ceiling tile is used, fire suppression heads to be centered in tile.
- 2) All fire suppression heads shall be concealed type using flexible fire suppression heads.
- 3) All fire suppression piping shall be black iron.

#### 21 10 00 Fire Protection System Impairment Procedure

- 1) This Fire Impairment policy is to be followed during construction projects at NDSU.
  - A) Contractor shall supply fire watch personnel as required for their work. Costs for the additional manpower shall be included with bids.
- 2) Guidelines for planned work
  - A) All efforts must be made to keep the fire alarm system active.
  - B) If the scope of the work affects only the fire alarm in a few rooms, the system is not considered impaired. The smoke detectors should be covered while work is going on and then uncovered before the end of the work day.
  - C) If a large area of the building will be affected or the system must be put into walk test AND the building is occupied, the following procedure must be followed.
- 3) The following procedure shall be used when the fire alarm or fire suppression system is not in active service – this includes fire alarm systems placed in walk test. See International Fire Code 2015 for more details.
  - A) An impairment coordinator will be assigned to make sure the procedure is followed. The impairment coordinator will be used for project related shut downs or the Electricians for maintenance related shut downs.
  - B) A tag will be used to indicate that a system, or portion thereof, has been removed from service. The tag can be found in the impairment coordinator's office.
  - C) The tag shall be posted at each fire department connection, system control valve, fire alarm control unit, fire alarm annunciator and fire command center, indicating which system, or part thereof, has been removed from service.
  - D) Preplanned impairments shall be authorized by the impairment coordinator. Before authorization is given, the impairment coordinator shall be responsible for verifying that all of the following procedures have been implemented:
    - 1) The extent and expected duration of the impairment have been determined.
    - 2) The areas of buildings involved have been inspected and the increased risk determined.
    - 3) NDSU Police and Safety Office has been notified via email at [nds.police.safety@nds.edu](mailto:nds.police.safety@nds.edu).
      - a) The Police and Safety Office will notify the fire department
    - 4) Insurance carrier has been notified via email at [globalproperty.impairment@aig.com](mailto:globalproperty.impairment@aig.com).
    - 5) North Dakota State Fire and Tornado has been notified via email at [jbitz@nd.gov](mailto:jbitz@nd.gov) and [BMehlhof@nd.gov](mailto:BMehlhof@nd.gov).
    - 6) The fire watch personnel has been identified and established.
    - 7) The occupants have been notified.
    - 8) A tag impairment system has been implemented.
  - E) When unplanned impairments occur, emergency action will be taken to minimize potential injury and damage. Step D above will be implemented the best as possible.
    - 1) If a panel fails when campus is closed for an un-occupied building, the on-call person shall do the following:
      - a) Notify the Police and Safety Office that the fire protection system is down.
      - b) Notify their supervisor of the issue.
      - c) Contact the fire alarm or fire suppression company to get repairs going as quickly as possible.
      - d) Post an approved no fire watch sign on each entrance.
    - 2) If a panel fails when campus is closed for an occupied building (i.e. Residence Halls), the on-call person shall do the following:
      - a) Notify the Police and Safety Office that a fire protection system is down. Work with Campus Police to determine if they have someone available to help with fire watch.
      - b) Notify supervisor of the issue.

## Design Guidelines

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- c) Notify the appropriate department who will provide fire watch.
  - d) Contact the fire alarm or fire suppression company to get repairs going as quickly as possible.
  - e) Post an approved fire watch sign at each entrance.
- F) When the system is restored to normal working order, the impairment coordinator shall verify that all of the following procedures have been implemented:
- 1) Necessary inspections and tests have been conducted to verify that affected systems are operational.
  - 2) NDSU Police and Safety have been notified that protection is restored.
    - a) The Police and Safety Office will notify the fire department
  - 3) Insurance carrier and North Dakota State Fire and Tornado have been notified that protection is restored.
  - 4) The occupants have been notified that protection is restored.
  - 5) The impairment tag has been removed.

## Design Guidelines

### 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 stainless steel 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.
- 9) Water meter shall have a flanged ball valve on both sides of meter.

#### 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) Lettering on piping up to 1-1/4" size shall be 1/2" high.
    - 2) Lettering 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 ID tags. See section [01 77 00](#) for project close-out requirements regarding valve chart.
  - D) Mark all valves above ceilings with appropriately colored 1/2" diameter stickers.
  - E) Pipe identification shall be as follows:

ITEM	ABBRV.	PIPE COLOR	LETTERING COLOR
Cold Water (Potable)	CW	Blue	White
Hot Water (Potable)	HW	Green, Light	White
Circulating <u>H</u> ot Water (Potable)	CHW	Green, Light	White
Industrial Cold Water (Non-potable)	ICW	Green, Light	White
Industrial <u>H</u> ot Water (Non-potable)	IHW	Green, Light	White
Circulating Industrial <u>H</u> ot Water	CIHW	Green, Light	White
Reverse Osmosis	RO	Blue, Dark	White
Tempered Water	TW	Blue	White
Drain Line	D	Green, Dark	White
Storm Drain	STORM	Blue, Light	White
Sanitary Drain	SAN	Green, Dark	White
Vacuum	VAC	Blue, Dark	White
Compressed Air	AIR	Yellow	Blue
Laboratory Air	LAB AIR	Yellow	Blue
Natural Gas	GAS	Yellow	Black

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100 PSIG Steam	STM-100	Yellow	Black
60 PSIG Steam	STM-60	Yellow	Black
15 PSIG Steam	STM-15	Yellow	Black
Condensate	COND	Gray-Yellow	Black
Pumped Condensate	PCOND	Gray-Yellow	Black
Condenser Water Supply	CWS	Blue, Light	White
Condenser Water Return	CWR	Blue, Light	White
Chilled Water Supply	CHWS	Blue, Light	White
Chilled Water Return	CHWR	Blue, Light	White
Glycol-Heating Water Supply	GHWS	Green, Light	White
Glycol-heating Water Return	GHWR	Green, Light	White
Heating Water Supply	HWS	Green, Light	White
Heating Water Return	HWR	Green, Light	White
Heat Recovery Supply - Sys. 1	HRS-1	Green, Light	White
Heat Recovery Return - Sys. 1	HRR-1	Green, Light	White
Heat Recovery Supply - Sys. 2	HRS-2	Green, Light	White
Heat Recovery Return - Sys. 2	HRR-2	Green, Light	White
Heat Recovery Supply - Sys. 3	HRS-3	Green, Light	White
Heat Recovery Return - Sys. 3	HRR-3	Green, Light	White
Fireline (Zone No. 1)Sprinkler Piping	FIRE-1	Red	White
Fireline (Zone No. 2)	FIRE-2	Red	White
Fireline (Zone No. 3)	FIRE-3	Red	White
Fireline (Zone No. 4)	FIRE-4	Red	White
Radioactive		Yellow	Black
Toxic		Yellow	Black
Foam		Red	Black
Carbon Dioxide (Co <sup>2</sup> )		Red	Black
Halon		Red	Black

### 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"

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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:

Application	Pipe Size	Insulation Thickness
Cold water lines and Rain leaders	1-1/2" and less	1/2"
	2" and larger	1"
Hot water lines 106°F - 149°F	1" and less	1/2"
	1-1/4" to 3"	1"
	4" and over	1-1/2"
Hot water lines 150°F - 212°F	1" and less	1"
	1-1/4" to 3"	1-1/2"
	4" to 6"	2"
	8" and over	2-1/2"

- 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.

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- 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) CPVC piping preferred in open air plenums and in cases where high temperatures are a concern.
  - C) PVC may not be used in ventilation ceiling plenums.
  - D) 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.
  - E) PVC is the preferred piping material below grade.
  - F) Foam Core PVC shall not be used.
- 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) Water supply to all sinks shall have angle or straight stops installed with solid brass and ceramic disk construction. Acceptable brands are Wolverine Brass, Dahl or approved equal.
- 8) 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) All pure water piping shall be Schedule 80 PVC or PEX unless approved by Owner.
  - D) Pipes penetrating exterior walls must be installed to prevent breakage if building settles.
  - E) In general, pressure piping should not be placed under concrete slabs within buildings.
  - F) No piping should be run in concrete floors with the exception of waste piping.
  - G) No piping should be buried under the lowest floor level with the exception of waste piping.
  - H) 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.
  - I) 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.
- 9) Floor drain elevation shall be installed such at sufficient floor slope is provided for proper floor drainage. This is especially important if ceramic floor tile is to be installed.
- 10) Provide brass full-port ball valves at all water lines up to two inches in diameter.
  - A) All Pro-Press ball valves shall be 600lb bronze valves.
  - B) A full port flanged ball valves shall be installed where domestic water main enters the building.
- 11) An above floor inspection door shall be installed in each under floor duct to be used to pump out water.
- 12) Water booster skids shall be all stainless steel or brass. No steel is allowed in any part of the skid.

## Design Guidelines

### 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 with 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.
- 4) Storm Drain inlets shall have wording that reads "DUMP NO WASTE. DRAINS TO WATERWAY." or similar.

### 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, Leslie 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 submersible pump type by Goulds, Zoeller or approved 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.
- 3) No "Lab Water" systems are allowed.
- 4) If a soil trap is required, no bottom shelf shall be installed to allow for trap removal.
- 5) Hot water mixing valve
  - A) Provide Heat Timer, Leonard, Armstrong or approved equal. Watts IntelliStation shall not be used.

### 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 handle mounted, battery powered automatic flush valves. Flush valve shall not be located in wall.
  - 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 faucets maybe considered, consult with owner.
  - E) Shower valves shall be approved by Owner.
    - 1) Shower valves shall be provided with integral stops and protrude straight out, not at an angle.
  - F) Water saver shower heads should be installed in all shower rooms.
  - G) For fiberglass showers, one piece receptor base with screw-in strainer shall be used.
  - H) Use water saver aerators in all sinks and wash basins.
    - 1) Aerators shall be bubble stream, not needle stream.
    - 2) Aerators do not need to be tamper-proof.
  - I) Wall hung electric water coolers, Halsey Taylor, Elkay or approved equal, shall be vandal proof and constructed of stainless steel, without filters.
    - 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) Owner shall be consulted during design to ensure ease of functionality and future repair service.
    - 1) Contractor shall perform a functional test with Owner and make necessary adjustments for poorly functioning devices.
  - B) Place a floor drain under shower.
    - 1) Floor drains shall be recessed into floor and flooring properly sloped to ensure water runs towards drain.

## Design Guidelines

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- 2) Eyewash bowl shall drain to sanitary line, not onto floor.
- C) Water for emergency shower and eye wash stations shall be tempered.
  - 1) Mixing valve shall be constructed of bronze or stainless steel to minimize mineralization.
- D) When appropriate, faucet mounted eyewash station shall be Speakman SEF-1800-CA or approved equal.
- E) All water piping to emergency shower and eye wash stations shall be thoroughly flushed and all foreign material removed so as to not impede water flow.
- F) Emergency showers shall be provided with a booth or curtain for privacy.



### 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.
  - A) All heating valve connections shall be installed with unions to facilitate removal and repair.
- 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) Building Automation System shall be able to monitor fire/smoke damper position.
- 6) 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.
- 7) Pedestrian safety shall be considered when designing elements such as steam pressure relief systems.
- 8) Air-conditioning equipment and cooling towers shall be installed on the roof of the facility where ever possible and practical.
  - A) Stairs shall be provided over roof piping and ductwork as needed.
  - B) If mechanical equipment is to be placed on the roof, maintenance platforms shall be provided with access stairways. Ladders should not be needed to gain access to routine maintenance items. If ladders are still necessary, an enclosure shall be provided to store ladder(s) nearby.
- 9) 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.
- 10) 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.
- 11) 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.
- 12) 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.
  - A) Glycol system flush and fill must be witnessed by Owner. Lab testing of glycol is required.
- 13) 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.
- 14) Incorporate an economizer cycle on all supply air fans. Other strategies maybe be used following the requirements of ASHRAE Std 90.1 latest version.
- 15) Building Heating shall be accomplished with hot water systems heated from the central steam system.
- 16) Recover heating and cooling energy from exhaust air whenever possible and practical.
- 17) Furnish liberal quantity of hand air vent valves on closed circuit heating and cooling water systems.
- 18) 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.
- 19) 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

## Design Guidelines

- 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.
  - 20) All valves regardless of service, including future connections, shall be plugged or capped.
  - 21) All building services piping shall be installed as per ASME B31.9, including flanged connections.
  - 22) 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 equipment is properly identified.
  - 23) 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.
  - 24) Mark all valves above ceilings with appropriately colored 1/2" diameter stickers.
  - 25) All floor mounted mechanical equipment shall rest on 4" high housekeeping pad.
  - 26) All hangers and fasteners in mechanical rooms and exposed areas shall be prime coated and painted or galvanized.
  - 27) Grooved piping not allowed.
  - 28) All heating and chilled water piping shall be welded or threaded.
  - 29) Within the warranty period all hazardous cleaning required to perform warranty work shall be the responsibility of this work scope. Owner will provide a complete list of chemicals that the systems may have been exposed to.

### 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:

Blower Coil Units			
Ductwork System	Insulation Type	Insulation Thickness	Density
Supply Duct	Foil faced fiberglass	2"	3/4 lb/ft <sup>3</sup>
Return Duct	None	n/a	n/a
Mixed Air Duct	Foil faced fiberglass	2"	1-1/2 lb/ft <sup>3</sup>
Outdoor Air Duct	Sheet metal over rigid board fiberglass	2"	3 lb/ft <sup>3</sup>
Relief Air Duct	Foil faced fiberglass	2"	1-1/2 lb/ft <sup>3</sup>
Exhaust Fans			

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Ductwork System	Insulation Type	Insulation Thickness	Density
Exhaust duct from exhaust fan to 10'-0" back from exhaust fan.	Foil faced fiberglass	2"	1-1/2 lb/ft <sup>3</sup>

### Relief Air Hoods and Louvers

Ductwork System	Insulation Type	Insulation Thickness	Density
Relief duct from hoods and louvers to 10' back from hoods or louvers.	Foil faced fiberglass	2"	1-1/2 lb/ft <sup>3</sup>

### Mechanical Room Ductwork

Tops of ducts may be 2" foil faced fiberglass in lieu of rigid

Ductwork System	Insulation Type	Insulation Thickness	Density
Supply Duct	Sheet metal over rigid board fiberglass	2"	3 lb/ft <sup>3</sup>
Return Duct	None	n/a	n/a
Mixed Air Duct	Rigid board fiberglass	2"	3 lb/ft <sup>3</sup>
Outdoor Air Duct	Rigid board fiberglass	2"	3 lb/ft <sup>3</sup>
Combustion Air Duct	Rigid board fiberglass	2"	3 lb/ft <sup>3</sup>
Exhaust Air Duct	Rigid board fiberglass(10' back)	2"	3 lb/ft <sup>3</sup>
Relief Air Duct	Rigid board fiberglass(10' back)	2"	3 lb/ft <sup>3</sup>

- 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 2" thick pre-molded fiberglass insulation. 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.

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### 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:

Application	Pipe Size	Insulation Thickness
Hot water lines 120°F - 200°F	1" and less	1"
	1-1/4" to 4"	1-1/2"
	5" to 6"	2"
	8" and over	2-1/2"
Hot water lines 201°F - 250°F	1" and less	1"
	1-1/4" to 2"	1-1/2"
	2-1/2" to 4"	2"
	5" to 6"	2-1/2"
	8" and over	3"

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:

Application	Pipe Size	Insulation Thickness
Steam lines (Low Pressure) 201°F - 250°F	2" and less	1-1/2"
	2-1/2" - 4"	2"
	5" - 6"	2-1/2"
	8" and over	3"
Steam lines (Medium Pressure) 251°F - 305°F	1" and less	1-1/2"
	1-1/4" - 2"	2"
	2-1/2" - 4"	2-1/2"
	5" - 6"	3"
	8" and over	3-1/2"
Steam lines (High Pressure) 306°F - 460°F	1" and less	2"
	1-1/4" - 2"	2-1/2"
	2-1/2" - 4"	3"
	5" - 6"	3-1/2"
	8" and over	4" total thickness
Condensate lines	1" and less	1"
	1-1/4" - 2"	1-1/2"
	2-1/2" and over	2"
Flash Tanks	All	2"

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

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- 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.
      - 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 fiberglass 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.

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- 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) All projects with existing DDC controls must be updated to reflect changes in floor plans due to remodeling. This includes updating the graphics to show the new floorplan, correct placement of thermostats and sensors and correct room numbers. For any equipment added or altered as part of a remodeling project, the HV Supervisor should be consulted to determine if the equipment needs to be added to the controls system.
- 3) Provide temperature sensors on the inlet and outlet water piping for all heat transfer equipment such as coils and heat exchanger.
- 4) 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.
  - A) Any devices requiring a static IP address need to have a [DNS request](#) submitted.
- 5) Thermostatic Controls shall be adjustable units in private areas (office, conference, sleeping rooms) and non-adjustable in common areas (classrooms, auditoriums, corridors, etc).
- 6) To the extent feasible, establish separate temperature control zones that can be heated, cooled, or ventilated independently. Review temperature control zone layout with Owner.
- 7) All heating systems should have outdoor air resetting capabilities.
- 8) Low limit control. Consider software control low temperature limits on projects in which coils are filled with glycol in lieu of standard manual reset low limit controllers.
- 9) 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.
- 10) All low voltage control conduit shall be blue.
- 11) Fume hood controls shall be Antec, Phoenix, Critical Room Control (CRC) or approved equal.

### 23 20 00 HVAC Piping and Pumps

- 1) All future connections shall be valved and capped.
- 2) Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.
  - A) 2" through 12": Installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with center leg and red color code designed for operating temperatures from -30 degrees F (-34 degrees C) to +250 degrees F (+120 degrees C).
- 3) Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source. Flexible couplings shall be Grade "EHP" EPDM compound with center leg and red color code designed for operating temperatures from -30 degrees F (-34 degrees C) to +250 degrees F (+120 degrees C).
- 4) Install valves at all major connections and at each floor.
- 5) 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
- 6) Side-stream filters with either a ¾" or 1" view indicator shall be installed for chilled water and hot water heating

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- loops. Provide Owner with a carton of 30 micron filters.
- 7) Tangential air separator shall be used in hydronic loops with ball valve isolated automatic air vent.
- 8) Label valves with tags, valves used for isolating equipment do not require ID tags. See section [01 77 00](#) for project close-out requirements regarding valve chart.
- 9) Pumps shall be laser aligned prior to initial startup.

### **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 cast 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 and Low 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.

## Design Guidelines

- C) Valves 2" and larger shall be flanged, OS & Y, with stellite trim. (Optional for 1-1/2" and smaller). Acceptable 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 3/4" 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.

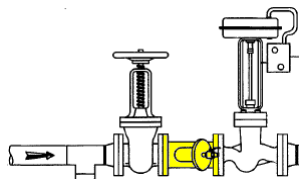


## Design Guidelines

- E) The conductivity probe shall be an ABB model# TB26-010111000332 with a 3/4" 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 or IMC.
- 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) All high and low PSI steam and condensate valves shall be class 150 SWP cast steel and stamped for high pressure steam applications.
  - 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.
  - C) Socket weld valves not allowed inside buildings.
- 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.
  - B) All flanged connections shall use spiral wound gaskets with B7 rated stud bolts.
- 4) Provide a clear access to all valves.
- 5) All steam gauges shall be rated for steam applications and supplied with a minimum 1/2", 800# forged steel isolation valve.
- 6) 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.
  - B) Install wye strainer with manual blow-down valve upstream of PRV.
  - C) PRV wye strainers shall be installed sideways (either the 3 or 9 o'clock position) in relation to piping:



- 7) Condensate pumps shall be either electric or positive displacement pressure-powered. The units shall be Johnson, 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.
- 8) Electric condensate pumps may be used for smaller loads and at Owner's discretion and shall have generator backup.
- 9) 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. Verify connection with Owner.
  - B) Conductivity Meter shall be an ABB Two Electrode Conductivity Sensor TB26, 392°F, 1-2000 µS/cm, with

## Design Guidelines

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.

- 10) All float and thermostatic traps shall have "H" pattern connections with isolation valves on both inlet and outlet.
- 11) 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.
- 12) Install strainer upstream from all steam traps. Strainer to be fitted with manual blow-down valve.
- 13) When thread-o-lets are used in steam and condensate, they shall be at least 1/2" in size and be supplied with at least 1/2" isolation valves.

### 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.
- 7) Avoid custom brand AHUs where possible. Parts need to be available in a timely manner.

### 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.

## Design Guidelines

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### **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, Daikin or Quantech 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.

## **Design Guidelines**

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### **Division 24 Reserved**

This division is reserved for future use.

### **Division 25 Integrated Automation**

There are currently no items for this division.

## Design Guidelines

### Division 26 Electrical

#### 26 05 00 Common Work Results for Electrical

- 1) All installations must meet the minimum standards of the latest approved edition of the National Electrical Code and Laws, Rules and Wiring Standards of North Dakota.
- 2) Work must be performed by a Licensed Electrician or apprentices and be done in a neat and workmanlike manor, at the discretion of the Owner.
- 3) All installations are subject to inspection by the Authority Having Jurisdiction and will be called in by the contractor.
- 4) No switchgear or ATS shall be located outside.
- 5) All new installations of services, switchgear, MCCs or panels shall have an OSHA approved arc-flash study done and be labeled accordingly.
- 6) Shunt trip breakers shall not be used during single phase conditions for main breakers.
- 7) 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.
- 8) Where applicable, provide general accessibility to ceiling spaces and pipe chases, to facilitate potential fixture changes or remodeling.
- 9) Where disconnects are required, non-fused shall be used where possible. Verify with Owner.
- 10) All conduit in Academic Buildings shall be a minimum of 3/4" EMT. Verify with Owner.
  - A) Conduit colors shall be as noted:

Type	Color	Notes
Fire Alarm	Red	Junction boxes shall be labelled "FA"
Emergency Power (Life Safety)	Red Bands	Junction boxes shall be labelled "EM POWER"
Telephone, Data, TV, A-V	Orange	
Temperature Controls	Blue	
Security	Yellow	
Lighting Controls	Green	

- 11) MC cable shall not be used in concealed spaces.
- 12) All receptacles, light switches and fire alarm devices shall be labeled accordingly (panel, circuit, device number, etc.) on the cover plate with printed 1/4" black text on clear label.
- 13) 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 overload relays.
  - D) Install variable frequency drives on motors that cycle and for energy efficiency.
    - 1) ABB, Square D or approved equal.
    - 2) Drives provided with circuit breaker disconnects, lockout and bypass.
  - E) All three phase motors shall have phase failure protection.
  - F) Encourage use of Electronic Control Module (ECM) motors for single-phase applications.
- 14) Receptacles (Outlets)
  - A) In stair towers, one (1) 120V receptacle duplex outlet shall be installed on each level.
  - B) White plastic device or outlet covers.
- 15) Raceways
  - A) Raceways shall be Legrand Wiremold 4000 or equal and installed such that it is possible to pull more wires without disassembling the Wiremold.
  - B) Raceway shall be used in all laboratories. Verify receptacle spacing with Owner.
- 16) 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

## Design Guidelines

future wiring.

- C) All junction boxes shall be within 4' of ceiling.
- 17) Sump pumps shall be connected, and report, to the fire alarm system.
- 18) Freezers and refrigerators may need conduit installed for possible connection to report to fire alarm system, review with Owner.

### 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 and shall emerge from grade in Schedule 80 PVC or rigid 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 Siemens.
  - A) Service entrance distribution equipment shall be supplied fully equipped with bussing and mounting hardware.
  - B) Circuit breakers in switchgear shall have built-in lockouts.
  - C) Provide Shark model 250, Veris or approved equal electrical meter, PT's, and C/T's. Provide the circuit monitor with display and Ethernet communication. Unit must be set up by a factory certified installer.
  - D) 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.
- 5) Main switchgear shall include phase loss monitor connected to Building Automation System.
- 6) All panelboards shall have hinged covers.

### 26 32 00 Packaged Generator Assemblies

- 1) Consult with Owner concerning back-up power generation requirements for new facilities.
- 2) Caterpillar, MTU, Cummins or approved equal. Kohler engines shall not be allowed. Service technicians shall be within one hour of campus.
- 3) All generators shall be diesel powered.
- 4) All generators shall have sight glass for coolant.
- 5) Generators shall be monitored by the fire alarm system. There shall be two (2) trouble points – one for generator running and one for generator trouble.
- 6) Generator shall have the ability to be started remotely with the building automation control system to comply with RICE NESHAP
- 7) ATS shall be States, Asco or approved equal.
- 8) A *Permit Application for Air Contaminant Sources* ([SFN 8516](#)) and *Permit Application for Internal Combustion Engines and Turbines* ([SFN 8891](#)) must be completed prior to the installation of generator.

### 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 if possible; battery-powered units are not preferred.
- 2) 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) Special consideration should be given to classroom lighting. Coordinate with Owner.
  - C) Minimize lighting used only for decorative purposes.
  - D) Minimize atypical lighting fixtures, lamps, and ballasts; consider life-cycle cost (including lamp replacement) and accessibility for maintenance in selecting lighting fixtures.

## Design Guidelines

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- E) Lighting controls shall be Acuity Nlight or Owner approved equal.
  - F) All lighting devices to have hard wired power. Battery only devices shall not be used. Wireless controls are acceptable.
  - G) Stairwell lighting shall be on landings and accessible with 10'-0" ladder unless approved by Owner.
- 3) Exterior Lighting
- A) General Outdoor Lighting
    - 1) All outdoor lighting shall be 5000k LED.
    - 2) All lights on building and in surrounding area to be turned on and off at one time from one point in building.
    - 3) Lights to be controlled by Owner provided RAB Light Cloud Controller LLControl 20/D10. Coordinate placement to work with existing system.
    - 4) Lights shall be turned on from contactor(s) by light cloud device or override/bypass switch.
  - B) Parking Lot and Street Lighting:
    - 1) Luminaire fixture shall be LED roadway cobra head light, 5000k (cool) LED. 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.
  - C) Walkway Lighting:
    - 1) Fixture shall be high output LED area light, bronze in color (RAB ALED5T78 or Owner approved equal).
    - 2) Lamps shall be 78W, 5000k (cool) LED.
    - 3) Poles shall be 12'-0" tall, bronze aluminum with tenon top and hinged base.
    - 4) Form for poured concrete base shall be supplied by Owner
  - D) Building Lighting:
    - 1) All lighting on buildings (wall packs, can lights, etc.) shall be 5000k (cool) LED or Owner approved.
    - 2) All lighting on new buildings or remodels shall be energized with contactor(s) controlled such that all lights turn on and off at the same time.

### 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.
  - 2) Telecommunications Room (Closet)
    - A) Common Work
      - 1) Note on the print that all items installed in this room shall have their mounting location approved by NDSU Enterprise Networks. This includes data racks, ladder rack, door access panels, electrical panel, fire alarm panel or panels, HVAC panels, lighting control devices/panels, electrical outlets, radio relay panel emergency responders, thermostats, and anything else mounted in the data room. Different contractors come in and mount their conduit, equipment, and panels in the data room without taking into consideration of anything else.
        - a) NDSU EN will provide a data room layout showing where everything is to be mounted.
      - 2) All low voltage cabling must follow Division 27 SPECS and any division other than Division 27 guiding low voltage cabling must reference to and follow Division 27 SPECS for installation.
      - 3) All pathways installed for Division 27 must comply with Division 27 SPECS.
      - 4) No carpet allowed in the data rooms.
      - 5) No plumbing pipes or ductwork will be installed in the data room unless it's for use in the data room.
      - 6) No ceiling in data rooms and walls must be painted all the way to the deck.
    - B) Power
      - 1) Note on print that the placement of all outlets and switches will be approved by NDSU Enterprise Networks prior to installation. Placement is required in specific location to be accessible to the data racks and various panels without the need for extension cords or hard wiring.
      - 2) Note on the print conduit shall not run horizontally on walls between 18 inches to 8' 4"
      - 3) All circuits must be tied to an emergency generator when available
      - 4) AC outlets to be mounted at 18 inches to center.
      - 5) AC outlets will be installed behind the data racks
        - a) For rooms with 1 or 2 racks, there will be 1 - NEMA L5-30R outlet
        - b) For rooms with 1 or 2 racks, there will be 2 - 20 amp 120 volt outlets on separate electrical phases
        - c) For rooms with 3 racks, there be 2 - NEMA L5-30R outlets
        - d) For rooms with 3 racks, there will be 4 - 20 amp 120 volt outlets on separate electrical phases
      - 6) There will be a minimum of 7 quad 20 amp 120 volt outlets in the data rooms – placement determined by NDSU Enterprise Networks
      - 7) Building UPS based on building design
    - C) Lighting
      - 1) Use LED strip lights that provide a minimum of 8,000 lumen at 5000K each and minimum of 30 LED watts.
      - 2) Install lights parallel with the data racks one in front of the data rack(s) and one behind the data rack(s) to provide sufficient lighting on both sides.
      - 3) Note on print, rack layout to be determined by NDSU Enterprise Networks so lights are properly positioned to run perpendicular to data rack fronts and backs.



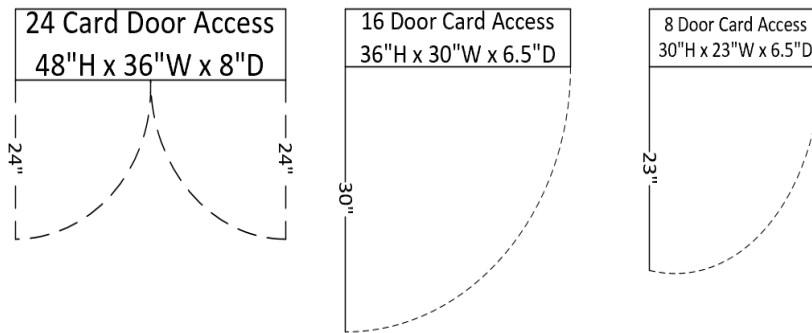
## Design Guidelines

- D) Plywood
  - 1) Plywood will be installed on all walls vertically.
    - a) Place at least 4" above floor to allow space for base trim installation.
    - b) Paint light gray, do not paint over the fire rating logo
    - c) screws used to mount plywood shall be flush
- E) Grounding (place on the detail on the print)
  - 1) Use BICSI rated ground bars for data rooms.
  - 2) Use 2 hole compression lugs.
  - 3) List Wire size for ground wire to electrical service.
  - 4) #6 AWG for all equipment and racks in the data room.
- F) Fire Alarm (Note the following on bid and construction specifications and on print details to ensure contractors understand the work they are required to complete)
  - 1) Conduit for fiber to fire alarm panel will be 1 ¼".
  - 2) Install a fiber box inside the fire alarm panel. Corning SPH-001 or equal.
  - 3) Install an SC fiber adaptor plate in the fiber box.
  - 4) Contractor is responsible for supplying, installing and testing all fiber patch cords to activate the fire alarm panel in NDSU's looped system except for the building interconnection in QBB – though the vendor will remain responsible for end to end testing and certification.
    - a) In the Fire Alarm Panel, install a 2 meter SC/SC fiber jumper from fiber box to the fire alarm media card.
    - b) Lower fiber strand number is the IN fiber and the Higher fiber strand number is the OUT fiber.
    - c) In the MDF data room install 1 meter SC/SC fiber jumper from strands that come from QBB designated by NDSU EN to Strands 1 and 2 of the cable that feeds the fire alarm panel.
      - i) If the fire alarm panel fiber feeds to an IDF, it will require additional 1 meter SC/SC fiber jumpers for the connection to MDF
    - d) For QBB ONLY, NDSU EN will provide and install 2 custom length fiber jumpers, one for the IN and one for the OUT on the fire alarm loop.
      - i) Vendor will be responsible to test end to end fiber communications including the fiber path through QBB.
    - e) Campus Police, NDSU EN, and NDSU Electricians must be notified when connecting the fire alarm panel into the loop as it will set off the alarm.
- G) Data Room Layout and Construction Print Specific Directives
  - 1) Typical Data room layouts are dependent on what items are housed in the room – some of the potential items are listed below. Ensure all items going in data room are document on the print with proper clearances as these items directly impact the room size requirements.
    - a) MDF/Data rooms with 3 racks Minimum Size = 10' x 13'
    - b) IDF Minimum Size = 10' x 10'
    - c) 2 data racks will support up to 280 cables
    - d) 2 data racks with vertical management foot print equals 4' width x 6' length plus need 3' clearance in front of racks
    - e) 3 data racks will support up to 520 cables
    - f) 3 data racks with vertical management foot print equals 4' width x 8' 6" length plus need 3' clearance in front of racks
    - g) Need 3 feet clearance in front of vertical management of data racks
    - h) Electrical Panel make sure can meet code clearances
    - i) No electrical conduit to be installed horizontally from 18" to 8'
    - j) Door Access Panels make sure can meet code clearances. Might need more than 1 panel per room depending on door count. Measurements of panels below.
    - k) 4" x 20" BICSI Rated TMGB ground bar mounted towards top of plywood
    - l) 4" sleeves through floors
  - 2) Potential Date Room Items that will impact the Data Room size.
    - a) Classroom Technology Cabinet/Rack. Make sure there is room. Work with NDSU Classroom Tech on cabinet size requirements.
    - b) Area of Rescue controller. Get size from manufacturer.

### Design Guidelines

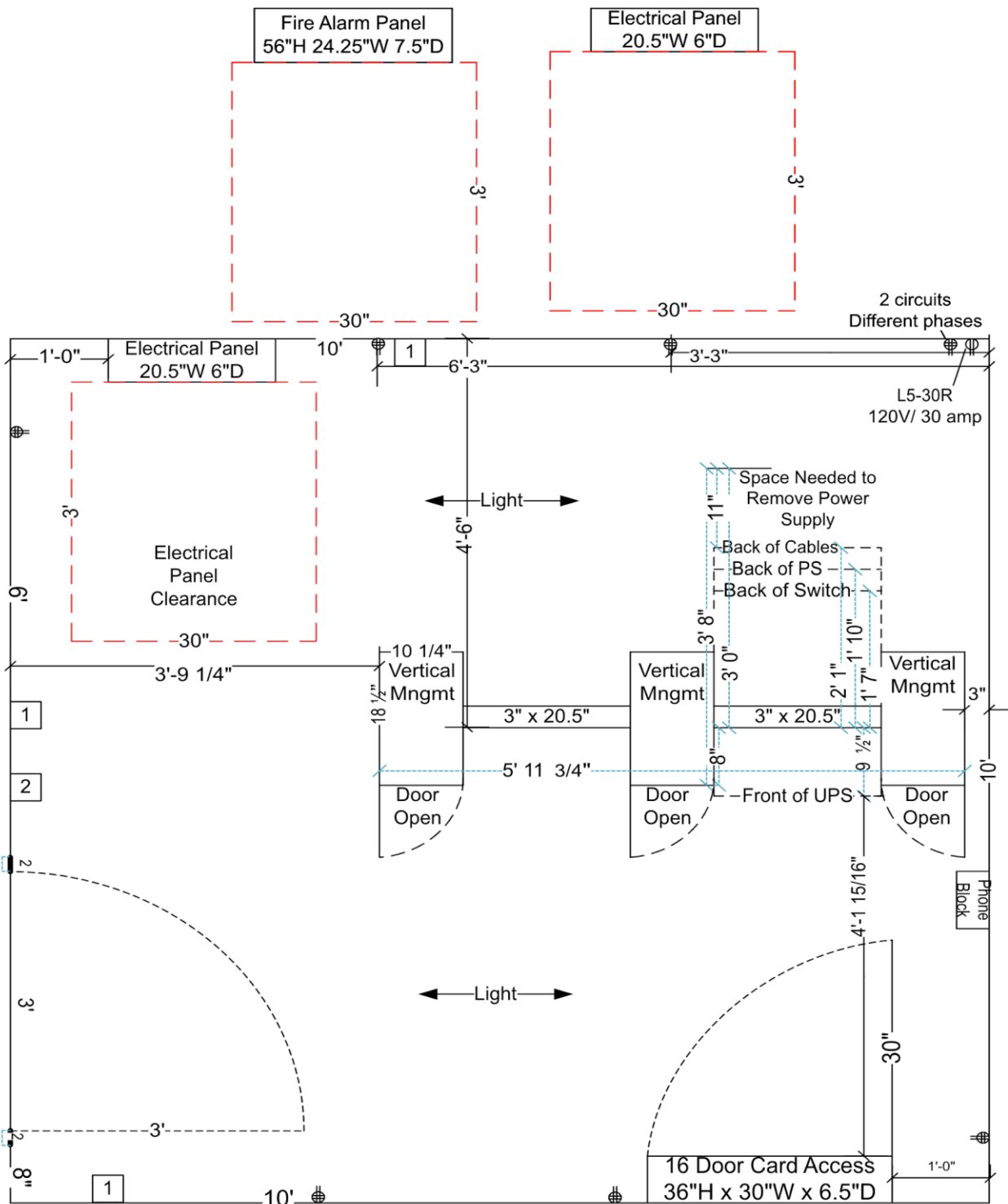
- c) Fire Alarm Panel make sure can meet code clearances. Show on print if fire alarm is 1 or 2 panels for spacing needs. Panel measurements below.
- d) Emergency Response System. Get measurements from manufacturer.
- e) Temp control panels make sure can meet clearances. Get panel measurements from manufacturer.
- f) Lighting control equipment make sure can meet clearances. Get panel measurements from manufacturer.
- g) Wiring Closet Examples and Notes:

Example A: Typical Card Access Panel Sizes



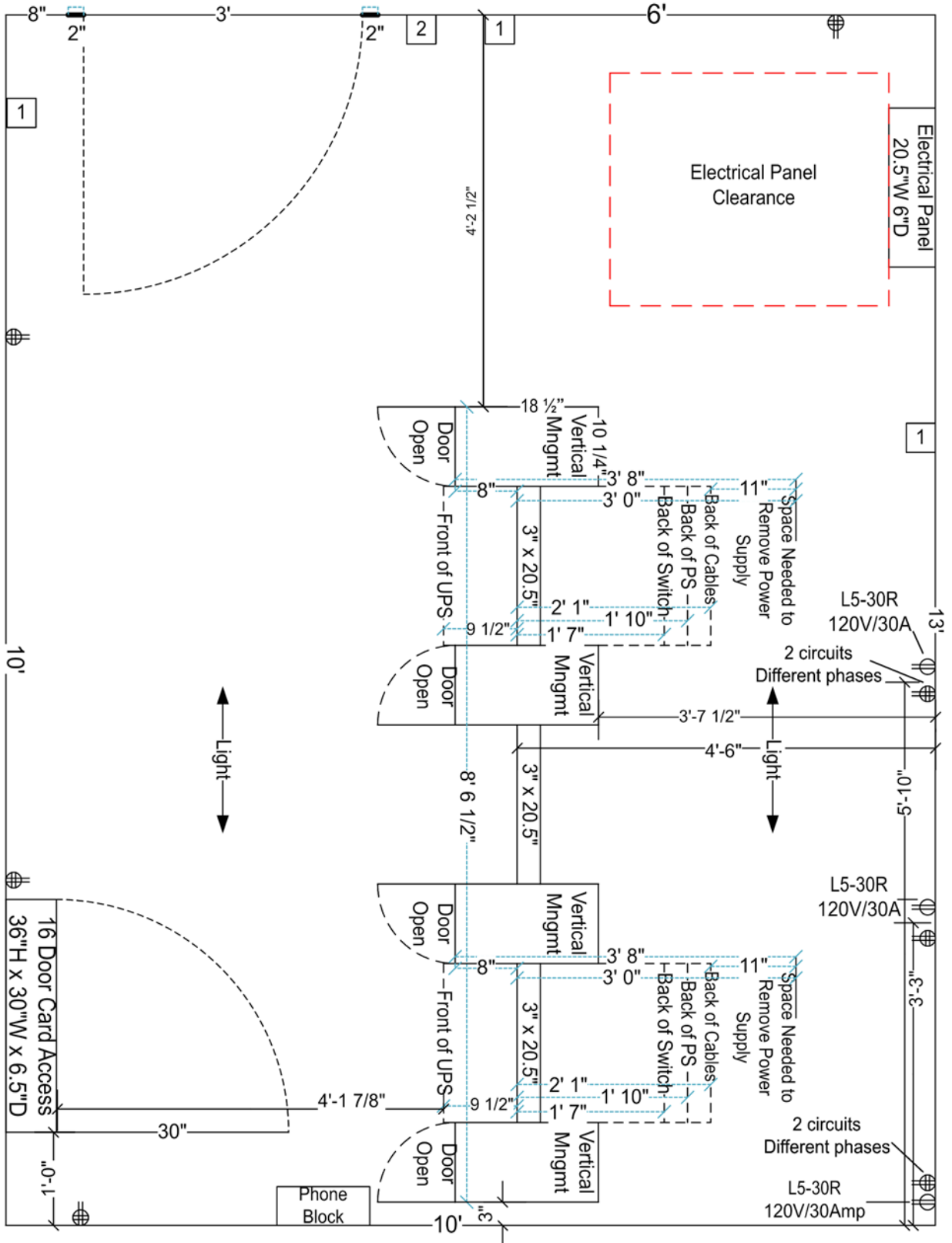
## Design Guidelines

Example B: 2 Rack Data Closet



### Design Guidelines

Example C: 3 Rack Data Closet



## Design Guidelines

- 3) Rough In CONDUIT
  - A) Conduit for communications will be minimum of 1" Follow manufacturers conduit fill chart to ensure there is sufficient space for the required number of cables.
  - B) Each data location will have its own conduit. Do not combine 2 locations into 1 conduit.
  - C) Wireless Access Points should have their own conduit with 4 11/16 inch box with single gang mud ring.
- 4) Wire Mold
  - A) Opening on the back of the dual channel wire mold will be large enough to access the electrical box behind the wire mold.
    - 1) Must be able to access the conduit to push a fish tape in.
- 5) Cable Tray
  - A) Cable tray T's off from the hallway routing into the data room shall have 50% additional capacity beyond the expected capacity needed.
  - B) Remodels (Note the following on bid, construction/demolition specifications and on print details to ensure contractors understand the work they are required during demolition)
    - 1) All demolished cables will be removed from end to end. This includes the patch cable in the data room hooked up to the network switch.
      - a) Verify network switch port associated with cable to be demoed with tester.
      - b) Disconnect patch cable from network switch port associated with cable being demoed before cutting any cable.
      - c) When patch cables are removed from the network switch, update the NDSU EN documentation that is in the data room and communicate updates to NDSU EN.
- 6) Door Access
  - A) Two data cables to each door access panel.
  - B) Door access cabling will follow the same methods for supporting and sleeves as telecommunication cables. Installation will follow applicable BICSI or other standards.
  - C) If Door Access/control cabling/telecommunication cables run through same hook system/ cable tray/ sleeves and different contractors are doing the work they will have to work together to make sure that the extra capacity for the support system/sleeves meets the specs.
- 7) Control Panels
  - A) Show on print which control panels need to have data cables.
- 8) Manholes/Vaults/Steam Tunnels
  - A) Contractor is responsible for pumping water out of manholes/vaults to proceed with work they need to perform.
  - B) Contractor is responsible for following all safety measures needed to work in manholes/vaults/steam tunnels.
  - C) Contractor responsible for cleaning and removing all material and garbage they bring into manholes/vaults/steam tunnels.
- 9) Pathways
  - A) Sleeves, J-Hooks, cable trays. Plan sleeve, J-hook and cable tray capacities to include all cables utilizing the pathway such as door access, telecommunications and control cable. Verify that there is 50 percent extra capacity for future or run cabling in separate pathways to leave an extra 50 percent capacity.
- 10) Wireless Access Points
  - A) Note on the print the contractor is responsible for installing owner provided WAP mounts and WAPs
  - B) Rough In for WAP's
    - 1) Shall not be combined in the same outlet box as a regular network drop.
    - 2) Install its own conduit
    - 3) Install 4 11/16 inch box with single gang mud ring
  - C) Wall mount WAP's.
    - 1) Shall not be mounted on single or dual channel wire mold.
    - 2) Need to be mounted vertically on their own outlet box.
  - D) Ceiling, exterior and explosion-proof WAP's.
    - 1) Need to be mounted facing down
    - 2) Will be mounted at a height of at least 8 feet but not exceeding 14 feet.
    - 3) Nothing shall be mounted below a WAP. Ex. Ductwork, plumbing, or anything else as it affects the

## Design Guidelines

signal.

- 4) No WAP's will be mounted higher than 14 feet.
- 5) Indicate on the construction print the type of WAP to be installed according to the mounting bracket (See attached Spec sheets)
  - a) Type A - Ceiling WAP, Aruba AP-MNT-A mount , 9/16" T-Beam Rail (such as Armstrong Suprafine 9/16" Exposed Tee)
    - i) Provide 10 foot service coil above suspended ceiling
    - ii) Terminate cable and install a 2 port surface box
  - b) Type B - Ceiling WAP, Aruba AP-NMT-B mount, 15/16" T-Beam Rail (such as Armstrong Prelude 15/16" Exposed Tee)
    - i) Provide 10 foot service coil above suspended ceiling
    - ii) Terminate cable and install a doghouse above the ceiling
  - c) Type C - Ceiling WAP, Aruba AP-NMT-C mount, 9/16" Profile Rail (such as Armstrong Interlude 9/16"), 9/16" with ¼" Bolt slot Rail (such as Armstrong Silhouette 9/16" Bolt slot ¼"Reveal), 9/16" with ⅜" Bolt slot Rail (such as Armstrong Silhouette 9/16" Bolt slot ⅜"Reveal)
    - i) Provide 10 foot service coil above suspended ceiling
    - ii) Terminate cable and install a doghouse
  - d) Type D - Ceiling WAP, Aruba AP-MNT-D mount, Solid Surface Mount
    - i) Install 4 11/16" electrical box with single gang mud ring
  - e) Type E - Ceiling WAP, Aruba AP-MNT-E mount, Junction Box Mount, hard lid ceilings, where there is no ceilings
    - i) Install on 4 11/16" outlet box with single gang mud ring
  - f) Type F - Ceiling WAP, Oberon 1006-xx mount, Right Angle WIFI Access Point Wall Bracket (Used to mount ceiling style WAP's on the wall to maintain a height of 14 feet or below when ceilings are high)
    - i) Install a 4 11/16" outlet box with a single gang mud ring.
    - ii) Terminate cable with standard faceplate
    - iii) Mount this bracket right below the face plate
  - g) Type G - Wall Mount WAP, Aruba MNT1 mount, Wall Mount Installation
    - i) Mount 4 11/16" outlet box with single gang mud ring
  - h) Type H - Exterior and dust rated ceiling WAP, Aruba AP-270-MNT-H2 mount
    - i) Install double gang with a blank cover
  - i) Type I - Exterior and dust rated ceiling WAP, Aruba AP-270-MNT-V2 arm mount (Used to mount ceiling style WAP's on the wall to maintain a height of 14 feet or below)
    - i) Install a double gang with a blank cover
  - j) Type J - Explosion proof ceiling WAP, Aruba AP-270-MNT-H2 mount, (Mount to be used is the same as type H)
    - i) Install double gang box with blank cover
  - k) Type K - Explosion proof ceiling WAP, E Aruba AP-270-MNT-V2 arm mount (Mount to be used is the same as Type I) (Used to mount ceiling style WAP's on the wall to maintain a height of 14 feet or below)
    - i) Install double gang box with blank cover
- 11) Cameras
  - A) Note on the print contractor responsible for mounting and focusing all cameras
- 12) Redlines
  - A) Contractor responsible for providing digital copy of redlines showing the cable ID's on the print.

### 27 10 05 Telecommunications Cabling

- 1) General
  - A) Reference Standards
    - 1) ICEA S-83-596 - Indoor Optical Fiber Cables 2016.
    - 2) TIA-568-C.3 - Optical Fiber Cabling Components Standard 2016.
    - 3) TIA-598-D - Optical Fiber Cable Color Coding 2014d.
    - 4) NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction,

- Including All Applicable Amendments and Supplements.
- 5) TIA-492CAAB - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak 2000 (Reaffirmed 2005).
  - 6) TIA-492CAAA - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers 1998 (Reaffirmed 2002).
  - 7) UL 1651 - Fiber Optic Cable Current Edition, Including All Revisions.
  - 8) UL 444 - Communications Cables Current Edition, Including All Revisions.
  - 9) ICEA S-83-596 - Indoor Optical Fiber Cables; Insulated Cable Engineers Association; 2011 (ANSI/ICEA S-83-596).
  - 10) CEA-310 - Cabinets, Racks, Panels, and Associated Equipment; Consumer Electronics Association; Revision E, 2005.
  - 11) NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006. (ANSI/NECA/BICSI 568)
  - 12) NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
  - 13) TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; Telecommunications Industry Association; 2012.
  - 14) TIA-526-7 - OFSTP-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant; Telecommunications Industry Association; 2002.
  - 15) TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015
  - 16) TIA-568-C.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Telecommunications Industry Association; Rev C, 2009.
  - 17) TIA-568-C.3 - Optical Fiber Cabling Components Standard; Telecommunications Industry Association; 2008 (with Addenda; 2011).
  - 18) TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.
  - 19) TIA-569-C - Telecommunications Pathways and Spaces; Telecommunications Industry Association; Rev C, 2012 (with Addenda; 2013).
  - 20) TIA-598-C - Optical Fiber Cable Color Coding; Telecommunications Industry Association; Rev C, 2005.
  - 21) TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Telecommunications Industry Association; Rev B, 2012.
  - 22) TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Telecommunications Industry Association; Rev B, 2012 (with Addenda; 2013).
  - 23) ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.
  - 24) UL 444 - Communications Cables; Current Edition, Including All Revisions.
  - 25) UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; Current Edition, Including All Revisions.
  - 26) UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.
- B) Administrative Requirements
- 1) Coordination
    - a) Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
    - b) Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
    - c) Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
    - d) Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
  - 2) Arrange for Communications Service Provider to provide service.
  - 3) Preinstallation Meeting: Convene a minimum of one week prior to commencing work of this section to review service requirements and details with NDSU Facilities Management representative. Contractor shall have the cabling project manager and installation foreman present for this meeting. Additionally,

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- a representative from the General Contractor's project management team and electrical contractor shall be in attendance when this scope of work is performed under a subcontract to either party.
- C) Submittals
    - 1) Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
      - a) Storage and handling requirements and recommendations.
      - b) Installation methods.
    - 2) Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
      - a) Provide in writing as part of the Shop Drawing Submittal that the selected wiring and device Manufacturers system Warranty meets the requirements of Paragraph 1.08 Warranty.
      - b) Provide floor plan drawings showing suggested routing of cabling to the furthest telecommunications jack from the assigned termination rack to confirm telecommunications outlets and associated devices with telecommunications cabling connections are within rated distances of the assigned MDF/IDF Rooms. If cabling distances exceed the recommended manufacturer distances the bidder shall provide written notice to the Engineer for clarification in the shop drawing submittals.
      - c) Confirm drawings show sufficient quantity and size of cable pathways and cable tray. Note any required revisions to pathway sizes or routing in the shop drawing submittal floor plan drawings.
    - 3) Manufacturer Qualifications.
    - 4) Evidence of qualifications for installer(s).
    - 5) Field Test Reports.
    - 6) Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
      - a) Record actual locations of outlet boxes and distribution frames.
      - b) Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
      - c) Identify distribution frames and equipment rooms by room number on contract drawings.
    - 7) Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.
  - D) Quality Assurance
    - 1) Manufacturer Qualifications: At least 3 years' experience manufacturing products of the type specified.
    - 2) Installer Qualifications: A company having at least 3 years' experience in the installation and testing of the type of system specified, and:
      - a) Employing a BICSI Registered Communications Distribution Designer (RCDD).
      - b) On site foreman shall possess a current BICSI Installer 2 certification, and all installers shall possess a current Panduit installer certification.
    - 3) Products: Listed, classified, and labeled as suitable for the purpose intended.
  - E) Delivery, Storage and Handling
    - 1) Store products in manufacturer's unopened packaging until ready for installation.
    - 2) Keep stored products clean and dry.
  - F) Warranty
    - 1) Correct defective Work within a 1 year period after Date of Substantial Completion.
    - 2) Manufacturer shall warranty and provide maintenance service for 15 years minimum on the network system and a lifetime for products used in the system.
- 2) Products
- A) System Design
    - 1) Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
      - a) Comply with TIA-568 (cabling) and TIA-569 (pathways), latest editions (commercial standards).
      - b) Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
      - c) Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F



## Design Guidelines

- at relative humidity of 0 to 95 percent, non condensing.
    - d) In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
  - 2) System Description:
    - a) Building Entrance Conduit: 4" Schedule 40 PVC.
    - b) Telephone Backbone: 100 pairs, copper. See detail on the drawings.
    - c) Data Network Backbone: 24 strands of single mode fiber optic cable. See detail on drawings.
    - d) Horizontal Cabling: Copper.
  - 3) Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
    - a) For the entire campus there is one main distribution frame and for each building there is a building distribution frame (BDF) that functions as the main distribution frame (MDF) for that building.
    - b) Locate main distribution frame as indicated on the drawings.
    - c) Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.
  - 4) Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
    - a) Locate intermediate distribution frames as indicated on the drawings.
  - 5) Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.
  - 6) Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".
- B) Pathways
  - 1) Outlets
    - a) Sheetrock walls and ceiling installations: 4 11/16 inch by 2 1/8 inch deep with single gang plaster ring.
    - b) Masonry Walls: Single gang, 3 1/2 inch deep masonry box.
  - 2) Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.
- C) Copper Cable and Terminations
  - 1) For all underground conduits, including those within the building, the following will be used:
    - a) Superior Essex Group SEALPIC-F (RUS PE39) water resistant with aluminum shield.
    - b) 24 AWG, non-shielded, copper conductors.
    - c) ETPR compound filling with polyethylene jacket.
    - d) Pairs as indicated on the drawings.
    - e) Color Code: Standard telephone industry specifications.
  - 2) Manufacturer: General Genspeed 5500, Commscope 5504M or Superior Essex Cobra 52-200-8
    - a) Plenum rated cable, NFPA 70 type CMP
  - 3) Copper Horizontal Cable: TIA/EIA-568 Category 6A solid conductor unshielded twisted pair (UTP), 23 AWG, 100 ohm; 4 individually twisted pairs; complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444.
    - a) Manufacturer: General Genspeed 10000 or equal by Approved Manufacturer.
      - i) Panduit NUL6X Series.
      - ii) General Cable Genspeed 10000 Series.
      - iii) Berk Tek LANmark 10G2 Series.
      - iv) Commscope Ultra 10 Series.
      - v) Approved Equal.
    - b) Plenum rated cable, NFPA 70 type CMP.
    - c) Jacket Color:
      - i) Data, Telephone, Wireless Access Points: Blue
      - ii) Surveillance Cameras: Yellow
      - iii) Lighting Controls: Green
  - 4) Copper Horizontal Cable installed in underground conduit, including those within the building, require

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- the following cable:
- a) GenSpeed 10 UTP indoor/outdoor plenum cat 6A rated cable or equal
  - 5) Jacks and Connectors: Category 6A, 8 position, 8 wire, Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
    - a) Category 6A jacks shall be used.
    - b) Performance: 500 mating cycles.
    - c) Data Jacks: 4-pair, pre-wired to T568B configuration.
    - d) Connector modules shall be Panduit CJ6X88TG.
    - e) a. In locations where the minimum bend radius cannot be met such as in wire mold or modular furniture, utilize a Panduit 45 degree up/down wire cap or a Panduit 45 degree left/right wire cap.
      - i) Panduit CJUDCAPBU for up/down. or equal
      - ii) Panduit CJLRCAPBU for left/right. or equal
    - f) Jack Colors:
      - i) Data, telephone, Wireless Access Points Applications: Orange.
      - ii) Video Surveillance: Yellow.
  - 6) Copper Patch Cords
    - a) Description: Factory-fabricated, Category 6A 4-pair cable assemblies with 8-position modular connectors terminated at each end.
      - i) Approved Manufacturer: Ortronics, Allen Tel, Or Equal.
      - ii) Quantity: One per patch panel port. All jacks shall be active. Layout and routing will be defined by NDSU Enterprise Networks.
      - iii) Length: As needed to provide 10-14 inches (10" minimum, 14" maximum) of slack for each patch cord. Provide a mock-up of patch cable installation with approval from NDSU Enterprise Networks prior to completing patch cable install.
    - b) Color: As indicated below
      - i) Data, telephone, Wireless Access Points: Blue
      - ii) Video Surveillance: Yellow
    - c) Labels: Patch cables shall be installed with wrap around labels on each end with the switch and patch panel information on both sides.
      - i) Example (print the underlined identifiers on each end of the patch cable):
        - i. SW 1-23 -- (Switch 1 Port 23)
        - ii. PP 1-32 -- (Patch Panel 1 Port 32)
      - ii) Labels shall face so they are readable without twisting the cable when plugged into the switch and patch panels.
      - iii) Labels shall all face the same direction.
      - iv) If greater than 10% of labels are peeling within 1 year warranty period, all labels shall be replaced with a higher quality wrap around label to prevent future peeling.
    - d) Patch cords shall be straightened prior to installation so they may be neatly trained, without coiling, when installed.
    - e) Group in bundles and secure with 3/4" hook and loop fasteners.
  - 7) Faceplates:
    - a) Modular faceplates shall be Panduit Mini-Com Classic Series faceplates.
    - b) Plastic plates with label ID windows.
    - c) Color to match devices as specified.
    - d) See Drawings for quantity of connector modules and modular faceplates.
    - e) Provide with color coordinated screw cover and clear station and port label covers.
    - f) Provide blank inserts for unused ports.
  - D) Fiber Optic Cable and Interconnecting Devices
    - 1) Fiber Optic Cable:
      - a) Description: Tight buffered, indoor/outdoor rated, non-conductive fiber optic cable complying with TIA-568-C.3, TIA-598-D, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
      - b) Cable Type: Singlemode, 9/125 um (OS1), complying with TIA-492-CAAA. Singlemode, 9/125 um (OM1) complying with TIA-492CAAA.

- c) Cable Capacity: Quantity of fibers as indicated on drawings.
- d) Cable Applications: Use listed NFPA 70 Type OFNP plenum cable unless otherwise indicated.
- e) Cable Construction:
  - i) Interlocked armor with plenum rated non-conductive jacket.
  - ii) Water blocking with polymer coated yarn.
  - iii) Operating Temperature: -20 to +85 Celsius.
  - iv) Bend Radius: 15X outside diameter (installation), 10X (long term).
  - v) Flex resistance: minimum 1,000 cycles.
- f) Cable Jacket Color:
  - i) Single-Mode Fiber (OS1/OS2): Yellow.
- g) Products:
  - i) OCC DX Series or equal by Approved Manufacturer.
- 2) Fiber Optic Cable for Fire Alarm:
  - a) Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568-C.3, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
  - b) Cable Type: Singlemode, 9/125 um (OS1).
  - c) Cable Capacity: 6 strand.
  - d) Cable Applications: Use listed NFPA 70 Type OFNP plenum cable unless otherwise indicated, any fiber not in conduit shall be interlocked.
  - e) Cable Jacket Color:
    - i) Single-Mode Fiber (OS1/OS2): Yellow.
  - f) Manufacturers:
    - i) OCC DX Series or equal by Approved Manufacturer.
- 3) Fiber Optic Adapters and Fuse On Connectors: Duplex SC connectors for both data and fire alarm fibers, adaptors with zirconia ceramic alignment sleeves; complying with relevant parts and addenda to latest edition of TIA/EIA-568 and with maximum attenuation of 0.5 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21.
- E) Grounding and Bonding Components
  - 1) Comply with TIA-607.
- F) Identification Products
  - 1) Comply with TIA-606.
- G) Source Quality Control
  - 1) Factory test cables according to TIA-568.
- H) Cross-Connection Equipment
  - 1) Patch Panels for Copper Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 16 gauge steel with black powder coat finish; cabling terminated on modular connectors.
    - a) 48 port, all metal construction, modular patch panel frames, populated with Category 6A jack connectors, by approved equipment manufacturer. The data network, telephones, wireless access points, cameras. Coordinate with the owner.
      - i) For Data rooms with 1 or 3 racks use angled patch panels.
      - ii) For Data rooms with 2 or 4 racks use flat patch panels.
    - b) Manufacturers:
      - i) Panduit CP Series (Not the CPP series).
    - c) Capacity: Provide ports sufficient for all installed cables to be terminated plus 25% spare.
    - d) Hoffman DCHD2 horizontal wire management panels shall be provided above and below CP48BLY patch panel frames for front and rear patch cable management.
    - e) Provide 1 Hoffman DCHS2 for each Network electronic (switch) - quantity to equal the number of 48 port patch panels.
  - 2) Patch Panels for Fiber Optic Cabling:
    - a) 16 gauge steel construction, powder coated with black finish.
    - b) Size: for termination of fiber quantities as indicated on the drawings, plus 25% spare capacity.
    - c) Adaptors: As specified above under FIBER OPTIC CONNECTORS.
    - d) Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.

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- e) Provide with incoming cable strain relief, bend radius control, and routing guides.
- f) Provide rear cable management tray at least 8 inches deep with removable cover for rack mounted enclosures.
- g) Provide dust covers for unused adaptors.
- h) Rack Mounted: Sized to fit EIA standard 19 inch wide equipment racks:
  - i) Panduit FRME Series.
  - i) Wall Mounted.
    - i) Panduit FWME Series.
- I) Enclosures
  - 1) Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
    - a) Size: 48 inches wide by 96 inches high or as noted on the drawings.
    - b) Do not paint over UL label.
    - c) Wrap all data rooms with plywood from 4" to 8' 4" AFF unless noted otherwise on the drawings. Ensure space is left open for baseboard trim as noted.
    - d) Paint Light Gray
    - e) Screws to be flush with plywood to accommodate mounting of equipment
      - i) Entire sheet of plywood will be firmly secured to wall
  - 2) Equipment Racks and Cabinets: CEA-310 standard 19 inch wide component racks.
    - a) Floor Mounted Racks: Two post, open frame, heavy aluminum construction; vertical and horizontal cable management channels and grounding lug.
    - b) Manufacturer
      - i) Chatworth 55053 Series.
      - ii) Hoffman EDR Series.
      - iii) Panduit R2P Series.
    - c) Description: Standard 19" rack meeting EIA-310-D standards. 84" high, aluminum construction, black in color. 45 rack spaces minimum.
    - d) Mounting: Floor mount. Secure to floor, wall structure and to ladder rack systems.
    - e) Wire Management: Provide cable management for each rack as follows:
      - i) Vertical Wire Management: aluminum construction, powder coat finish, with hinged door, equal to Hoffman DV10D7 Series on each side of each rack.
      - ii) Horizontal Wire Management to be equal to Hoffman DCHD2 Series. Provide one above and below each patch panel installed.
      - iii) 1 Hoffman DCHS2 for each Network electronic (switch) - quantity to equal the number of 48 port patch panels.
      - iv) All Installed Ladder Rack: Minimum 18" wide, adjustable rung, black in color, equal to Chatworth 14300-718 Series. Install ladder rack the entire length of the MDF/IDF centered above the data racks and then to the adjacent walls.
      - v) Adjust ladder rack rungs to avoid landing directly above the vertical cable management.
      - vi) Install 6" elevation kits, Chatsworth 10506-706 or equal, on each rack to attach rack to ladder rack.
      - vii) Provide Tool-less Cross Member Radius Drop Chatsworth 14304-718 or equal accessories for connecting overhead ladder rack to the data racks in BOTH directions above each vertical cable management, on each rack. (2 dropouts above each vertical management, installed such that cables may be dropped into the vertical management from both directions)
      - viii) Route Ladder rack down walls to floor penetrations where ladder rack is routed up walls to overhead systems in MDF/IDF Rooms.
      - ix) For vertical cable routes, secure cables to tray/ladder rack at no greater than 2 foot intervals utilizing 3/4" hook and loop cable fasteners.
      - x) For horizontal cable routes, secure before, in the middle and after route angle changes.
    - f) Power Management:
      - i) Provide UL listed vertical power strip, 20 amp rated, (24) NEMA 5-20R outlets and an integral circuit breaker and 10 foot cord equal to Hoffman model DP1N622420.
      - ii) Provide 1 per rack
    - g) Grounding and bonding: Provide vertically mounted, rack grounding strip equal to Chatsworth

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- 40172 - 001 Series ground tape in each rack. Bond each rack to local grounding bar.
- 3) Outlet Boxes: For flush mounting in walls; depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
    - a) Size, Unless Otherwise Indicated: 4-11/16 inches square by 2-1/8 inches deep with single gang mud ring.
    - b) Wall-Mounted Telephones: 4-11/16 inches square by 2-1/8 inches deep with single gang mud ring.
    - c) Faceplates: High impact thermoplastic, complying with system design standards and UL 514C.
    - d) Labels: Comply with TIA/EIA-606 using encoded identifiers; label each jack on the face plate as to its function with a unique numerical identifier.
  - J) Penetrations
    - 1) Cable Sleeves
      - a) For fire or smoke wall penetrations provide Hilti CP 653 Speed Sleeve or approved Equal
      - b) Provide cable sleeves at all up to 2 hour fire rated wall penetrations.
      - c) Provide quantity and size (4 inch) of sleeves as required for 60% maximum fill of the quantity of cables being installed plus 50% spare capacity.
      - d) For non-fire rated partitions, provide conduit sleeves through the partitions providing quantity and size of conduits as required for 60% maximum fill of the quantity of cables being installed plus 50% spare capacity.
      - e) Provide 50% spare capacity in all sleeves to support future needs. Spare capacity shall be determined based on a maximum overall conduit fill of 60%. Conduit shall be considered 100% full once the 60% maximum fill threshold is met.
  - K) Cable Support Hangers
    - 1) Manufacturers:
      - a) Panduit J-Pro Series J-hook.
      - b) CADDY CAT HP Series J-hook.
      - c) CADDY CAT 425 Series adjustable strap hanger.
      - d) Approved Equal.
      - e) Panduit JP2 Series j-hook shall be used for up to 30 Category 6A cables.
      - f) Panduit JP4 Series j-hook shall be used for up to 115 Category 6A cables.
      - g) Caddy CAT 425 Series adjustable cable support for up to 210 Category 6A cables.
      - h) Manufacturer guidelines shall be used for supporting/mounting the cable supports. Provide wall mount, ceiling mount, threaded rod clip, beam clamp, etc. mounting option as appropriate for the installation.
      - i) Cable shall be supported at no greater than four-foot intervals. Provide a hook and loop fastener at each J-hook to retain and manage the cable bundle.
      - j) J-hooks or adjustable cable supports to be UL listed as suitable for air handling plenum spaces.
      - k) Provide a minimum of 50% spare capacity in each J-hook and cable support to provide for future needs.
      - l) Install J-hooks in all locations where conduit is not within 3 feet of cable tray.
      - m) J-hooks shall be installed such that all pathways run either perpendicular to or parallel with building structure and at sufficient mounting heights and locations to prevent cables from resting on ceiling tiles, pipes, duct work or any other structures.
      - n) Where elevation changes occur in hooks or cable tray, cables shall be adequately secured with 3/4" hook and loop fasteners.
- 3) EXECUTION
- A) Installation - General
    - 1) Comply with latest editions and addenda of TIA-568 (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
    - 2) Comply with Communication Service Provider requirements.
    - 3) Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.
  - B) Installation of Pathways
    - 1) Install pathways with the following minimum clearances:
      - a) 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.

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- b) 12 inches from power conduits and cables and panelboards.
  - c) 5 inches from fluorescent and high frequency lighting fixtures.
  - d) 6 inches from flues, hot water pipes, and steam pipes.
  - e) Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
  - f) Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
  - g) Arrange conduit to provide no more than 100 feet between pull points.
  - h) Do not use conduit bodies.
- 2) Conduit:
- a) All penetrations through fire barrier walls or floors shall consist of a conduit sleeve and shall be sealed with a removable industry approved fire barrier, fire barrier plug, or compound reamed and bushed. All vertical/horizontal sleeves shall be sized according to station count passing through each. Sized for maximum 60 percent fill.
    - i) Fire caulk that hardens and isn't removable will not be used.
  - b) Install conduit from outlet to a location adjacent to the cable tray above the nearest accessible ceiling. Terminate conduit using an insulated bushing prior to pulling any cabling into conduit.
  - c) Provide a minimum of 50% spare capacity in conduit to provide for future needs. Install additional conduits as necessary to meet this minimum spare capacity requirement.
- 3) Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings.
- C) Installation of Equipment and Cabling
- 1) Cabling:
- a) Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
  - b) Do not over-cinch or crush cables.
  - c) Do not use zip ties to secure, strap, support or cinch cables.
  - d) Do not exceed manufacturer's recommended cable pull tension.
  - e) When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
  - f) Install cable support hooks a maximum of 4'-0" on center above ceiling.
  - g) Where cable tray is installed, run telecommunications cabling in cable tray and ensure cables are resting and supported by cable tray for the entire cable tray path.
  - h) Where telecommunication cables are run above accessible ceilings, support the cables to keep them from resting on ceiling tiles. Use properly sized Cable Caddies or J- Hooks on walls above the ceilings to neatly route cables between outlet and termination locations. Maximum distance between supports is 4 feet or in accordance with EAI/TIA standards, whichever is less.
  - i) Cables shall not lay on ceiling tiles, pipes, ductwork or other above ceiling services or structures. J-hooks or 3/4" hook and loop fasteners shall be used as required to prevent contact with these items and structures.
  - j) For vertical cable routes, secure cables at no greater than 2 foot intervals utilizing 3/4" hook and loop cable fasteners.
  - k) For horizontal cable routes, secure before, in the middle and after route angle changes.
  - l) Where elevation changes occur in hooks or cable tray, cables shall be adequately secured with 3/4" hook and loop fasteners.
- 2) Service Loops
- a) Support service loops in at least 2 positions on each loop, with some service loops requiring more supports (ex. 10 and 2, 12 and 6, 3 and 9).
  - b) Do not loop cabling in the cable tray.
  - c) Loops shall be secured away from the primary cable pathway and shall not obstruct access to other cables, cable tray, or other above ceiling services or equipment.
  - d) (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly and uniformly:
    - i) At Distribution Frames: Copper 12 inches.
    - ii) At Distribution Frames: Fiber 120 inches.

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- iii) At Outlets - Copper: 12 inches.
  - iv) At Outlets (specifically all outlets located in individual or small group offices) – Copper: Provide 10 feet excess length coiled above ceiling.
  - v) At Outlets - Optical Fiber: 39 inches.
- 3) Copper Cabling:
- a) Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
  - b) For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
  - c) Bridged taps/splices are not allowed as part of the horizontal wiring system.
  - d) Avoid routing cables near EMI sources.
  - e) All cabling shall consist of 4 pairs and 1 cable per jack.
  - f) Install modular outlets at all locations shown on the Drawings. Terminate wiring at workstation jacks and rack.
  - g) Install cable from all workstation outlets to rack.
  - h) Each workstation jack shall be provided with its own UTP cable continuous (without splice) from jack to rack.
  - i) Telecommunications wiring will be used for both voice and data wiring.
- 4) Owner Provided Wireless Access Points:
- a) Patch Cords:
    - i) Patch Cords for wireless access points shall be provided by contractor.
      - i. Ceiling mounts take 1 patch cord
      - ii. Wall mounts take 1 patch cords
    - ii) Color: Patch cord color to match ceiling color.
    - iii) Length: Provide 1' patch cords for wall mount and ceiling mounted WAP devices that are mounted to electrical boxes and 3' patch patch cords for WAP devices that are attached to the ceiling grid.
  - b) Installation, Testing and Documentation:
    - i) Contractor shall mount all Owner provided WAP devices.
      - i. Install label on Access Point. Ex. PT = 1-23 (This is the pass-through port.)  
AP = 1-24 (This is the WAP port)
    - ii) Testing: WAP devices will be tested and powered on once installation is complete.
    - iii) Documentation: Provide documentation directly on system's plans including NDSU's bar code number, Patch Panel Cable ID number, and Switch Port number for turnover to NDSU EN.
- 5) Fiber Optic Cabling:
- a) Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
  - b) Support vertical cable at 2-foot intervals.
- 6) Floor-Mounted Racks and Enclosures: Permanently anchor to the floor in accordance with manufacturer's recommendations.
- 7) Identification:
- a) Use wire and cable markers to identify cables at each end.
  - b) Use manufacturer-furnished label inserts to identify each jack at communications outlets with unique identifier.
  - c) Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.
- 8) Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
- a) Labeling to be verified with NDSU EN
  - b) Cables: Install color coded labels on both ends.
  - c) Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.
  - d) All horizontal cabling shall be labeled with permanent tag indication from which jack the cable originated.
  - e) Machine labels shall be installed on each workstation jack faceplate.
  - f) All labels shall be a machine label in conformance with ANSI/EIA/TIA 606.
  - g) Numbering of workstation jacks shall be consistent.

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- h) Final room numbers to be used for labeling, room numbers on plans are not to be used.
- D) Field Quality Control
  - 1) Comply with inspection and testing requirements of specified installation standards.
  - 2) Visual Inspection:
    - a) Inspect cable jackets for certification markings.
    - b) Inspect cable terminations for color coded labels of proper type.
    - c) Inspect outlet plates and patch panels for complete labels.
  - 3) Testing - Copper Cabling and Associated Equipment:
    - a) Test operation of shorting bars in connection blocks.
    - b) Category 6A Links: Perform tests for wire map, length, insertion loss, NEXT, PSNEXT, ELFNEXT, PSELFEXT, return loss, delay skew and propagation delay.
      - i) Utilize a Level III/Level IV rated tester compatible with the following test standards:
        - i. TIA-1152 Level IIIe and ISO/IEC 61935-1 Level IV accuracy.
        - ii. TIA-58-C.2, TIA 1152 Category 5, 5e, 6, 6A, and ISO/IEC 11801.
      - ii) The cabling tester shall be approved for use with the selected connectivity solution for both Channel and Permanent Link tests, and for the associated warranty provided by the connectivity Manufacturers.
      - iii) The company/individual testing the cable shall be manufacturer certified for products provided.
    - c) Documentation:
      - i) Contractor shall perform and document all conductor tests per TIA-568-B and ANSI/TIA-606. Return one copy of testing report to the Engineer and one copy to the Owner. All copper station runs must be tested after final installation and termination. All cable runs shall be documented with a hard copy printout of the test results. This printout shall be bound and delivered to the Owner prior to final payment.
      - ii) Contractor shall complete Owner provided spreadsheet with the following information: MDF #/IDF #, IP #, Switch #, Switch Port #, Room #, Jack ID #, and jack location in each room. An electronic copy of the completed spreadsheet in Microsoft Xcel format shall be submitted to NDSU Enterprise Networks for entering into the E911 system prior to Certificate of Occupancy.
      - iii) Verification:
        - i. Contractor shall perform an additional field side verification of jacks once patch cables are installed. The purpose of this test is to verify location documentation specified in subsection 3.04.C.3.b above. Record the following:
          - 1. Connectivity speed (1, 2.5, 5, 10 gig, etc.)
          - 2. Switch Name (Example: Building Name-MDF-Stack 2)
          - 3. Speed given out by switch
          - 4. Switch # with Port #
          - 5. VLAN
  - 4) Testing - Fiber Optic Cabling:
    - a) Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
    - b) Multimode Backbone: Perform tests in accordance with TIA-526-14 Method B.
    - c) Single Mode Backbone: Perform tests in accordance with TIA-526-7 Method B.
  - 5) Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

### 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.



**Division 28 Electronic Safety and Security**

**28 10 00 Electronic Access Control and Intrusion Detection**

- 1) The University employs a Avigilon 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, Honeywell Gamewell or approved equal. Any new building and renovation must be able 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 valves and fire protection.
- 3) The University utilizes a fire alarm control system by SimplexGrinnell or Honeywell Gamewell; 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 as determined by the Fargo Fire Department/Authority Having Jurisdiction.
  - B) The facility's Fire Alarm Control Panel (FACP) shall communicate with the wider University alarm system via connection to the University's fiber network.
    - 1) Fire alarm conduit emerging from underground shall be rigid or schedule 80 PVC. Conduit color shall be red.
  - 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.
  - F) Fire alarm monitor systems are located in Thorson Maintenance Center and University Police and Safety Office with graphics at both locations. All new panels must be able to be monitored from these locations.
- 4) During renovations, all provisions must be taken to transfer all alarm points from existing fire alarm 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 fire 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.
- 6) In residential buildings, smoke detectors in units shall only cause a supervisory alarm. It shall not clear itself but must be cleared from panel or annunciator. Common areas shall cause general building alarm.
- 7) Fire alarm systems must be kept up to code. If rooms are added or the use is changed, a review must be done to determine what fire alarm devices are required. If room numbers are changed, the fire alarm system will need to be updated to reflect the current numbers. The campus fire alarm network also needs to be updated. Any information or graphics that change due to a project must be changed in the network program.
- 8) All fire alarm devices shall have label with address that is visible from ground level printed with 1/4" black text on clear label.

## **Design Guidelines**

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### **Division 29 Reserved**

This division is reserved for future use.

### **Division 30 Reserved**

This division is reserved for future use.

## Design Guidelines

### 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. Verify with Owner.

#### 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, free of stones, 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:

Application	Compacted Topsoil Depth
Seeded with Grass	6" minimum
Shrub Beds	18" minimum
Flower Beds	18" minimum
Planter Boxes	To within 3" of box rim

#### 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.

## Design Guidelines

### 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) All underground irrigation piping shall be installed prior to the installation of plantings and/or hydroseeding. Hydroseeding shall be coordinated with NDSU.
  - E) Shrub and perennial beds are to receive 4" depth of shredded hardwood mulch.
  - F) Contractor shall repair irrigation, dirt work and hydroseeding to bring area back to a completed condition.

#### 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:

Aggregate, as determined by ASTM C136 and ASTM C117:		Crushed Portland cement concrete:	
Sieve Designation	Weight Passing Square Mesh Sieve	Sieve Designation	Weight Passing Square Mesh Sieve
1"	100 %	1 1/2"	100 %
3/4"	90 – 100	1"	90 - 100
3/8"	50 – 90	3/4"	80 - 100
No. 4	35 – 70	No. 4	35 - 70
No. 10	20 – 55	No. 30	16 - 40
No. 40	10 – 35	No. 200	4 - 20
No. 200	3 -10		

- 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 and/or hydroseeding.
    - 2) Sprinkler contractor is to coordinate with the paving and sidewalk contractor the placement of PVC pipe sleeves under the paved areas.

## Design Guidelines

- a) Pipe sleeves shall be two times larger than the irrigation pipe.
- b) Sleeve locations shall be stamped in the concrete using Owner provided stamp.
- 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 Rainbird IQ4 compatible. Controller shall be Owner provided, contractor installed.
    - a) 2-Wire decoder system shall be Rainbird ESP-LXIVM 2-Wire Controller with Smart Valve Technology
    - b) Conventional wire system shall be Rainbird ESP-LXME2 Pro Modular Controller.
  - 2) Controller shall include IQNCCEN – Network Comm Cartridge.
  - 3) Controller shall be located on exterior wall within 10'-0" of backflow/master valve and flow sensor.
  - 4) Ethernet cable shall be run to controller location.
  - 5) Provide Rainbird FS series flow sensor sized to system.
- 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:

Size	Manufacturer	Model	Assembly
1"	Watts	800M4FR	PVB
1"	Watts	919-QT	RPZ
1-1/4"	Watts	800M4FR	PVB
1-1/4"	Watts	919-QT	RPZ
1-1/2"	Watts	800M4FR	PVB
1-1/2"	Watts	919-QT	RPZ
2"	Watts	800M4FR	PVB
2"	Watts	919-QT	RPZ
2-1/2"	Watts	909-OSY	RPZ
3"	Watts	909-OSY	RPZ
4"	Watts	909-OSY	RPZ

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

Hunter	Rainbird
PGJ	1800 Series
PGP-Ultra	5000 Series
I-20	
I-40	

- F) Valves:
  - 1) Provide Rainbird PEB master valve sized to system.
  - 2) Provide Rainbird PEB zone valves sized to system.
- 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" pea rock.
- H) Repair/Renovation Work:
  - 1) Contact Owner for existing heads, valves, decoders, controllers, etc.

## Design Guidelines

### 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 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

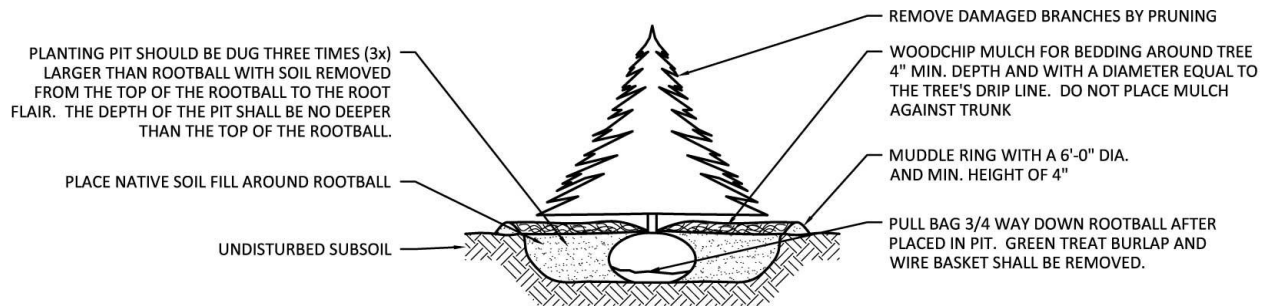


FIGURE 32 90 00-1: EVERGREEN PLANTING

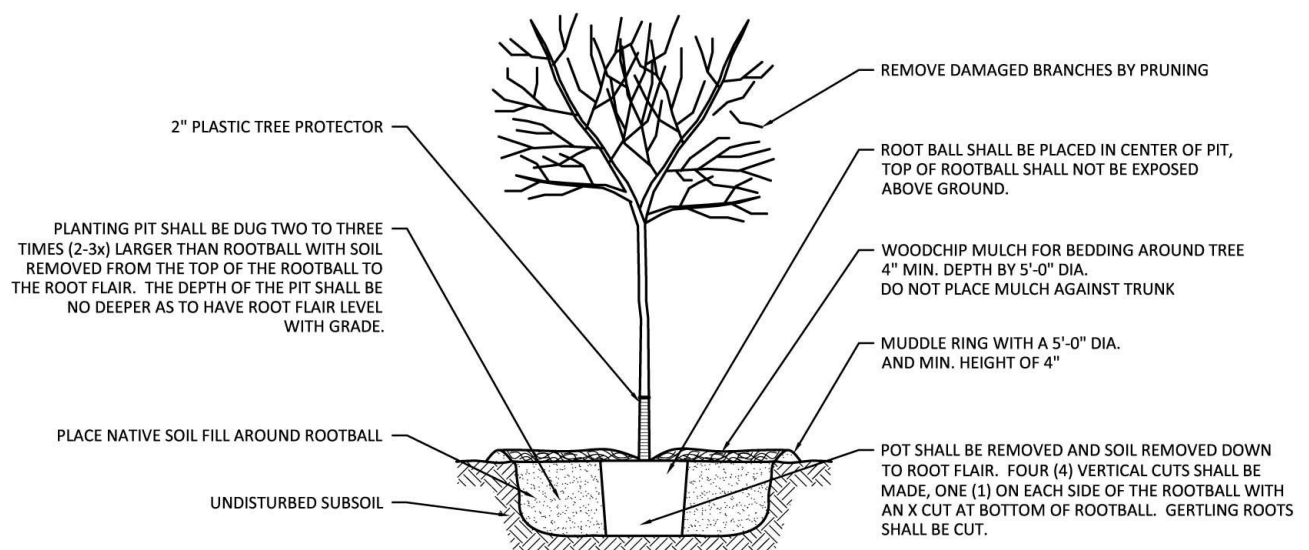


FIGURE 32 90 00-2: DECIDUOUS PLANTING

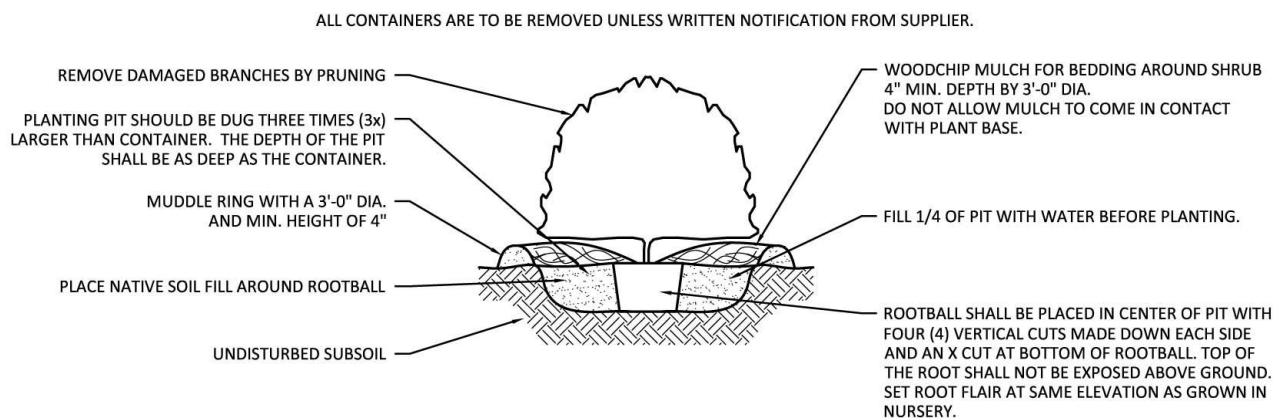


FIGURE 32 90 00-3: SHRUB PLANTING

**Design Guidelines**

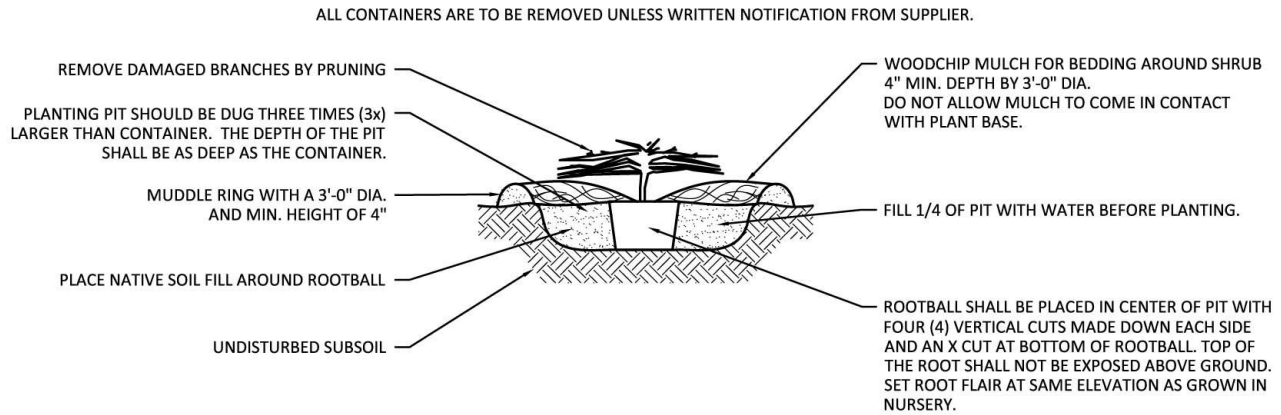


FIGURE 32 90 00-4: CREEPING EVERGREEN PLANTING

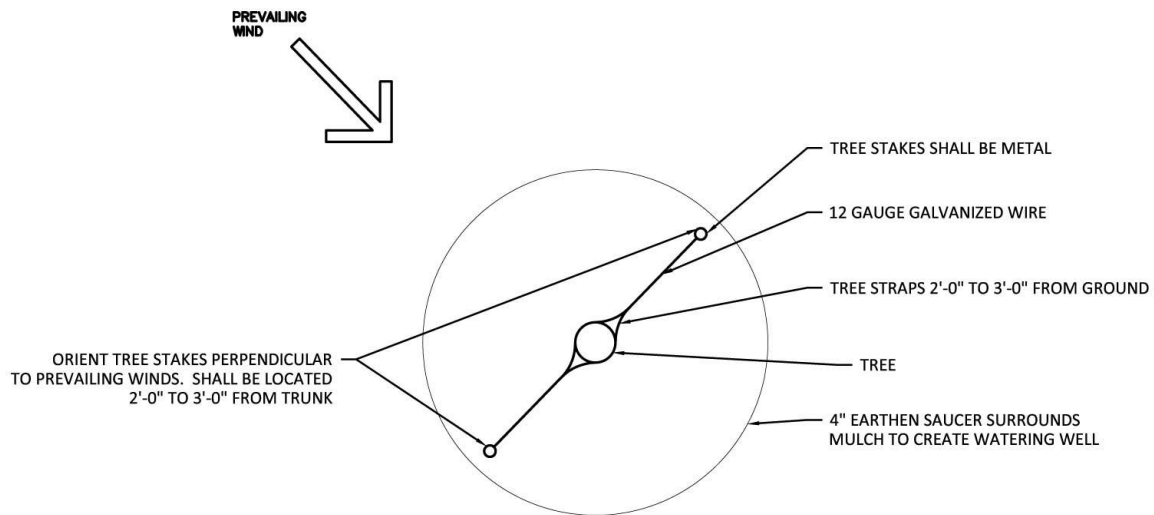


FIGURE 32 90 00-5: TREE STAKING

**32 92 19 Seeding**

- 1) Apply seed evenly in two intersecting directions. Rake in lightly.
- 2) Do not seed areas in excess of that which can be mulched on same day.
- 3) Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
- 4) Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- 5) Seed type:
  - A) Rivard's Athletic II Lawn Seed Mixture or approved equal.



**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.
- 6) Storm Drain inlets shall have wording that reads "DUMP NO WASTE. DRAINS TO WATERWAY." or similar.

## Design Guidelines

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### 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)**

## Design Guidelines

### ADVERTISEMENT FOR BIDS

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

**OWNER:** North Dakota State University

Sealed proposals for the work associated with the NDSU - Building Name – Building Number – Project Description 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 Time am, pm, Central Time Zone, Day, Date, at which time they will be opened and publically read.

Multiple prime bids for General, Mechanical and Electrical construction.

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 may be obtained by prime bidders from consultant name, between the hours of 8:00 a.m. and 5:00 p.m. Monday – Friday, with no deposit required or may be examined at the following locations until Bid opening time:

Consultant firm name, City, State

North Dakota Builders Exchanges: Fargo

**Pre-Bid Inspection: (Attendance Mandatory – or – Attendance Optional)**

Access to the building is restricted; A pre-bid inspection is scheduled for Day and Date at Time am, pm, local time. Interested sub-bidders may also attend. Bidders will meet at Location. Attendees can park in the Parking Lot Name 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.

Bids shall comply with North Dakota Century Code Chapter 48-01.2 as amended. 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, Electrical, or Combined Bid), NDSU – Building Name – Building Number – Project Name, 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 include 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. A bidder's bond must be executed by the bidder as principal and by a surety, conditioned that if the principals bid is accepted and the contract awarded to the principal, the principal, within ten days after notice of the award, shall execute a contract, or accept and return the award letter, in accordance with the terms of the bid, the bid bond, and any condition of the governing body. If a successful bidder does not execute a contract within the time allowed, the bidder's bond shall be forfeited to the governing body and the project awarded to the next lowest responsible bidder. Certified checks, money orders, personal checks, cash, or forms other than a bid bond will not be accepted.

Each Bidder shall hold a current and valid North Dakota Contractor's License of the proper class for the full amount of the bid, issued by the Secretary of State as required by North Dakota Law Sections 43-07-05 and 43-07-12, 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. A Contractor shall be the holder of a license at least ten days prior to the date set for receiving Bids to be a qualified Bidder.

Each Bidder shall complete the Bidder Questionnaire, and shall enclose the Questionnaire in the same envelope as the Bidder's Security Bond. If the Bidder Questionnaire is not included in the Bid Bond envelope the bid will be returned unopened.

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 copy of: Sales Tax Certificate, Workers' Compensation Certificate, Certificate of Insurance and Policies/Endorsements to include North Dakota Stop Gap Worker's Compensation, Builders Risk/Installation Floater coverage, Additional Insured Statement, Auto Insurance with 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**

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 the bidding party is a responsible bidder. 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.



**Exhibit C. Maintenance and Operating Manuals, Specifications, and Record Document Submittal Checklist (01 78 00)**



### Design Guidelines

	ITEM	Hardcopy				Electronic		
		Qty Req'd	Qty Recv'd	Date Recv'd	Note	Format	Date Recv'd	Note
<b>ARCHITECT</b>	Architectural Record (As-Built) Drawings	2				DWG		
	Mechanical Record (As-Built) Drawings	2				DWG		
	Electrical Record (As-Built) Drawings	2				DWG		
	Specification book, with addendums	1				PDF or DOC		
	Architect Final Payment	Y/N				<b>Not Required</b>		

<b>GENERAL CONTRACTOR</b>	General O & M Manual	2				PDF or DOC		
	General Punch List	1				<b>Not Required</b>		
	Certificate of Substantial Completion (AIA G704-2000)	3				<b>Not Required</b>		
	Contractor's affidavit of Payment of Debts and Claims (AIA G706-1994)	1				<b>Not Required</b>		
	Contractor's Affidavit of Release of Liens (AIA G706A-1994)	1				<b>Not Required</b>		
	Consent of Surety to Final Payment (AIA G707-1994)	1				<b>Not Required</b>		
	Certification of Non-Asbestos and Non-lead materials	1				<b>Not Required</b>		
	List of Subcontractors (AIA G705-2001)	1				<b>Not Required</b>		
	Painting Schedule	1				<b>Not Required</b>		
	5% supplies (attic stock)	1				<b>Not Required</b>		
	Final Payment Received	Y/N				<b>Not Required</b>		

<b>ELECTRICAL</b>	Electrical O & M Manual	2				PDF or DOC		
	Electrical Punch List	1				<b>Not Required</b>		
	Certificate of Substantial Completion (AIA G704-2000)	3				<b>Not Required</b>		
	Contractor's affidavit of Payment of Debts and Claims (AIA G706-1994)	1				<b>Not Required</b>		
	Contractor's Affidavit of Release of Liens (AIA G706A-1994)	1				<b>Not Required</b>		
	Consent of Surety to Final Payment (AIA G707-1994)	1				<b>Not Required</b>		
	Certification of Non-Asbestos and Non-lead materials	1				<b>Not Required</b>		

### Design Guidelines

	List of Subcontractors (AIA G705-2001)	1					Not Required
	Equipment Operation Training Sign-in Sheet	1					Not Required
	Panels Labeled with Arc Flash Calculation Stickers	Y/N					Not Required
	Final Payment Received	Y/N					Not Required

<b>MECHANICAL CONTRACTOR</b>	Mechanical O & M Manual	2				PDF or DOC		
	Certificate of Substantial Completion (AIA G704-2000)	3					Not Required	
	Contractor's affidavit of Payment of Debts and Claims (AIA G706-1994)	1					Not Required	
	Contractor's Affidavit of Release of Liens (AIA G706A-1994)	1					Not Required	
	Consent of Surety to Final Payment (AIA G707-1994)	1					Not Required	
	Certification of Non-Asbestos and Non-lead materials	1					Not Required	
	List of Subcontractors (AIA G705-2001)	1					Not Required	
	Valve Chart as Required	1					Not Required	
	Equipment Operation Training Sign-in Sheet	1					Not Required	
	Are pipes insulated & marked (Flow direction and Type)	Y/N					Not Required	
	HVAC systems testing & balancing	1					Not Required	
	Mechanical List: Extra filters	Y/N					Not Required	
	Final Payment Received	Y/N					Not Required	

**End of Job Checklist**

**Exterior Items**

- Turf Repaired
- Sprinkler heads repaired
- Sidewalks/Stairs Cleaned Off
  
- Handrails cleaned/repaired

**End of Job Checklist**

**Interior Items**

- Cabinets cleaned
- Windows Cleaned
- Sills Cleaned
- Door frames wiped down

### Exhibit D. Contractor Five Year Roof Guarantees

**Design Guidelines**

**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.

### Design Guidelines

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Size of Project	Schematic & Design Development Phase	Construction Document Phase	Bidding Phase	Construction Phase
Up to \$200,000	Two (2) months	Two (2) months	One (1) month	Six (6) months
\$200,000 through \$1,000,000	Four (4) months	Three (3) months	One (1) month	6-12 months
Over \$ 1,000,000	Four - eight (4 - 8) months	Four - six (4 - 6) months	One (1) month	12+ months

### **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](#)).5.4 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.
- 6.4 The A/E shall distribute final plans and specifications to appropriate state and/or local agencies for review as is required or as may be prudent.
- 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 §§48-01.2-24 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:
  - a. Buildings with occupancy classifications of F, H, M, S, or U do not require a plaque.
  - 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 ¼ 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](#)**

HISTORY: Amends and replaces Appendix F, 1980 Manual. State Board of Higher Education Minutes, Nov. 7, 1985, pg 5422.  
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. Exhibit B, SBHE Minutes, Oct. 26, 1989, pg 5902.  
Amend. Section 9.4, SBHE Minutes, May 24, 1990, pg 6002.  
Amend. Section 2 & Exhibit A, SBHE Minutes, Nov. 8, 1990, pg 6059.  
Amend. Section 6 & Exhibit B, SBHE Minutes, Sept. 19, 1996, pg 6685  
New Procedure, Chancellor's Cabinet Meeting, February 8, 2012.  
Chancellor's Cabinet Meeting, March 28, 2012.  
Amended, July 1, 2015.

**Exhibit F. NDUS AEM – Compensation Guidelines for Architectural Services**

## Design Guidelines

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### 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 \$1,875,000 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

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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.

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- 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 chooses 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

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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.

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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**

## Design Guidelines

### 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.



**GUIDELINES FOR PREPARATION OF CONSTRUCTION CONTRACTS AND RELATED DOCUMENTS (CONTINUED)**

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. Design Team to request sample AIA-101 and AIA-201 contracts from NDSU to include in specifications.

**North Dakota State University**  
*Architect/Engineer Contract Review and Checklist*

**Review By:**

- Architect  Owner  ND AG Office

**Contract:**

- Date of Contract: \_\_\_\_\_
- Architect/Engineer Firm Name: \_\_\_\_\_
- Project Name: \_\_\_\_\_
- Commencement Date: \_\_\_\_\_
- Completion Date: \_\_\_\_\_
- Contract Amount: \_\_\_\_\_
- Signed Contract
- Owner Signature: Bruce A. Bollinger, VP Finance and Administration
- Signature Authorization if Contract not signed by company president.
- Amendments included in Contract
- Architect/Engineer's Services Clearly Defined

- **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 & Endorsements:**

- Certificate of Insurance Included
- Name and Address consistent with contract.
- General Liability - \$1,875,000
- Automotive - \$250,000 per person / \$1,000,000 occurrence
- Professional Liability - \$500,000
- Copy of Auto Insurance Endorsement with Waiver of Subrogation
- Copy of Stop Gap Worker's Compensation Endorsement
- Copy of Excess/Umbrella Liability Endorsement
- Copy of Professional Liability Endorsement
- Copy of General Liability Endorsement
- 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\*
- Insurance expiration dates are current.
  - Expiration Date: \_\_\_\_\_

**Worker's Compensation Certificate:**

- Included
- Name and Address consistent with Contract
- Current/Active Date
  - Expiration Date: \_\_\_\_\_

**Other Items for Contract:**

- Report of Consultant's Employees on Registered Sex Offenders List. If none are employed, state that on letterhead.**

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**North Dakota State University  
Owner/Contractor Contract Review and Checklist**

- Review By:**
- Architect  Owner  ND AG Office
  - Date of Contract: \_\_\_\_\_
  - Contractor Firm Name \_\_\_\_\_
  - Project Name: \_\_\_\_\_
  - Commencement Date: \_\_\_\_\_
  - Completion Date: \_\_\_\_\_
  - Contract Amount: \_\_\_\_\_
  - 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
  - Contract Signed by Contractor \_\_\_\_\_
  - Signature Authorization if Contract not signed by company president  
Amendments for A101-2007 and A201-2007
  - Included  In Specifications

**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. Date: \_\_\_\_\_

**Acknowledgement of Attorney-in-Fact of Surety:**

- Name consistent with General Power of Attorney
- Date same as or after Contract. Date: \_\_\_\_\_

**Certificate of Insurance and Endorsements:**

- Included:  Yes  No
- Name and Address consistent with Contract
- Copy of Stop Gap Worker's Compensation endorsement
- Builder's Risk Required – Prime Contractor
- Builder's Risk NOT required – Covered by \_\_\_\_\_
- Builder's Risk Insurance – Full Value – List amount on Certificate of Insurance
- Builder's Risk Insurance not required for Parking Lot/Landscape projects

- Copy of Builders Risk Endorsement
- <\$100,000 - General Liability - \$250,000 occurrence / \$1,000,000 aggregate
- >\$100,000 - General Liability - \$1,875,000 occurrence / \$2,000,000 aggregate
- Copy of General Liability Endorsement
- Auto Insurance - not less than \$1,000,000
- Copy of Auto Insurance Endorsement with Waiver of Subrogation
- Copy of 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 \_\_\_\_\_
- Insurance expiration dates are current. Expiration Date: \_\_\_\_\_

**Worker's Compensation Certificate:**

- Included:  Yes  No
- Name and Address consistent with Contract
- Current/Active Date. Expiration Date: \_\_\_\_\_

**Sales Tax Certificate: (NDCC 43-07-11.1)**

- Included:  Yes  No
- Name and Address consistent with Contract.
- Current/Active Date. Expiration Date: \_\_\_\_\_

**Other Items for Contract**

- Agreement for Storing Materials Off-site (if applicable)
- Company Safety Manual (for projects over \$100,000)
  - Sent to NDSU Project Manager Electronically **OR**
  - Hardcopy Included with Contract in FM office
- Report of Contractor's Employees on Registered Sex Offender List

• **NDSU ADDRESS :**

ND State Board of Higher Education  
Dba North Dakota State University  
Thorsen Maintenance Center  
Dept 3200 – PO Box 6050  
Fargo, ND 58108-6050

Rev. 04/01/2021

**Exhibit I. NDUS AEM – Performance-Payment Bond (00 61 00)**

**Design Guidelines**

**PERFORMANCE - PAYMENT BOND**  
Standard Format Required by the North Dakota State Board of Higher Education

KNOW ALL MEN BY THESE PRESENTS: That we <sup>\*1</sup> \_\_\_\_\_ ,  
a <sup>\*2</sup> \_\_\_\_\_ hereinafter called "Principal" and  
<sup>\*3</sup> \_\_\_\_\_ of State of \_\_\_\_\_ ,  
corporation organized under the laws of the State of \_\_\_\_\_ , 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 <sup>\*4</sup> \_\_\_\_\_ 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.

**Design Guidelines**

**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

**Design Guidelines**

**ACKNOWLEDGMENT OF PRINCIPAL  
(Individual or Partnership)**

STATE OF \_\_\_\_\_

SS

COUNTY OF \_\_\_\_\_

On this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, before me personally appeared

\_\_\_\_\_ known to me to be the person (or persons) who is (are) described in and who executed the within instrument, and acknowledged to me that he/she (or they) executed the same.

\_\_\_\_\_  
Notary Public\*\*

(SEAL)

**ACKNOWLEDGMENT OF PRINCIPAL  
(Corporation)**

STATE OF \_\_\_\_\_

SS

COUNTY OF \_\_\_\_\_

On this \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, before me personally appeared

\_\_\_\_\_ known to me to be the person (or persons) who is (are) described in and who executed the within instrument, and acknowledged to me that he/she (or they) executed the same.

\_\_\_\_\_  
Notary Public\*\*

(SEAL)

**Design Guidelines**

**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 \_\_\_\_\_

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

(SEAL)

\_\_\_\_\_  
Notary Public\*\*

\*\* 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**

## Design Guidelines

### 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 \$1,875,000 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

## Design Guidelines

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to ascertain that adequate coverage for the existing building will be in effect should damage occur due to the contractor's work.

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 reasonably 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.

**Exhibit K. NDUS AEM – Agreement for Storing Materials Off-Site**

**Design Guidelines**

**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

Contractor

By: \_\_\_\_\_

By: \_\_\_\_\_

\_\_\_\_\_  
Surety

COUNTERSIGNED BY:

By: \_\_\_\_\_

\_\_\_\_\_

Resident Agent

**Exhibit L. NDUS AEM – Owner-Architect Agreement Amendments to AIA Document B141/CMA:  
Standard Form of Agreement Between Owner and Architect Where the Construction Manager Is  
Not A Constructor-Construction Manager-Advisor Edition**

## Design Guidelines

### **OWNER-ARCHITECT AGREEMENT AMENDMENTS TO AIA DOCUMENT B141/CMA: STANDARD FORM OF AGREEMENT BETWEEN OWNER AND ARCHITECT WHERE THE CONSTRUCTION MANAGER IS NOT A CONSTRUCTOR – CONSTRUCTION MANAGER – ADVISOR EDITION**

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 \$1,875,000 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 architects 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**



## Design Guidelines

### 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 12.2.1.1 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 § Section 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**

## Design Guidelines

### ADAAG CONFORMANCE STATEMENT

NORTH DAKOTA DEPARTMENT OF COMMERCE/DCS

SFN 19701 (06/03)

(This form must be submitted for new construction, alterations, and additions to buildings and facilities subject to the Americans with Disabilities Act.)

AMERICAN WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG) CONFORMANCE STATEMENT													
Name & Building Address	Owner												
	City/County												
Date Construction to Start	Projected Completion Date												
<p>Type of Construction</p> <table style="width: 100%; border: none;"> <tr> <td style="padding: 5px;">New Building</td> <td style="padding: 5px;">_____</td> <td style="padding: 5px;">Sq. Ft.</td> <td style="padding: 5px;">_____</td> </tr> <tr> <td style="padding: 5px;">Addition</td> <td style="padding: 5px;">_____</td> <td style="padding: 5px;">Sq. Ft.</td> <td style="padding: 5px;">_____</td> </tr> <tr> <td style="padding: 5px;">Alteration</td> <td style="padding: 5px;">_____</td> <td style="padding: 5px;">Sq. Ft.</td> <td style="padding: 5px;">_____</td> </tr> </table>		New Building	_____	Sq. Ft.	_____	Addition	_____	Sq. Ft.	_____	Alteration	_____	Sq. Ft.	_____
New Building	_____	Sq. Ft.	_____										
Addition	_____	Sq. Ft.	_____										
Alteration	_____	Sq. Ft.	_____										
Describe Alteration:													
Type of Occupancy/Use (Refer to Occupancies and Divisions defined in the International Building Code):													
<p>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.</p>													
_____ Name of Design Professional	_____ Firm												
_____ Signature	_____ Phone Number <span style="float: right;">_____</span> Date												
<p>Send To:      Division of Community Services            1600 East Century Avenue, Suite 2            P O Box 2057            Bismarck, North Dakota    58502-2057</p>													

**Exhibit O. Contractor Certification of Non-Asbestos and Non-Lead Materials**

## Design Guidelines

### 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 lead free 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**



**ENTERPRISE NETWORKS**

**CONSTRUCTION STANDARDS**

## **PREFACE/OVERVIEW**

This document is intended as a design aid as it relates to the telecommunications and networking infrastructure at North Dakota State University. Telecommunication systems and the technologies and infrastructure used to effectively enable those systems are complex and shall be designed and installed by experienced professionals and will be considered the third UTILITY with the same value as electrical and mechanical systems. The Enterprise Networks systems specified herein provides for voice, data, video as well as an array of low voltage systems using a variety of media types. The designed system infrastructure shall provide acceptable resources for any telecommunication device which requires connectivity to other devices, networks or information systems serving the specific and general university requirements.

The objectives outlined herein are to:

- Provide a typical structure for inter/intra-building infrastructure design and deployment at North Dakota State University
- Define minimum standards for the spaces, pathways, and telecommunications-related infrastructure that must be incorporated into either new building construction, remodels or retrofits.
- Define specific media selection and design criteria;
- Specify technical issues that must be incorporated into a projects design
- Describe methods and procedures for installing, testing, and documenting cable and related infrastructure.

Enterprise Networks (EN) is responsible for the network and communications infrastructure and will provide direction and therefore shall be consulted throughout the design and construction processes.

Although planning a new facility or retro fitting an existing structure must be based on well-defined needs, the collective impact of changes in instructional and research technology and of the increasing use of information technology must be viewed as a moving target. No one can predict, with absolute certainty, what systems and applications will be required and installed in a building three to four years in the future. Thus, taking a long-term view of the structure in design and focusing on providing an inclusive system of pathways, spaces and affiliated infrastructure for telecommunications technologies, the designer/engineer can limit the number of alterations that may be needed upon completion of the project.

Data 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 EN 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 'network infrastructure 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 synchronize with other designers/engineers/architects on building/structural or infrastructure projects (architectural, electrical, mechanical, etc.) to determine if proposed systems are compatible with the telecommunications cabling system.



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## **BACKGROUND**

The University-wide standards for structured premise wiring, outlined in this document, are designed to bring North Dakota State University Telecommunications facilities into compliance with industry-wide standards and are based on the latest EIA/TIA Building Telecommunications Wiring Standards for commercial buildings. The goal is also to effectively provide for the future of high-speed networks, systems and applications while maintaining complete compatibility with current data and voice technologies.

Note: North Dakota State University owns and manages all interior and exterior distribution infrastructure (Copper twisted pair, CATV distribution, both multimode and singlemode fiber optic cable as well as a variety of special and custom media located on the NDSU main campus.

The North Dakota State University Enterprise Networks group will be the first point of contact for questions about adding, changing, testing, and accepting new materials and suppliers. All decisions will be based on quality, performance, price, and availability.

Special cases and exceptions will be reviewed on a case-by-case basis. Enterprise Networks will be the first point of contact for questions about non-standard communications cable installations.

The construction specification should follow the current Master Format for Division 27.

- 27.00 Communications – General
- 27.10 Structured Cabling
- 27.20 Data Communications
- 27.30 Voice Communications
- 27.40 Audio/Video Communications
- 27.50 Distributed Communications and Monitoring Systems

Each of these primary divisions will have many sub-divisions and categories.

**Note: Not all elements relating to any required interdependencies, electrical, concrete, landscaping/earthwork and restoration are detailed in the guide. Please reference the Facilities Management construction guide for more detailed specifications.**

[https://www.ndsu.edu/facilities/construction\\_and\\_maintenance/](https://www.ndsu.edu/facilities/construction_and_maintenance/) PDF – Design Guidelines

## **TELECOMMUNICATIONS SYSTEMS GENERAL DESIGN, CONSTRUCTION & TECHNOLOGY**

### **SECTION 1: SCOPE/CODES**

Although the scope is limited only to the telecommunications aspect of building design, it should be recognized that this standard highly influences the design and build of other building systems and services. It also impacts space allocation within the building.

- A. These standards apply to all North Dakota State University locations and includes the Voice Network, Data Network, CATV, security/life safety systems, IoT and other applicable low voltage cabling
- B. Development and final 'system' drawing shall be submitted to NDSU Network Engineering for assessment and approval in either paper form, CAD or PDF.
- C. The North Dakota State University Facilities Management Project Manager and Enterprise Networks group (NEO) will be the first point of contact regarding questions relating to adding, changing, testing, and accepting new materials and suppliers. All decisions will be based on quality, performance, price, and availability.
- D. Special cases and exceptions will be reviewed on a case-by-case basis. Enterprise Networks will be the first point of contact for questions about non-standard communications cable installations
- E. Any exceptions will not replace federal, state, local, or other applicable codes, laws, or regulations.
- F. Codes and Standards

Refer to the following codes and standards used in developing this document. Note: Where applicable, refer to the current edition and any related addendums

- 1. ANSI/EIA/TIA-568-B Commercial Building Telecommunications Cabling Standard
  - 2. TIA/EIA 568-B.2-10 Performance Specifications for 4-pair 100 Ohm Category 6a Cabling
  - 3. TIA/EIA 568-B1 Performance Specifications for 4-pair 100 Ohm Cabling
  - 4. ANSI/EIA/TIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces
  - 5. ANSI/EIA/TIA-598 Color coding of Optical Fiber Cables
  - 6. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
  - 7. ANSI J-STD-607-A Grounding, Bonding and Electrical Protection (formerly ANSI/EIA/TIA-607)
  - 8. ANSI/EIA/TIA-758 Customer Owned Outside Plant
  - 9. TIA/EIA TSB67 Transmission Performance Specifications for Field Testing UTP
  - 10. TIA/EIA TSB72 Centralized Optical Fiber Cabling Guidelines
  - 11. TIA/EIA TSB75 Additional Horizontal cabling Practices for Open Offices
  - 12. BICSI Telecommunication Distribution Methods Manual, Current Edition
  - 13. American National Standards Institute (ANSI)
  - 14. Building Industry Consulting Service International (BICSI) publications
  - 15. Institute of Electrical and Electronic Engineers (IEEE)
  - 16. National Electrical Code (NEC) Current edition
  - 17. National Fire Protection Association (NFPA) Current release
  - 18. Underwriters Laboratories (UL)
  - 19. TIA/EIA 568 B.3 Fiber Optics Cabling and Components
- G. Systems/Applications
    - 1. IP based Systems and applications (present day or future) that may require network access and therefore requiring the appropriate communications infrastructure

- a. Voice, data & ancillary cabling System
- b. Building Automation (BAS)
- c. Energy Management and control
- d. Fire Alarm systems
- e. IP based Video Distribution System (CATV)
- f. Ancillary low-voltage systems (signal & control)
- g. Digital Signage
- h. Generator Control panels
- i. IoT (In consultation)
- j. Underground distribution infrastructure
- k. IP based access control - Security & Access Systems (Card Key. CCTV/video surveillance)
- l. Emergency notification systems

## **SECTION 2: APPARATUS**

### **CONDUIT SYSTEM (Facility - Interior)**

- A. Provide conduit system:
  1. Provide minimum of 1" 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.
- 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, 2 $\frac{1}{8}$ " deep box with single gang mud ring.
- B. Two-gang, 3 $\frac{1}{2}$ " deep masonry box.

### **CABLE TRAY SYSTEM**

- A. Provide cable tray (prefer basket style) - (see VOICE AND DATA CABLING section).
  1. Sized appropriately (Typically 12"w X 4"h)

### **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 PATHWAYS (MDF/IDF/TR's)**

#### **Pathway Element Definitions**

Pathways include the interbuilding (between buildings) distribution system, building backbone (riser) system, horizontal pathways, and station outlets, as follows:

##### **1. Interbuilding Distribution System**

The conduit, tunnel systems, overhead, or buried media support structures for wire and fiber optics between buildings on the campus.

##### **2. Building Backbone (Riser)**

The vertical (and on occasion, horizontal) pathways that connect all telecommunications rooms and spaces together throughout an individual building.

##### **3. Horizontal Pathways**

The conduit, cable tray, or other cable support system

Telecommunications pathways and spaces are to be designed for the life of the building avoiding creating a standalone design for a specific system or technology.

- A. Telecommunications spaces (MDF/IDF) should be sized 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 13 ft.
- B. Minimum ceiling height is 8ft. above finished floor.
- C. Drop or suspended ceilings are not permitted
- 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 telecommunication 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 40% - 55%, maintained 24 hours per day and 365 days a year.
- H. Minimum floor loading of 50 lbs per sq. ft.
- I. Access to building ground in each Telecommunications room (install grounding bus bar). A solid copper grounding bus bar with dimension profile - (unplated) measuring 10" long by 2" wide by ¼" thick with minimum of 16 pre-drilled ¼" holes shall be installed, e/w standoff insulator. The ground bar shall be connected to the main building distribution 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 2500 LUX (measured 1 meter above finished floor).

**NORTH DAKOTA STATE UNIVERSITY  
ENTERPRISE NETWORKS CONSTRUCTION STANDARDS**

- L. Provide perimeter overhead cable distribution (basket) + intersections (12"x 4") to adequately route cables between walls and equipment cabinets/racks ('H' configuration). **(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 295feet.
- N. Efforts should be made to collapse all Telecommunications infrastructure to a single Telecommunications room when possible. When this is not feasible (to ensure 295' limitation), provide riser and distribution design to NDSU for approval. Type, size and quantity of all cable infrastructure within the riser design shall be provided by NDSU Network Engineering.
- O. Provide a 100 amp electrical branch sub- panel (on building generator if applicable) to serve each MDF/IDF/TR within the facility. 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 and one on opposite walls from dedicated sub-panel. Extend power to equipment racks if installed in the center of the space. **(Exhibit 'A')** Verify method with owner.
- Q. Provide 2 – 20 amp duplex (non-switched/dedicated branch circuit) to each 'two post' equipment rack. **(Exhibit 'B')**
- R. Three walls shall be lined with 4' x 8' x 3/4" 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 this space.
- 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 Enterprise Networks personnel.
- W. Any vertical or horizontal distribution channel that will be mounted directly to the plywood will be done by NDSU Enterprise Networks.
- X. Sample Wirecloset build 'Task management' Schedule form **(Exhibit 'H')**

**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 (Enterprise Networks shall be consulted for design criteria, product and execution) Locations provided by future occupants.
    - b. Video Surveillance (Enterprise Networks and Campus Police & Safety) shall be consulted for design criteria, product and execution) Locations provided by University Police & Safety
  - 2. Emergency Communication:
    - a. Blue Light Emergency Telephone for either 'tower' or 'wall' mount. All equipment provided by owner through NDSU Telecommunications and Emergency Technologies  
Provision 2 – Cat 6a cables and a 6 stand singlemode fiber optic cable (terminated on both ends with 'SC' connectors) extended from the nearest ground floor MDF/IDF to blue light locations. Both fiber ends shall be appropriately secured in patch panels.
    - b. Elevator emergency call.
    - c. Fire Alarm (Simplex, Protection Systems or other)
- B. Information Technology Services (ITS) and the Technical Support Services Department shall be consulted with reference to the following technologies and/or systems.
  - 1. Classroom technology: (Refer to 'Classroom Technologies' section)
    - 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. Control and management
  - f. Video Conferencing.
  - g. Architectural – seating configuration, window coverings etc.)
2. Reserved or dedicated space for ITS support (if necessary)
- a. Area for technical support staff and storage

## **SECTION 5: 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. Five years of experience working with category 6a cable, coaxial systems, multimode and singlemode fiber optics
- C. A minimum of 5 years experience in the installation and service of Outside Plant Cabling Systems (Copper and fiber optics) on projects of comparable size and scope.
- D. Registered Communications Distribution Designer (RCDD) certified by the Building Industry Consulting Service International (BICSI).
- E. The RCDD shall affix their stamp (signed) to the bid document as well as all subsequent changes to the communications design.

### **SUPERVISION**

- A. Installations shall be made by persons 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 plans and riser diagram.

### **SUBMITTALS**

- A. Shop Drawings and Product Data:
  - 1. Submit for review by the Architect, Facilities Management & Director, Enterprise Networks, shop drawings and product data (cut sheets) of materials and equipment to be incorporated as part of the project.

## **SECTION 6: PRODUCTS**

### **MATERIALS**

- A. Materials shall be new.
- B. Furnish materials specified in this document or as indicated on the drawings and project specifications manual
- 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. Product components containing restrictive substances shall bear the ROHS compliant label.
- E. Category 6A solid conductor, unshielded twisted pair, 23 AWG, 100 ohm
- F. Panduit Minicom series (Jacks & modular face plates)
- G. Panduit patch panel **CPPKLA6ATG48WBL** or approved equal
- H. Standard 19” equipment rack – 84” in height – Black – equipped with both vertical and horizontal cable management

## **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. Adhere to all current editions of TIA-568, 569 & NFPA70,
- C. In coordination with the Facilities Management PM, provide areas for general storage for the duration of the project. Provide temperature and/or humidity controls where applicable.
- D. Equipment and materials shall not be installed until such time as the environmental and general 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.
- B. All penetrations through fire-rated walls and floors must be properly sealed with approved materials or devices to block the spread of fire, smoke, toxic gases, and fluids in accordance with applicable building codes.
  - 1. Each type of penetration is different, and the fire stopping materials and configuration must be selected specifically for the conditions in the field. Contractor must work with the installer, the designer, and the firestop manufacturer to identify the correct products for the job.
  - 2. All fire stopping materials must be re-enterable and reconfigurable to allow for either reduction or expansion of the cable infrastructure.

### **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. This process is to be tightly coordinated with the Owner.
- B. Reroute cabling as required to serve equipment not in the demolition area (coordinate with Enterprise Networks).
- C. If equipment is to be re-installed at the completion of a specific space the project contractor is to ensure all equipment removed is appropriately cleaned before reinstallation – see below.

### **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 to the best of their ability the interior of all enclosures.

### **SERVICE OUTAGES**

- A. Non-emergency work and/or maintenance requiring interruption of networking service, which would adversely affect the normal operation of portions of the NDSU main campus and/or downtown campuses, shall be done at a time other than normal working hours. Normal working hours shall be considered as 7:00 a.m. to 6:00 p.m., Monday through Friday.
- B. Schedule work requiring interruption of networking service at a minimum of one week prior to actual shutdown. Submit schedule in writing indicating extent of system to be interrupted, date and time of when interruption is to occur, and date & time service will be restored. Schedule shall be subject to approval by appropriate NDSU personnel.
- C. Cancellation: NDSU reserves the right to cancel or change the scheduling of any outage up to 24 hours in advance of the approved starting time.

## **BUILDING TELECOMMUNICATIONS SYSTEMS – VOICE & DATA CABLING**

### **SECTION 1: GENERAL**

#### **SCOPE**

A. The Data Cabling System includes:

1. **Non-shielded Category 6-Augmented (Cat6a, CMP Plenum rated) horizontal cabling permanent link meeting or exceeding the most recent addendum of the TIA/EIA-568-C.2 standard for voice and data (new buildings & major remodels) Verify with NDSU Network Engineering**
2. **Non-shielded Category 5e (Cat5e, CMP, Plenum rated) horizontal cabling permanent link meeting or exceeding the most recent addendum of the TIA/EIA-568-B.2 standard for voice and data (legacy/existing buildings)**

#### **NOTE:**

**Legacy/Existing are buildings constructed or remodeled and completed prior to 2014.**

3. Category 3 plenum rated twisted-pair backbone cabling for voice.
  4. Plenum rated Multimode & Singlemode fiber optic backbone cabling supporting data systems.
- 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 (VoIP).
  5. Wireless (WiFi) technologies @ 2.4 GHz & 5.0 GHz + PoE
- C. Includes mounting elements, cabling, connectors, terminal equipment, cable management and identification.
- D. Structured cabling and pathways should be provided a clearance of at least one foot from fluorescent lighting and conduit or cables used for power distribution. In addition, pathways should cross perpendicular to fluorescent lighting and electrical power cables or conduit. ANSI/EIA/TIA-568-B must be complied with.
- E. Manufacturer's warranty for a period of 10 years of operation
- F. Documentation of the voice, video, data, security, and supplementary/auxiliary cabling systems
- G. Tested and documented for reference by the NDSU Enterprise Networks
- H. Network Backbone
1. The function of the backbone wiring is to provide interconnections between telecommunications closets, equipment rooms, and entrance facilities in the site-wide wiring system structure. The backbone wiring includes transmission media between buildings and can consist of both fiber optic and multi-pair copper to support both data and voice applications.
  2. Intra-building backbone cabling should consist of the following recognized cable types specified by the EIA/TIA 568-B standard.
    - a. 8.3/125 $\mu$ m singlemode optical fiber cable - (strand count determined by NDSU Enterprise Networks)
    - b. Cat3 multi-pair 24 AWG twisted pair cable - (pair count determined by NDSU Enterprise Networks)

#### **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 (or suitable alternate), identifying 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. All appropriate warranty information
- C. As-Built Drawings: (Hard copy + digital media (CAD))
  1. Two sets including revised shop drawing

#### **DESCRIPTION**

- A. The voice and data cabling system shall be a premises distribution system consisting of horizontal cabling and backbone cabling for voice, video and data  
NOTE: →"Data" = data jacks in support of: wired/wireless connectivity, BAS, life safety, security, surveillance, IoT monitoring and alarm systems
- B. The voice and data cabling system shall support the future installation and connection of the following equipment:
  1. Active data switch gear mounted in MDF/IDF/TR – wall or floor mounted equipment racks.
  2. Workstation Outlets.
  3. Workstation telephones and wall telephone outlets.
  4. Wireless (WiFi) Local Area Network (Access Points).
  5. Video surveillance
  6. Environmental monitoring
  7. Alarm systems
  8. Internet-of-things (IoT) May require sign-off by IT Chief Security Officer
- C. **NOTE: All MDF/IDF/TR switch gear and patch cord installation as well as voice cross-connect wire will be provided and installed by NDSU Enterprise Networks unless otherwise specified**
- D. All voice and data RJ45 terminations shall be **TIA-568B**

## **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 & faceplates) shall be **Panduit Mini-Com** series rated for either **Cat5e** for legacy/existing facilities or **Cat6a** for new construction or major remodel. (Confirm with owner)
- 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

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6. Superior Essex Group
  7. 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. **Non-shielded Cat5e (CMP, Plenum rated) horizontal cabling permanent link terminated on Cat5e Rated 110 hardware (legacy/existing buildings) Verify with Owner**
- B. **Non-shielded Cat6a (CMP Plenum rated) horizontal cabling permanent link terminated in Cat6a rated patch panels (new buildings & major remodels) Verify with Owner**
- C. **110 Termination Blocks (Cat 3 - backbone) & (Cat. 5e – permanent link):** Modular array of IDC terminal blocks arranged to terminate cables and permit interconnections  
**(No patch panels are used for Cat5e 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 Cat3 cabling.
  3. Four pair connecting blocks for horizontal cabling (Rated for Cat5e)
  4. Labeling: Designation strip with black machine printed lettering on white background and clear plastic cover integral to the cross connect panel.
- D. **Voice Jacks: Cat5e for legacy/existing buildings or Cat6a for major remodel and new buildings & major remodel (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)**

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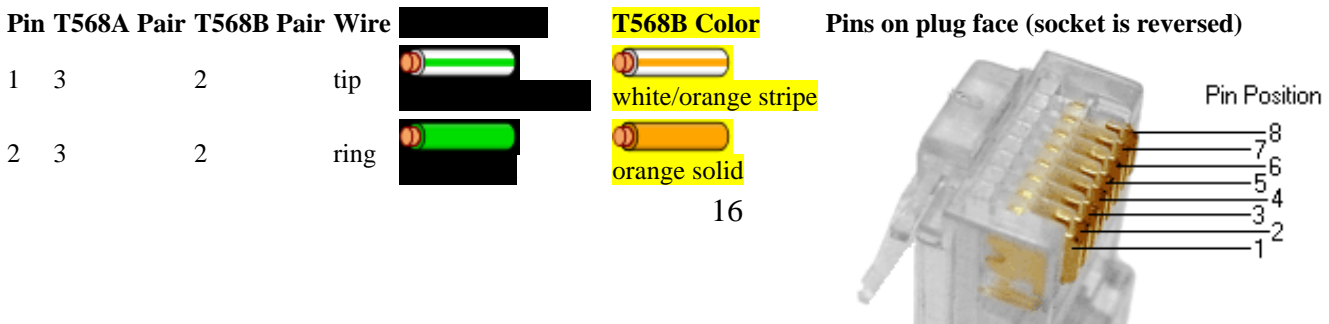
- E. **Data Jacks:** Cat5e for legacy/existing buildings or Cat6a for new buildings and major remodel (consult with owner)
  - 1. 8 position modular.
  - 2. Panduit Mini-Com series
  - 3. RJ-45 receptacle units with integral IDC-type terminals.
  - 4. Non-keyed
  - 5. Color **Orange (Or)**
- F. Workstation **Outlets/Faceplates** (Panduit Mini-Com series)
  - 1. Wall
    - a. Multiple jack inserts.
    - b. Single or multiple gang faceplate.
    - c. Faceplate: Plastic unless SS specified by the architect
    - d. Color/style (Panduit Minicom): by Architect or Electrical Engineer
    - e. Labeling: Black machine printed lettering on white background. **(Exhibit 'D')**
  - 2. Surface raceway:
    - a. Wiremold plastic or metal surface mounted raceway or approved equivalent
    - b. Color: Coordinate with Architect.
    - c. Labeling: Black machine printed lettering on white background.
  - 3. Ceiling (data jack): (Wireless AP & surveillance)
    - a. Single jack
    - b. Mount in single faceplate.
    - c. Faceplate: Stainless steel or approved substitute
    - d. Labeling: Black machine printed lettering on white background.
- G. Voice Wall mount Outlets:
  - 1. Single jack
  - 2. Mounted at 48" AFF
  - 3. Mount in single faceplate
  - 4. Faceplate: Stainless steel with mounting posts for wall mount telephone

**TWISTED PAIR CABLES**

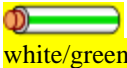




A. UTP Horizontal Cable:

**1. Data:**

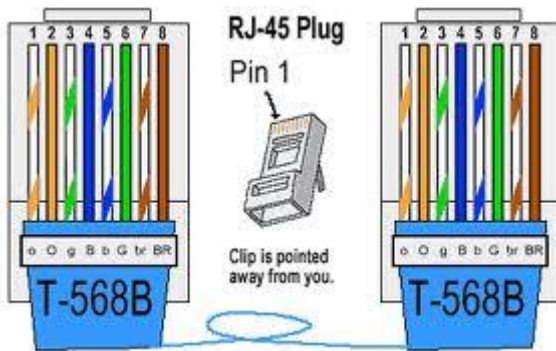
- a. Cat6a
  - b. Jacket color: **Blue**
  - c. Plenum/CMP rated
2. All terminations shall comply and tested with the TIA-568B standard



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3	2	3	tip			white/green stripe
4	1	1	ring			blue solid
5	1	1	tip			white/blue stripe
6	2	3	ring			green solid
7	4	4	tip			white/brown stripe
8	4	4	ring			brown solid

Note: This is from left to right, with the plastic latching tab facing away from the viewer.



**B. Analog/Digital Voice Twisted pair Backbone Cable:**

1. Category 3 w/industry standard binder groups
2. Thermoplastic-insulated, individually twisted pairs of conductors.
3. 24 AWG
4. Plenum/CMP rated

**FIBER-OPTIC CONNECTORS AND TERMINAL EQUIPMENT**

**NOTE: All strand counts shall be determined by NDSU Enterprise Networks**

**A. Connectors:**

1. Quick connect (alternate or equal approved by NDSU Network Engineering)
2. Insertion loss not more than 0.7 dB.
3. Duplex-type 'SC' UPC (Blue) 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. Up to 12 modular panel locations per patch panel.
4. 12 fiber connectors per modular panel.

5. Provide adequate modular panels and fiber connectors to terminate all strands specified by NDSU Enterprise Networks.
6. Labeling: Designation strip with black machine printed lettering on white background.

### **FIBER-OPTIC CABLES**

#### **A. Cables:**

1. Multimode:
  - a. 50/125µm diameter tight-buffered optical fiber (verify with owner)
  - b. Fiber counts (Specified by NDSU Enterprise Networks).
  - c. Dual window, 850 µm and 1300 µm.
  - d. Maximum attenuation —3.5 dB/km at 850 nm, 1.5 dB/km at 1300 µm
  - e. Listed types: OFNP
2. Singlemode:
  - a. 8.7 to 10 µm diameter tight-buffered optical fiber.
  - b. Fiber counts (Specified by NDSU Enterprise Networks).
  - c. Dual window, 1310 µm and 1550 µm
  - d. Maximum attenuation —1.0 dB/km at 1310, 1.0 dB/km at 1550 µm
  - e. Listed types: OFNP

### **MOUNTING ELEMENTS**

#### **A. Data Racks: (Exhibit 'B')**

1. Freestanding two post
2. Modular-steel or aluminum units designed for Telecommunications equipment support.
3. Approximate Module Dimensions: 84 inches high by 22 inches wide.
4. 19" mounting width.
5. Rails tapped - ETA spacing.
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 of each rack or utilizing overhead cable tray

#### **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 (**Exhibit A**)

#### **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 (prefer basket style)
  - b. High tensile tubular steel
  - c. Width: 12" - height 4"
  - d. Trapeze mounting
  - e. Cross-Rung Spacing: 9" for ladder style
  - f. Minimum Fitting Radius: 33"

**CABLE DOCUMENTATION - DATA**

A. The Contractor must provide cable documentation files. The files shall be windows compatible spreadsheet (Excel).

The files shall identify:

1. Station type: voice, data, wifi, video, other
2. Cable type and tested performance.
3. Location of outlet
4. Location of associated cable MDF, IDF or TR

**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 (neatly written)

**SECTION 3: EXECUTION**

**INSTALLATION**

- A. Provide **1 voice jack** and **1 data jack** at each workstation unless noted otherwise mounted at industry standard height (12" from center AFF) unless noted otherwise
  1. Provide 1 data jack for each location required for CCTV (video), surveillance camera, wireless (WiFi) as well as IoT devices/appliances
  2. 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 5e or 6a cable run shall not exceed 295 feet (jack to wire-closet termination (defined as the "permanent link"))
- C. Provide 4" x 12" basket tray or 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 jack to wire-closet (no splices allowed)
- E. Install armored fiber optic cabling in raceway and/or cable tray (if non armored cable, run in 1" or greater innerduct for length of run)
- F. Terminate cabling as appropriate at both ends per specification
- G. Install cable without damaging conductors, shield, or jacket.
- H. Do not bend cable at a smaller radii than minimums recommended.
- I. Pull cables without exceeding cable manufacturer's recommended pulling tensions (<= 25 ft. lbs.)

1. Pull cables simultaneously if more than one is being installed in the same raceway.
  2. Use pulling compound or lubricant as necessary.
- 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 minimum recommendations.
- K. Comply with EIA/TIA-569 rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources.
- L. Digital Signage – Connectivity to enable devices providing signage shall have 1 – data and 1 – RG6 coax adjacent to the electrical outlet. Height AFF shall be determined by the mounting height of the signage device.

**GROUNDING**

- A. Ground equipment racks, raised flooring and cable tray to provided Telecommunications Grounding Busbar.
- B. Bond cable shields, screens and drain conductors to Telecommunications Grounding Busbar. (Method to be determined by installer)
- C. Provide Telecommunications Grounding Busbar: In Equipment Room, Telecom Rooms and service entrance per (EIA/TIA-607-A).
- D. 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 stranded or solid AWG copper wire.
- E. All cable trays and racks are to be grounded to the main building ground using #6 stranded 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 ANSII-STD-607-A.
- B. All EMT conduit stubbed into ceiling or wall spaces as part of the horizontal cabling shall be ¾” unless specified otherwise.
- C. Conduit for risers shall be sized accordingly with at a minimum of 100% of additional capacity
- D. Each conduit terminating in an telecommunications box shall have a plastic bushing installed at the end of the run to protect the cable
- E. Maximum conduit fill requirements for station and riser cable

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

		Sample cable outside diameters (in) per BICSI					
Conduit Inside Diameter (in)	Trade Size	0.15	0.19	0.23	0.27	0.31	0.35
0.82	3/4	11	7	5	3	3	2
1.04	1	18	11	8	6	4	3
1.38	1-1/4	30	19	13	10	8	6
1.61	1-1/2	41	26	18	13	10	8
2.06	2	68	43	30	22	17	13

<b>2.46</b>	2-1/2	96	62	43	31	24	19
<b>3.06</b>	3	149	95	66	49	37	29
<b>3.54</b>	3-1/2	199	127	88	65	50	39
<b>4.02</b>	4	255	163	113	83	64	50

**INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS**

- A. Mount terminal equipment hardware on backboards or racking. **(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 to assist in facilitating backboard layout.
- C. Provide and install ‘110’ hardware to terminate station voice and data drop cables entering the Telecommunications room meeting or exceeding Category 5e specifications
- D. Use ‘110’ hardware to terminate Cat.3 rated risers
- E. Provide and install Cat6a rated patch panels appropriately sized to terminate voice and data cables entering the Telecommunications room meeting or exceeding Category 6a specifications

**IDENTIFICATION**

- A. Workstation Outlet/Faceplate:
  - 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 (starting clockwise from the entrance within room/space) - Cable Function & Jack sequence # on faceplate
    - b. Example: RRRR- nnn-X#
    - c. Where:
      - 1) ‘RRRR’ = Room number
      - 2) nnn = Faceplate Number (01-99 →Clockwise around room or area)
      - 3) X# = Cable Function & jack number on faceplate (‘D’=Data, ‘V’=Voice, ‘W’=Wi-Fi  
Jack # = 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.
    - a. Format: Workstation Room Number - Faceplate Number - Cable Function & sequence #
    - b. Example: RRRR- nnn-X# **(Exhibit ‘D’)**
    - c. Where:
      - 1) ‘RRRR’ = Room number
      - 2) nnn = Faceplate Number (01-99 →Clockwise around room or area)
      - 3) X# = Cable Function & jack number on faceplate (‘D’=Data, ‘V’=Voice, ‘W’=Wi-Fi  
# = Jack sequence number on faceplate)
  - 3. Label cables within outlet boxes - Label each cable within 4-6 inches of each termination
- C. Cross Connect 110 hardware & Cat6a patch panels
  - 1. Label type: Designation Strip or manufactures recommended technique (Cat5e and/or 6a)
    - a. Label twisted pair backbone cable terminations with the Telecommunications Room Name/number at the opposite end of the terminated cable and the pair count provided by owner.

- b. Label voice and data horizontal cable terminations with the 'Faceplate' ID
- D. Fiber Optic Patch Panels:
  - 1. Label type: Designation Strip or the manufactures recommended technique.
  - 2. Label the designation strip for each connector identifying the Telecommunications Room of originating closet at the opposite end and the assigned strand count.

## **WIRELESS**

### Wireless Design and Installation Standards

#### A. General

- 1. The wireless standards below are for indoor design only. Outdoor specifications are not included and shall be consulted with Enterprise Networks prior to designing for outdoor/green spaces.
- 2. The following are general guidelines only and each space shall be evaluated separately based on architecture, electrical and mechanical systems design.
- 3. Design shall take into consideration the avoidance of EMI when determining access point location(s).

#### 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 require 1 WAP per 40 seats
- 2. 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 utilize Power-over-Ethernet (803.11af/at)

#### 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

## **PROJECT EXAMINATIONS AND COMMISSIONING**

- A. During construction, all work is subject to inspection and review by NDSU Network Engineering.
- B. Cables identified with noticeable flaws will be replaced regardless if they past the battery of installation tests
- C. After all circuits and hardware are permanently installed (permanent link), testing can begin and SCS can be certified to obtain manufactures warranty (25 years).
- D. All grounding/bonding to be tested and certified by a qualified electrician or telecommunications installer

## **CLASSROOM FACILITIES**

Note: See 'Classroom Technologies' & Exhibit 'I' section in this document)

### A. General

Typically all NDSU classroom facilities will have a high volume of student and instructor workstations being used continuously throughout the day. The concentration can be from just a few workstations to several dozen in a large lecture hall requiring student access to both power and networking services (wired and wireless).

These spaces must be designed and configured to support ongoing reconfiguration, changes in technology and an array of types and styles of furniture. If using built in furniture it must be able to support extensive power and telecommunications cabling

If freestanding tables are used:

1. A floor duct/walker duct and/or trench system separate from other floor distribution infrastructure (typically running the length of the room – consult IT Classroom Technologies)
2. A wall mounted surface raceway system
3. Manufactured or as built raised floor system (provides the most flexibility but most expensive)

- B. Design personnel should contact the Classroom Technologies Department within the Division of IT to assist in detailing design requirements.

## **TESTING**

### A. Voice and Data Horizontal Cables:

1. Test 100% of voice and data horizontal cables for performance to the current addendum for 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. Denote those bad pairs in as-builds.

### C. Fiber Optic Backbone Cables:

1. Test 100% of backbone fiber strands for performance to current addendum for 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

**TELECOMMUNICATIONS SYSTEMS OUTSIDE/UNDERGROUND PLANT (OSP)**  
**SECTION 1: GENERAL – OUTSIDE PLANT**

**DESCRIPTION / Introduction**

The purpose of this document is to provide consulting architects, engineers, and designers working for NDSU with a guide for the design of outside plant (OSP) communications distribution systems that accurately reflect NDSU and industry standards in effect as of this publication.

Outside plant communications distribution systems designed for NDSU are expected to support and integrate voice, data, and video communications with common media (fiber optic and unshielded twisted pair (UTP) copper cable).

In general, it is the responsibility of the outside plant communications distribution designer to coordinate with the other designers on a project (architecture, electrical, mechanical, etc.) to ensure that other systems are both compatible with and complementary to the communications cabling system. NDSU's design philosophy is that it is critical to coordinate between disciplines during the design phase of a project, rather than attempting to make adjustments in the field during construction.

The outside plant cabling system consists of backbone/distribution cabling, terminations, buried duct/vault systems, service entrance rooms and copper and fiber performance testing.

**SCOPE**

- A. The Outside Plant Cabling System typically includes:
  - 1. Singlemode fiber optic backbone system for data, voice and CATV
  - 2. Category 3 backbone cabling system for voice, telemetry and signal/control.
  - 3. Buried 4" PVC conduit including innerduct.
  - 4. A secure telecommunications service entrance room (minimum 8' x 10')
  - 5. Various sizes and configurations of underground concrete manholes and quazite hand holes (See Exhibit 'F')
- B. Support the following network topologies and technologies
  - 1. Analog Voice Circuits.
  - 2. Digital Voice Circuits.
  - 3. Ethernet 10/100BaseTX, 100 BASE FX, 1000Base LX, 1000Base SX, 1000Base TX, 10Gbase-SR/LR, 40, 100 Gb/s Ethernet standards (high bandwidth – low latency applications and systems)
  - 4. Broadband applications
  - 5. OC3 → OC192
- C. Manufacturer's warranty 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 Enterprise Networks
- E. Underground cables
  - 1. Cables to be placed underground are to be rated for the purpose. All cable shall be gel filled with armored cladding
  - 2. Cable service loops are required at each hand-hold opening or vault
  - 3. A 50' loop per opening between hand holes must be provided.
  - 4. A service loop of 50', neatly coiled with a diameter of no larger than 2 feet, will be left at every building entrance.
  - 5. At no time shall an outside plant rated cable run inside a building further than 50 feet (per NEC) unless it is encased in rigid metal conduit. Otherwise there must be a transition from outside plant cable to a plenum rated fiber cable which will then be run through a plenum rated inner duct. This transition can be accomplished by a fusion splice, a mechanical splice or by a fiber wall mount enclosure.
- F. Network Backbone (OSP)

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1. The function of the backbone wiring is to provide interconnections between telecommunications building entrance facilities and the Quentin Burdick Building (aka QBB). The campus/enterprise backbone wiring includes transmission media between buildings and can consist of fiber optic cable and multi-pair copper.
2. Intra-campus backbone cabling consists of the following recognized cable types specified by the EIA/TIA 568-B standard.
  - a. UG rated four-pair, 23 AWG solid core 100-Ohm, UTP (Cat.6a) TIA/EIA 568-B.2-10
  - b. 8.3/125µm singlemode optical fiber cable (Loose tube, gel filled, color coding per TIA/EIA 598B) Meeting or exceeding Ethernet transmission standard of IEEE 802.3ae
  - c. Multi-pair Cat.3 24 AWG twisted pair cable (pair count determined by NDSU Enterprise Networks)

**G. Designer Qualifications**

It is required that all outside plant communications distribution system designs executed on the behalf of NDSU be designed or consulted by a Registered Communications Distribution Designer (RCDD) as certified by BICSI. This means that the design project shall be managed under the direct supervision of an RCDD on the consultant's staff. Project related communications between NDSU and the consultant shall be mainly through the RCDD.

In addition to the RCDD certification, it is desirable that the RCDD have the following qualifications:

1. Professional Engineer (P.E.) in the electrical engineering field
2. RCDD/LAN certification from BICSI

**In addition, the RCDD shall have the following qualifications:**

1. The RCDD shall demonstrate a minimum of 5 years of experience in the design of outside plant communications distribution systems. Experience not directly related to the design of outside plant communications distribution systems, such as sales and/or marketing, project management, or installation experience, is not acceptable.
2. The RCDD shall demonstrate that he/she has designed or has had personal design oversight of a minimum of five projects similar in size and construction cost to the current NDSU project.
3. The RCDD shall not be affiliated with any manufacturer associated with the communications distribution system industry.
4. The RCDD shall be completely familiar and conversant with the standards listed below.

**EXISTING PLANT**

- A. NDSU campus distribution system drawings including maintenance holes/vaults and conduits provided by NDSU/NEO 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. Identify the project, site, date and vendor/contractor 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. Catalog sheets with complete technical data for each item being furnished.
  - e. Confirmation that products are registered components for the manufacturer's warranty.

C. Operation and Maintenance Manual

1. As-Built Drawings:

- 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.

**GENERAL (OSP)**

- A. When designing duct/conduit pathways the designer/engineer shall take into consideration any master plans for the University as to mitigate any future issues with campus design.
- B. The following Telecommunications Construction companies have proven experience in the installation of OSP at NDSU.
1. Master Construction – MasComm
  2. MVM Contracting
  3. Ernst Trenching
  4. MEI Technologies
- C. Conduit shall be Polyvinyl-Chloride (PVC) Schedule 40 (Schedule 80 for special configurations) for underground installations
- D. Duct bank consists of an arrangement of multiple ducts constructed in tiers. **(See Exhibit 'E')** Typical manhole-to-manhole duct bank arrangements are 2, 3, and 4 ducts wide by 2, 3, or 4 ducts high. Manhole to the building is typically 3 non-stacked.
- E. Multi-cell type innerduct or 3 – 1 ¼" innerduct shall be installed when two or more 4" ducts are called for in a specified run.
- F. Duct banks used for telecommunications pathway should not be shared with other utilities.
- G. The minimum depth of a trench shall be at a minimum of 36" from existing grade to allow for cement slurry (CDF) or concrete cap, fill and top soil. **(See Exhibit 'E')**
- H. All conduit placed in trenches shall be encased with either concrete or cement slurry (CDF) to a thickness cap of no less than 6" above top of duct bank.
- I. A duct section may have no more than the equivalent of two 90-degree bends (a total of 180 degrees) between pull points.<sup>®</sup> The 180-degree maximum shall include kicks and offsets
- J. Boring - depth shall be at a depth of 36" and consistent throughout the entire length of the route
- K. All installed conduits shall be cleaned with a flexible mandrel and brush.
- L. All metallic conduit and sleeves shall be reamed and brushed
- M. All unused underground conduits and innerduct shall have minimum of a 2500 lb. mule tape or pull rope installed
- N. The end of the conduit that enters through the building exterior wall shall be sealed with Link-Seal® or approved equal and plugged with expandable duct plugs
- O. Warning tape shall be placed above conduit on all conduit runs
- P. Factory manufactured conduit bends should be used wherever possible.
- Q. No single conduit/duct run shall be longer than 600' with no more than two 90 degree bends/sweeps between pulling points – cover to cover or cover to wall
- R. Any hand-hole or man-hole shall be constructed of reinforced pre-cast concrete, 4500psi designed appropriately for vehicle loading
- S. All underground hardware shall have a hot dipped galvanized finish
- T. Provide cast-iron frame and cover with nominal 32" – 36" opening equal to NEENAH #R-1640-D with a NEENAH TYPE-C lid e/w pick holes. Lid shall have "COMMUNICATIONS" cast on the lid.
- U. When work is completed in Man-holes and Hand-holes, they should be left free of dirt and all debris.



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- V. All innerduct shall be routed up through the open bottom of the hand-hole with a minimum of 8” above pea rock and all unused duct appropriately sealed.
- W. All proposed splices not indicated on construction drawing shall be approved by the Director, Network Engineering
- X. NDSU maintains an extensive underground steam tunnel distribution system. This infrastructure can be used for the delivery and distribution of telecommunications and network infrastructure providing approval is granted by NDSU Facilities Management. Contractor shall ensure that all NDSU policies, guidelines and construction methods are adhered to when utilizing the NDSU steam tunnel to distribute telecommunications and network infrastructure.
- Y. It is the contractor's responsibility to coordinate the location of all subsurface utilities (gas, electrical, water, sewer, etc.) 48 hours prior to initiating any work
- Z. 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)
- AA. Reference the NEC or current BISCII-TDM for separation requirements

**SECTION 2: PRODUCTS**

**MANUFACTURER**

- A. Mounting Elements:
  - 1. Chatsworth
  - 2. Hoffman
  - 3. Homaco
  - 4. Ortronics
  - 5. Link-Seal®
  - 6. NDSU approved equal
- B. Cable: Partnered with the System Manufacturer:
  - 1. Belden Wire & Cable Company.
  - 2. Berk-Tek, Inc.
  - 3. CommScope, Inc.
  - 4. General Cable
  - 5. Mohawk/CDT
  - 6. NDSU approved equivalent.
- C. Primary Protection Devices:
  - 1. Avaya
  - 2. Circa
  - 3. NDSU approved equivalent.
- D. Underground Conduits:
  - 1. Carlon
  - 2. Hubbell
  - 3. Arnco
  - 4. NDSU approved equivalent

**TYPICAL UNDERGROUND MANHOLE/HANDHOLE CONFIGURATION**

- A. For reference only (not for construction) **Exhibit 'F' & 'G'**

**B. Hand Holes**

1. Quazite 'PG' series
2. Equipped with LOGO Code 092 "TELECOMMUNICATIONS"

**BUILDING ENTRANCE MOUNTING ELEMENTS**

**A. Data Racks:**

1. Freestanding (two post)
2. Approximate Module Dimensions: 84 inches high by 22 inches wide unless noted otherwise.
3. Rails tapped on EIA spacing.
4. 19" mounting width
5. Finish: Baked-polyester powder coat (Black).
6. Vertical Cable Management at the end of each row of racks and between each rack.
7. Horizontal cable management at the top 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

**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. Execution**

1. Provide three - 4" schedule 40 PVC conduits between the proposed building entrance and the nearest Telecommunications maintenance vault (consult Enterprise Networks).
2. Open trench, encase conduits in concrete or slurry (**See Exhibit 'E'**)
3. Install spacers to ensure 2" – 3" space between conduits (every 8 - 10 ft.).
4. Populate one of the three 4" conduits with multi-cell or 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.
7. Conduit types/usage

<b>Conduit Type</b>	<b>Usage</b>
Schedule 40 PVC	Encased in concrete/slurry
Schedule 80 PVC	Direct-buried
Rigid Galvanized Steel	Exposed
PVC to Steel	Direct-buried, Transitions at building entrances

**TWISTED PAIR BACKBONE (UNDERGROUND CABLES)**

- A. Conductors:
  - 1. Twisted pairs
  - 2. Solid copper, 24 AWG
  - 3. Polyethylene insulation
  - 4. Pair counts specified by NDSU Enterprise Networks / 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 copper splice cases shall be filled with re-enterable encapsulate

**COPPER CONNECTORS AND TERMINAL EQUIPMENT**

- A. Cross-Connect 110 Hardware: 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

**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 OSP CABLES**

**NOTE: All strand counts shall be determined by NDSU Enterprise Networks**

- A. 50/125 Multi-Mode cable:
1. 50/125  $\mu\text{m}$  diameter loose tube – GELL FILLED optical fiber.
  2. Fiber counts provided by NDSU Enterprise Networks
  3. Dual window, 850  $\mu\text{m}$  and 1300 $\mu\text{m}$
  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.
  7. Jacket: black polyethylene.
  8. Jacket marking indicating manufacturing code, strands, date and length.
- B. Single-mode cable:
1. 8.7 to 10  $\mu\text{m}$  diameter loose tube – GELL FILED optical fiber.
  2. Fiber counts provided by NDSU Enterprise Networks
  3. Dual window, 1310  $\mu\text{m}$  and 1550  $\mu\text{m}$
  4. Maximum attenuation —0.5 dB/km at 1310, 0.5 dB/km at 1550 nm.
  5. Water blocking compound over the core.
  6. Jacket: black polyethylene.
  7. Jacket marking indicating manufacturing code, strands, date and length.

<b>OPTICAL FIBER ATTENUATION (LINK LOSS BUDGET)</b>	
<b>OPTICAL FIBER TYPE</b>	<b>ALLOWABLE LOSS PER KILOMETER AT A GIVEN WAVELENGTH</b>
<b>Singlemode ISP/OSP</b>	<b>1.0dB @ 1310nm / 0.5db @ 1310nm</b>
	<b>1.0dB @ 1550nm / 0.5db @ 1550nm</b>
<b>Multimode ISP and OSP</b>	<b>3.5dB @ 850nm</b>
	<b>1.5dB@ 1300 nm</b>
<b>Connector loss (per mated pair)</b>	<b>0.75 dB</b>
<b>Splice</b>	<b>0.3 dB per splice max (mechanical or fusion)</b>

**FIBER CONNECTORS AND TERMINAL EQUIPMENT**

- A. Cable Connectors:
1. Quick connect
  2. Insertion loss not more than 0.7 dB
  3. Duplex-type ‘SC’ UPC connectors with self-centering, axial alignment mechanisms. (Verify with owner)

- 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. 12 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 documentation. The files shall be windows compatible (Excel)
- B. The files shall identify:
  - 1. Cable type, length and tested performance.
  - 2. Location of termination points

#### **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
- D. Appropriately spaced (~ 48") to minimize excessive sag.
- E. Alternate methods approved by owner

### **SECTION 3: EXECUTION**

#### **INSTALLATION**

- A. Comply with the NEC 50 ft. rule to not extend (black) underground rated cables beyond 50' from building entrance. Extensions that extend beyond 50' from the building entrance using an UG rated (Black) cable will need to be routed in appropriately sized EMT or converted to an indoor rated cable sheath.
- 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 for indoor installations
- 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).

#### **SEPARATION**

- A. All PVC underground conduit shall be kept at a minimum of 8 feet from any steam lines unless approved by the Director of Network Engineering. As added protection, the engineer may specify additional pipe insulation be installed.
- B. If the necessary separation cannot be met, the contracted 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.

#### **EQUIPMENT ROOMS (MDF/TR)**

- 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 with permanent ink.
- 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

#### **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 5% 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: (Tested with a freshly calibrated OTDR)
  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
    - b. Test results shall be documented for each strand and returned to NDSU Enterprise Networks in an Microsoft Excel form in both hardcopy and digital form.

#### **CONSTRUCTION DRAWINGS**

- A. Construction drawings should be thoroughly and accurately marked. Listed below are items that should be included on construction drawings, dependent upon the type of project:
  1. Routing and pathways including manholes and pull boxes

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2. Duct configurations and sizes
3. Pair counts for copper and strand counts for fiber optics
4. Curb offsets where possible
5. Any obstructions
6. Clearly label building entrance locations

**NETWORK SECURITY**

- A. In an effort to protect the security and integrity of the NDSU enterprise network against unauthorized or inappropriate use, and to protect campus authorized users from the effects of such abuse, negligence or improper/non-approved configurations, NDSU reserves the rights to restrict, or terminate any account or use of NDSU network resources, and to remove any elements (hardware/software) which may destabilize authorized use. The University also reserves the right to inspect or check the configuration of computer or network resources for compliance and to take any action as to protect NDSU computer and network resources. NDSU further reserves the right to enforce these requirements without prior notice to the user.
- B. Authorizing network access will be the responsibility of the NDSU IT Chief Security Office or an appointed surrogate and will require a detailed description of the applications, how it is architected and what mechanisms are being put in place to ensure university compliance.
  - 1. At the end of this document is a form – **EXHIBIT 'K' (CONTRACTOR REQUEST FOR Static Public 'IP' SERVICES)** that will need to be completed and faxed to the NDSU – IT Chief Security Officer (701 231-8541).  
Questions relating to completing this form should be directed to the Network Engineering Project Manager or the (project) project coordinator.
- C. Non NDSU or NDUS entities (contractors/vendors/service providers) will be held responsible for the following actions relating to their specific system or application:
  - 1. Understanding and complying with all NDSU security policies governing all computer and network resources
  - 2. Protecting passwords as well as other variations of access control. Such information shall never be transited or shared with others not affiliated with the system or application implemented.
  - 3. Respecting the privacy of the NDSU community, under no circumstances shall a vendor or agent of a vendor sniff or inspect any data traversing the NDSU network.
  - 4. Ensure all equipment configurations are kept secure
  - 5. Ensure that all appliances are further kept secure with proper password maintenance
  - 6. Access privileges are properly and timely maintained and remain restricted only to authorized personnel
  - 7. No network extensions (jacks, wifi, etc....) are permitted without proper documentation and approval from Enterprise Networks and the NDSU Chief Security Office or an appointed surrogate.
  - 8. Any attempt to breach policy at NDSU or other locations will result in forfeiting the use of NDSU network resources.



## CLASSROOM TECHNOLOGIES

### **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, conference room, and small study space. Each element should be discussed in detail with the architect, electrical engineer and HVAC engineer. It is vital to the successful completion of these spaces that the CTM be contacted early on in the project to work through each of these items.

**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.**

Micah McGowen, CTM

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OR

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Classroom technologies and applications currently supported are: high end video projection, integrated sound system (program and voice reinforcement), A/V switcher, control system, computer, document camera, video conferencing equipment, AppleTV and interactive board/panel.

### ***REFERENCE EXHIBIT 'I' THROUGHOUT THIS SECTION***

#### **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 - 3/4" and 3 - 1/2" conduits. The gutter at the front of the room shall be attached to a vertical chase or a 2" conduit in the wall to provide a path to the under-floor distribution. (See owner for exact details).

All conduit shall be run in the most direct path possible and shall not exceed 180 degrees in bend.

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 ceiling mounted projector(s)/video display(s).

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.).

For conference rooms and small study rooms there shall be 1 - dedicated 1" conduit running from a floor box in the center of the room to the ceiling for AV cabling in addition to data and electrical.

**Data & Voice Networking:**

Provide the following data circuits in each AV area or room (Confirm with CTM):

**REF. EXHIBIT 'I'**

- 3 - Cat 6a at the podium
- 4 - Cat 6a at the AV cabinet/closet (if provided)
- 2 - Cat 6a on front wall
- 2 - Cat 6a on each side wall
- 2 - Cat 6a in all floor boxes installed in conference rooms and small study rooms.
- 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/video display (See Audio & Video below); install 10' of flexible conduit
- 2 circuits inside the podium at the front of the AV room (isolated neutral); double duplex each outlet

- 2 circuits inside the AV equipment cabinet/closet (if provided) (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 the floor box in conference rooms and small study rooms
- 1 switchable (interrupted) circuit at powered screen (if installed)
- Check with CTM about providing outlets at student seating (laptops)

#### **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.
  - (a) 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.
  - (b) The remaining tubes are to be manually controlled to dim or turn off lights with switches only at podium area.
  - (c) 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.
- 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.

Lighting control system

- Work with NDSU IT while determining a control system to ensure that the lighting control system can be securely connected to the NDSU network.
- AV Control system access – The lighting control system selected shall be one that allows for integration with the AV control systems in the rooms. Work with the CTM to determine the needs of the network connection in the closet where lighting control system is located
- All classrooms, conference rooms and quiet study rooms shall have occupancy sensors.
- Occupancy sensors shall have NO and NC relay connections for integration with the AV control system.

#### **Architectural:**

Room environment (see HVAC & Lighting above)

When sizing an AV room, the length to width ratio shall be coordinated with the CTM.

Interior columns for support beams should be avoided.

There shall be nothing obstructing the student view of writing surfaces, projection screen, and instructor/podium.

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 room 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)

If powered window coverings are installed, they shall be integrated with the AV control system. Confirmed the control method with the CTM.

### **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 1/6<sup>th</sup> 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.**

The following mounting hardware shall be used in mounting the projectors:

Chief CMS440 (provided and installed by project)

Peerless PRGS-UNV-W (provided and installed by project)  
Chief CMS-XXXW (provided and installed by project)

All remaining hardware shall be left on the Chief CMS440 ceiling plate for the CTM.

The ceiling plate must be secured to the ceiling grid with provided set screws and to a solid structure above the ceiling grid as outlined in the documentation provided by the manufacturer. Consult CTM for questions.

In most rooms a Chief CMS-009W extension pipe will be sufficient. If the installation of the projector screen, or obstructions in the ceiling requires the projector to be lower, then an appropriate length Chief CMS-XXXW pipe shall be used.

The extension column must be installed centered on the projection screen.

For extension columns with a cable exit port, the extension column shall be installed with the cable exit port at the ceiling.

Sound reinforcement requirements for each room must be discussed and approved by CTM. Approved equipment, will be provided by project (unless otherwise specified). Appropriate cabling must be installed to the locations (instructor podium, sound closet, etc.) specified by CTM.

-Preferred speakers for ceiling installations are Crestron SAROS\_IC or equivalent speakers. Speaker size should be approved by CTM.

-Preferred speakers for on wall installations are Crestron SAROS\_SR or equivalent speakers. Speaker size should be approved by CTM.

-In a standard height room (9'6" ceiling) install a single gang electrical box at either side of the front of the room 10" down from the ceiling and 8" in from the side wall with ¾" conduit run to about the ceiling for on wall speaker installation. If ceiling height is larger than 9'6" consult with CTM for location. Provide a cover plate at each location and coordinate color with the architect.

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 room needs.

Owner will generally purchase and install switchers and microphones (unless otherwise specified).

All equipment other than speakers, cameras, microphones, ceiling mounted projectors, and displays will be installed at or within the podium.

1 - Crestron Digital Media Plenum (DM-CBL-ULTRA-P) cable shall be pulled from the AV equipment cabinet to each projector/display. Crestron Digital Media cable shall be sole sourced, no substitutions.

In installations where the equipment is installed in an AV cabinet external to the instructor podium, 4 - Crestron Digital Media Plenum (DM-CBL-ULTRA-P) cable shall be pulled from the AV equipment cabinet to the instructor podium.

Speaker cable shall be shielded 18/2 plenum cable.

- For ceiling speakers, daisy chain (unless otherwise designated by CTM) all speakers together. Home run to the AV rack shall be from the nearest speaker
- For wall mounted speakers run one cable from each speaker location (single gang box installed at the front of the room) to the AV equipment cabinet.

When ceiling microphones are installed 1 – Cat 6a cable shall be pulled from each microphone location the AV equipment cabinet. Coordinate the location and number of microphones with the CTM).

When ceiling mounted or wall mounted cameras are specified 1 STP and 1 UTP Cat 6a shall be pulled from each camera location the AV equipment cabinet. Coordinate the location and number of cameras with the CTM).

In the AV cabinet and/or instructor podium each cable should have at least 15' of cable

All cables to be provided and installed by the project and terminated by the owner.

#### **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 room would be 10.7' W x 6' H (16:9 formats). Maybe larger depending on room size.
- Seamless, matte white finish.
- Side tension rods preferred (to maintain vertical stability of screen).
- Heavy black backing recommended.
- Motorized screens with low voltage controls should be selected
- 20/3 cable shall be run from each projection screen to the AV equipment cabinet
  - Confirm proper wiring of the control module with the CTM.
- DaLite projection screens shall be sole sourced, no substitutions.
- When wall mounted displays are installed confirm mounting height with CTM

Instructor podium will be furnished by the owner.

The instructor podium that will be placed at the front of the room will generally be no larger than 48" wide by 30" deep (Confirm with CTM). The placement of this cabinet and the associated electrical, data, and AV cabling must be such that this cabinet doesn't obstruct the audience's view of the projection screen(s) from all angles. Final placement of podium approved by the CTM.

If the AV equipment is to be installed in a location external to the Instructor podium this location shall have

- Front and rear access to the full height of the cabinet
- No walls within 4' of either side of the front and rear access.
- Access doors must be able to open at least 180 degrees
- Internal dimensions of the cabinet shall be no smaller than 30" wide x 36" deep by 90" tall.
- A junction box shall be installed with 2" conduit feeds run to the ceiling and in floor distribution system. The quantity of conduit feeds will be determined by the type of room (Confirm with CTM)
- Sole Lighting, Shade, and projection screen controls must not be installed within the AV equipment cabinet/closet. There must be access to these controls elsewhere in the room.

All AV cabinets and tables must be secured and they must be keyed for the campus C420A key.

If the AV equipment is in a closet behind the door must be secured and it must be keyed for the campus GM50 key.





**Exhibit A**

**Typical Wirecloset Configuration  
 Butterfly Drawing**

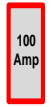
Exhibit 'A'


**NOTE:**


Actual size based on serving area


-  Ground Bus Bar
-  Active equipment racks


Cat.6a terminated on rack  
 mounted patch panels

-  100 Amp feed & room distribution.


-  3/4" Plywood 2" off deck  
 Painted F/R gray


-  12" basket tray


-  110/210 termination H/W

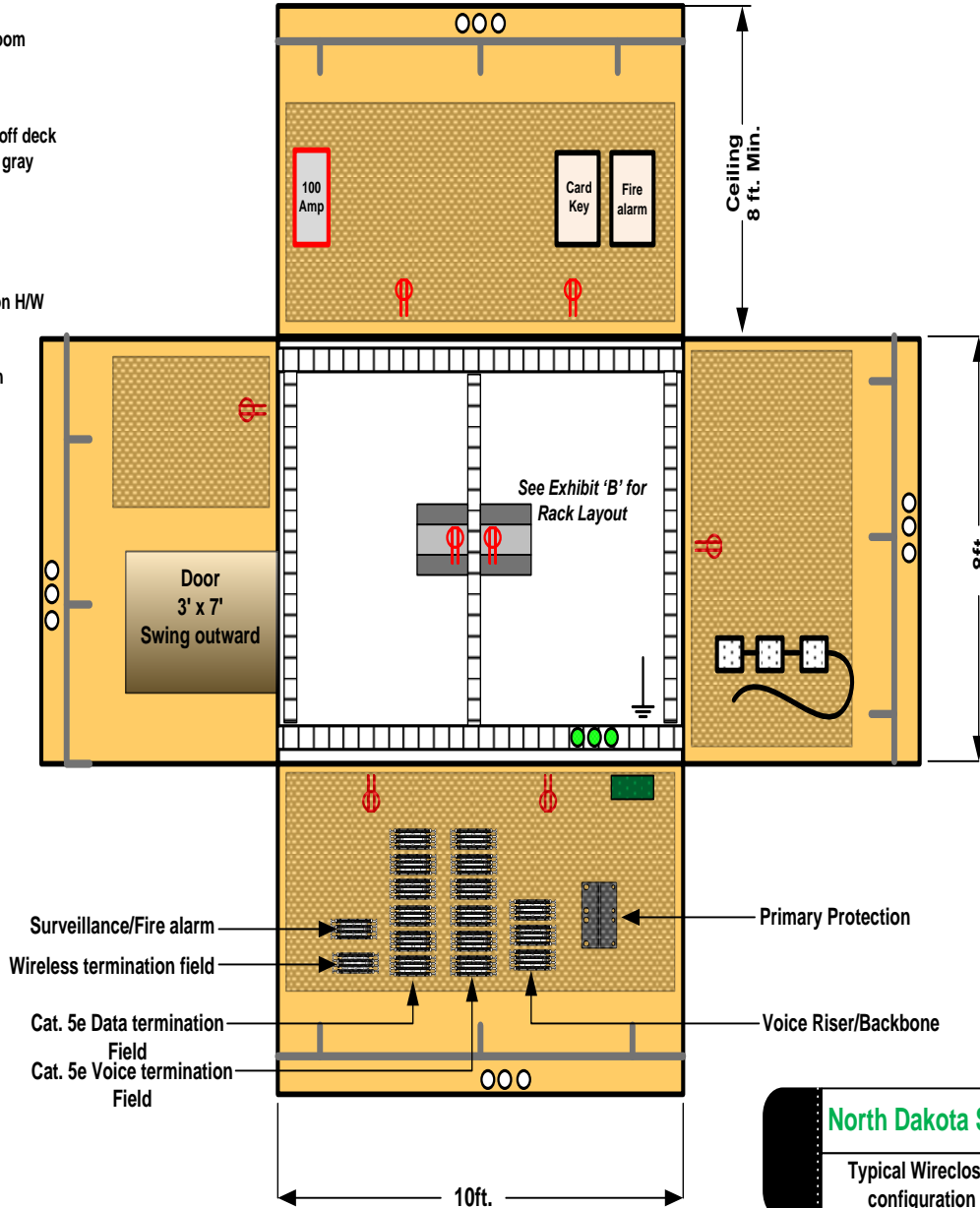
-  120v. 20 amp  
 Dedicated branch 'double duplex'

-  Ancillary  
 Services  
 Card Key  
 F/A, Etc.

-  CATV  
 Distribution

-  4" conduits to  
 Nearest MH  
 If MDF or BE

-  4" Riser sleeves  
 Where necessary



<b>North Dakota State University</b>	
Typical Wirecloset configuration	10-18-2016



**Exhibit B**

8-22-2017/tw

North Dakota State University  
Network Engineering & Operations

**Exhibit 'B'**

**Typical Rack Configuration**

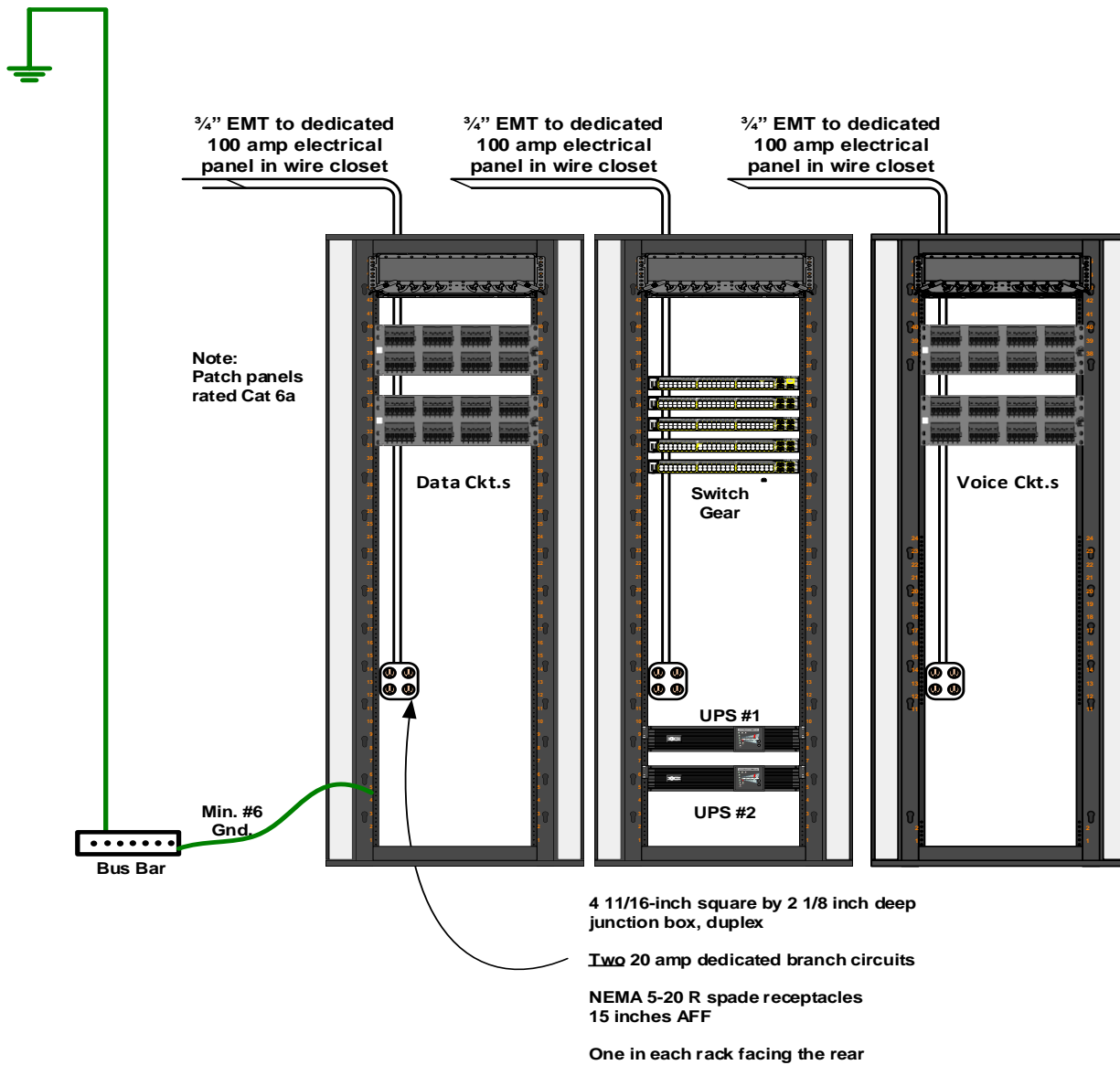


Exhibit C

**Exhibit 'C'**

**Telecommunications Symbols  
 Configurations**

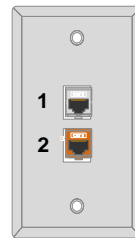
The following is not an exhaustive example. Only to reflect some of the possible/more typical configurations



**W**  
 ▽ (1) Voice  
 Wall Mount



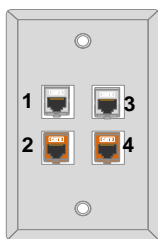
▽ (1) Voice



▽ (1) Voice  
 (1) Data



▽ (1) Voice  
 2 ▽ (2) Data



2 ▽ (2) Voice  
 2 ▽ (2) Data



▽ (1) Data  
 TV (1) CATV



**WAP**  
 ▽ (1) Wireless AP (Data)



TV (1) CATV

**NOTE:** Each jack within each faceplate shall be appropriately labeled as to the service.  
 (See 'Faceplate Labeling')

Exhibit D

**Exhibit 'D'**  
**Faceplate Labeling 'example'**

**Faceplate Labeling Scheme:**

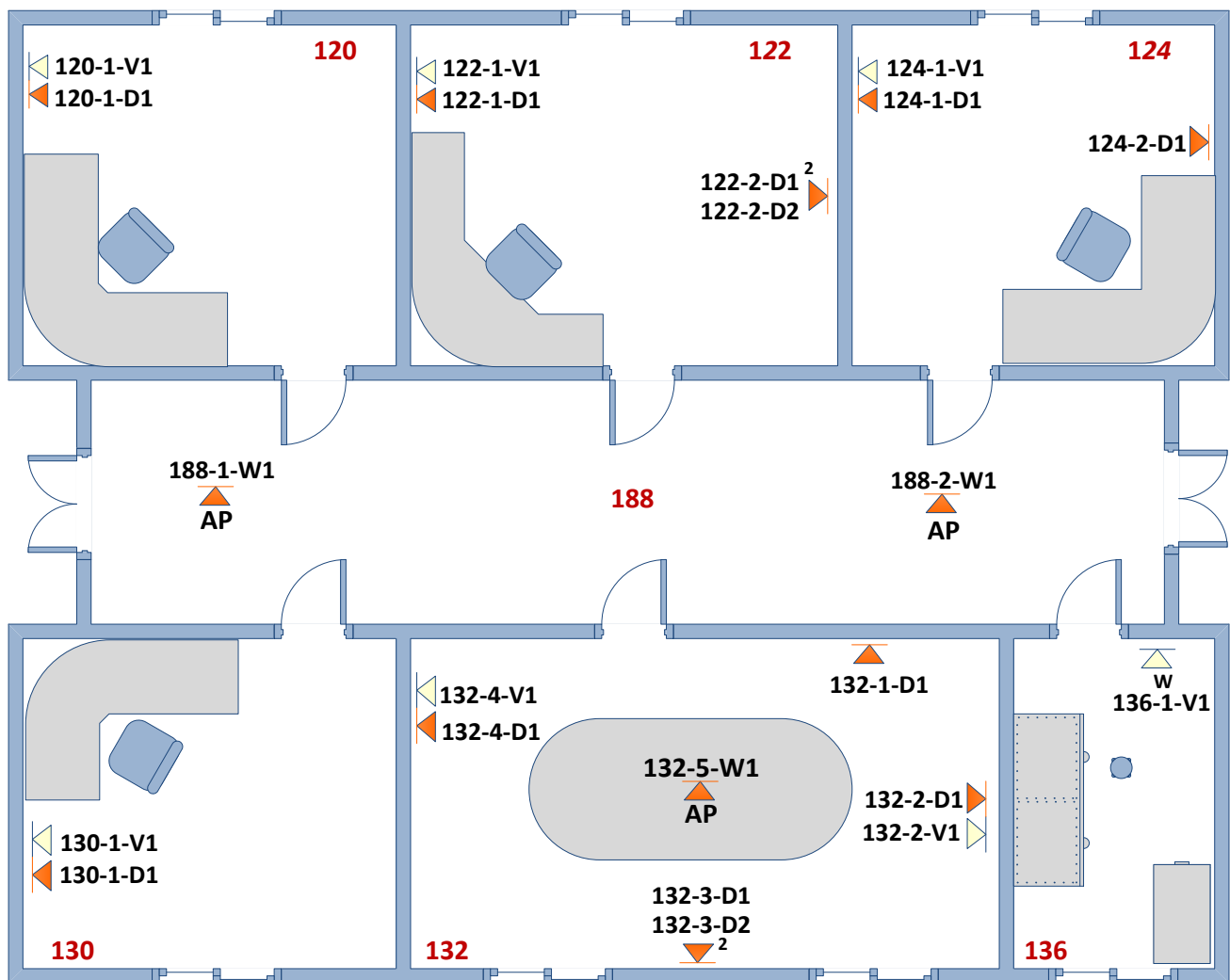
**RRRR-nnn-X#**

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



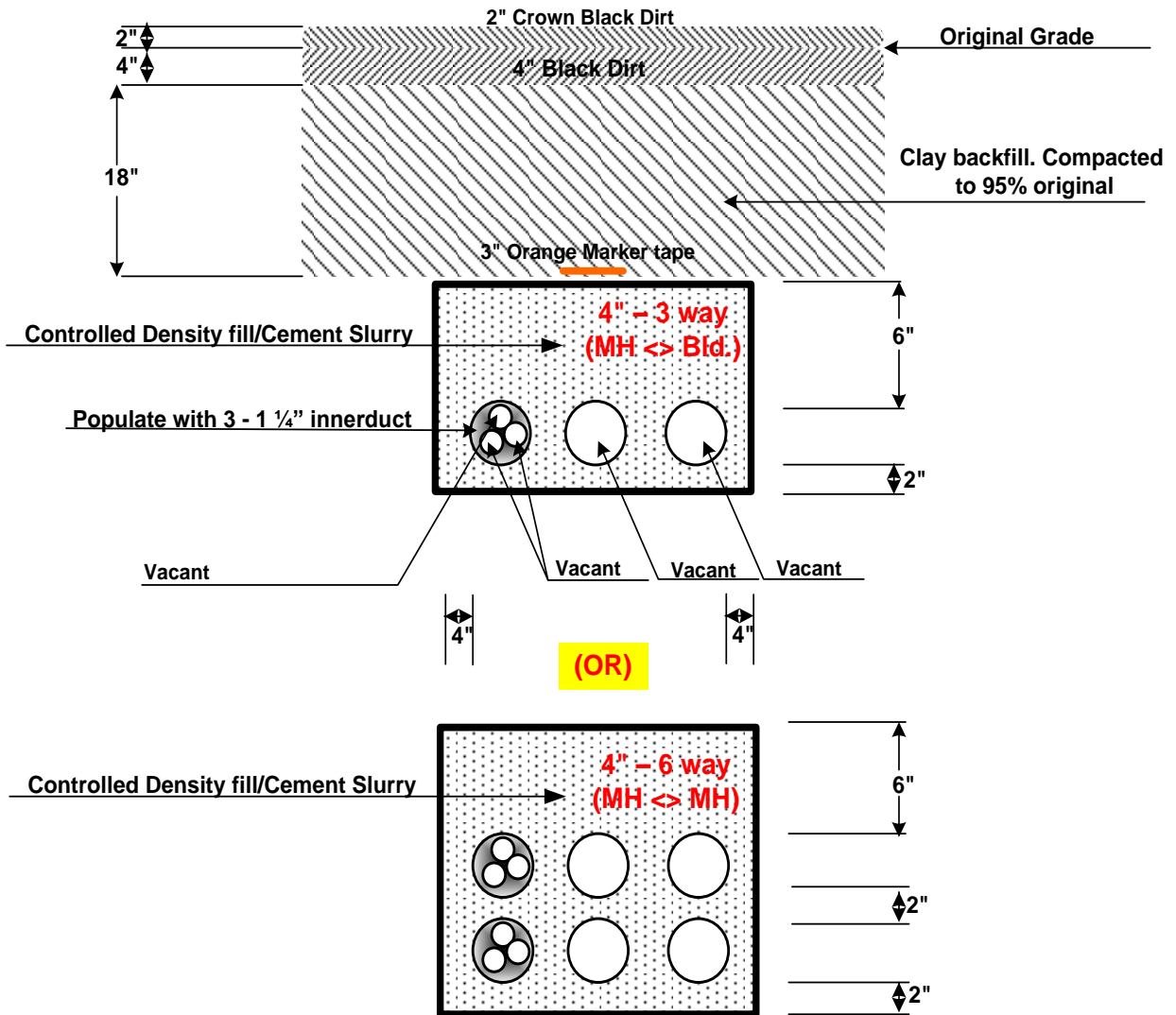
**Exhibit E**

1-11-12tw

North Dakota State University (NEO)

**Exhibit 'E'**

# 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.

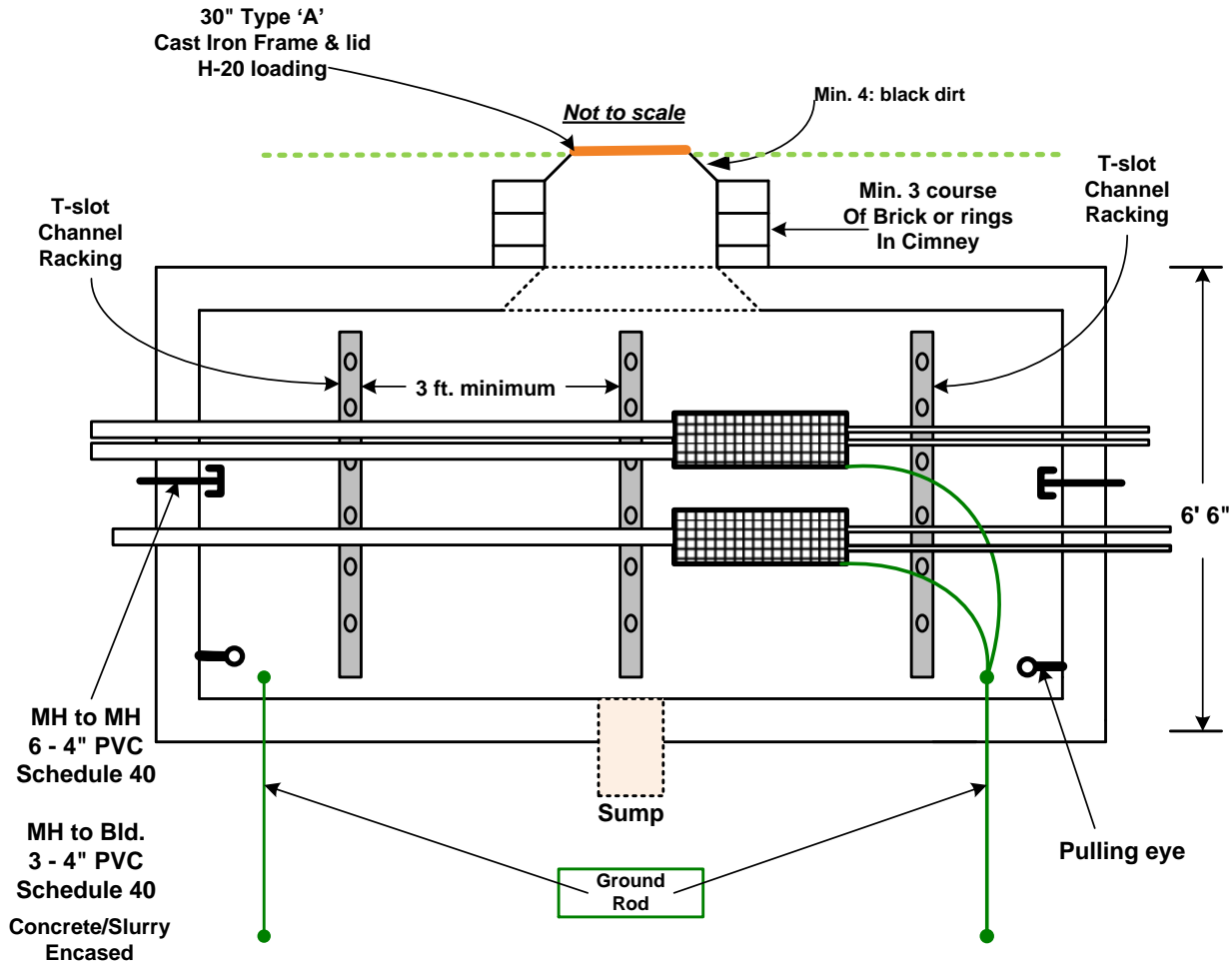
NDSU Landscape & Grounds should be consulted as to grass type and density for restoration.

**Exhibit F**

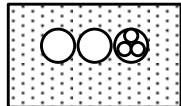
**Typical Manhole Configuration**

(Size of perimeter to be determined at time of engineering)

**Exhibit 'F'**



3 - Duct Config.



6 - duct Config.

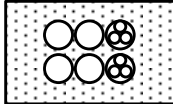
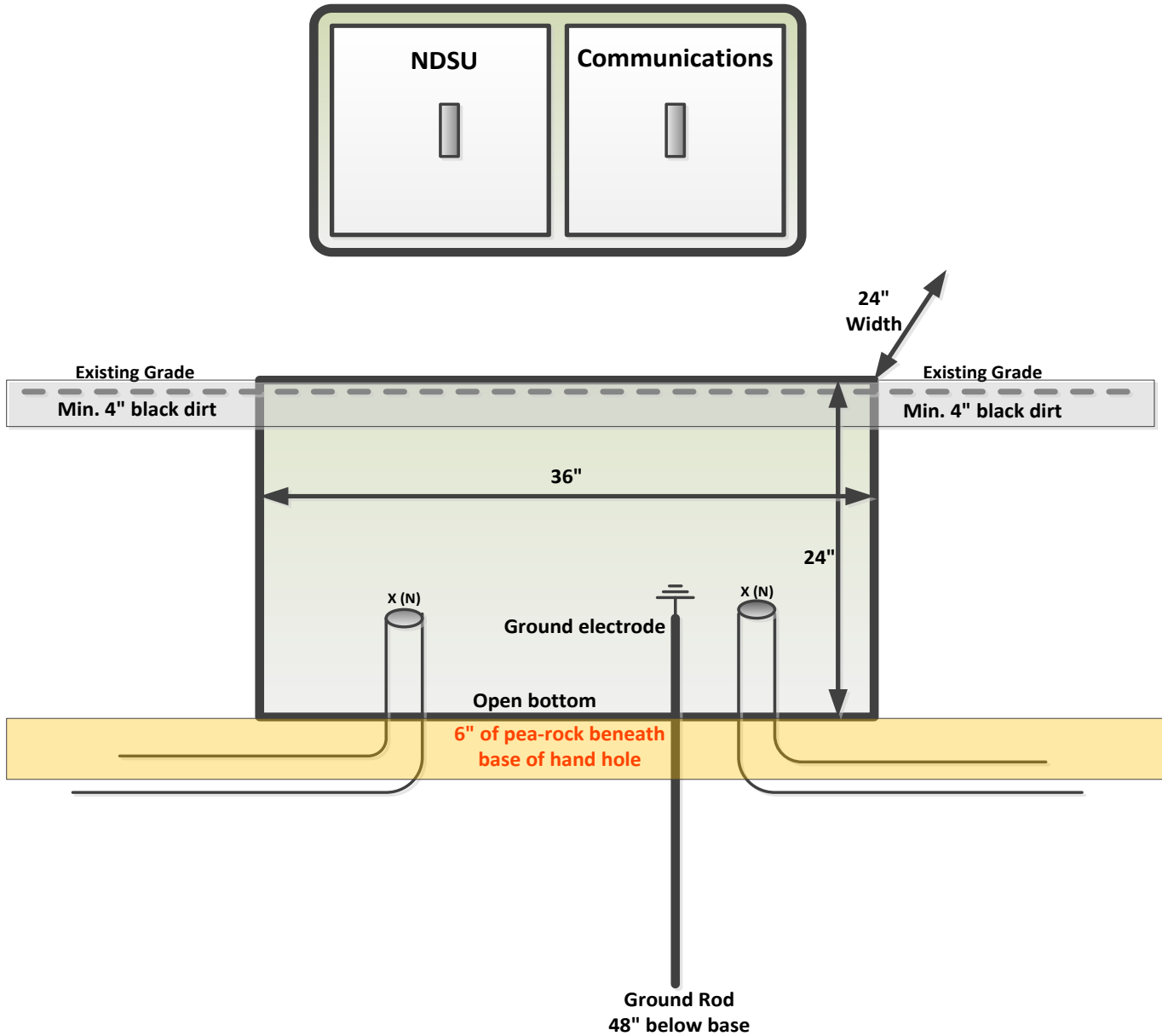


Exhibit G

TYPICAL FIBERGLASS  
POLYMER-CONCRETE HANDHOLE

EXHIBIT 'G'

ANSI LID RATED AT TIER 15  
TAMPERPROOF SPLIT LID



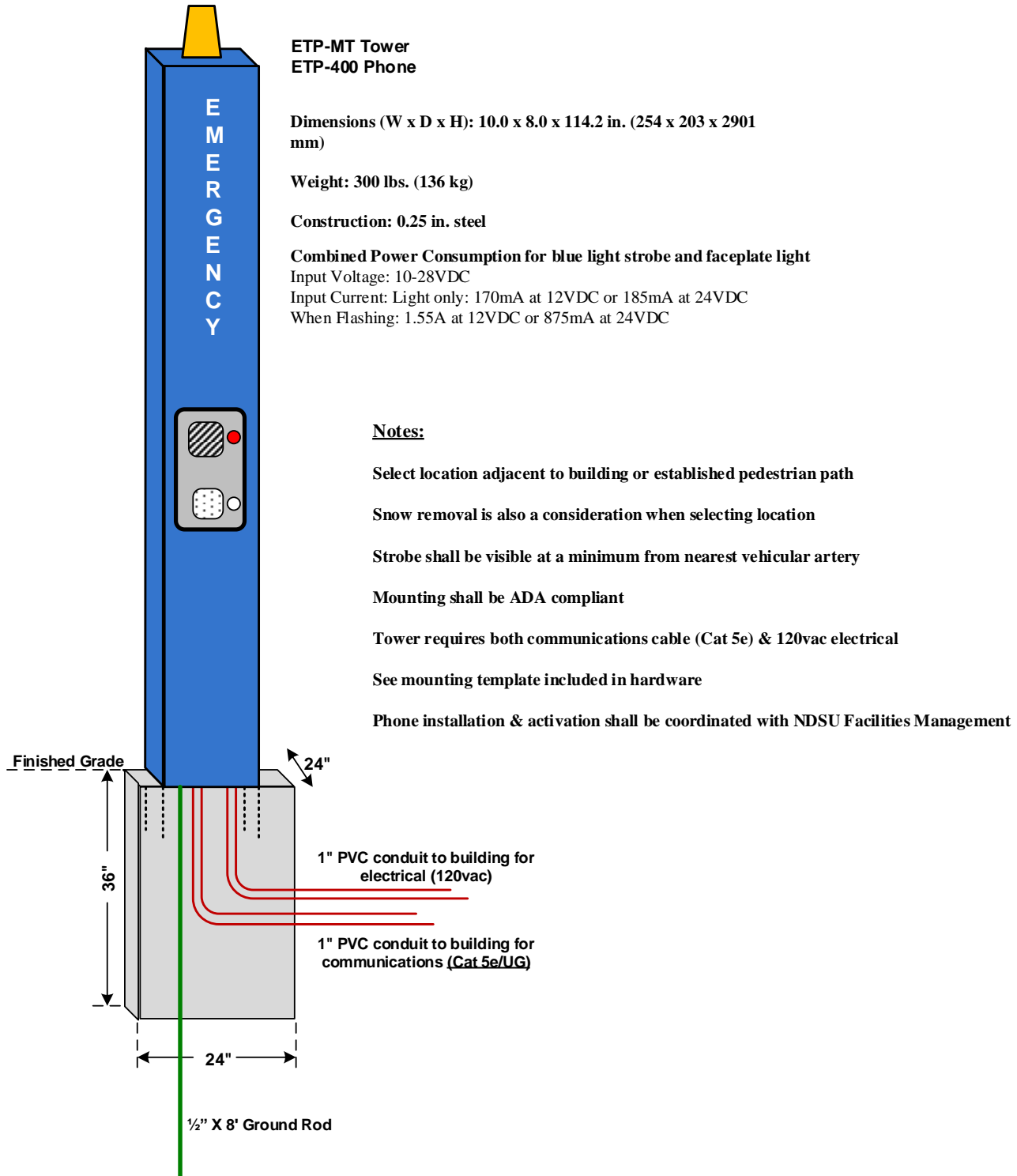
**Notes:**

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

Exhibit H

# OUTDOOR EMERGENCY PHONE TALK-A-PHONE

## Exhibit 'H'



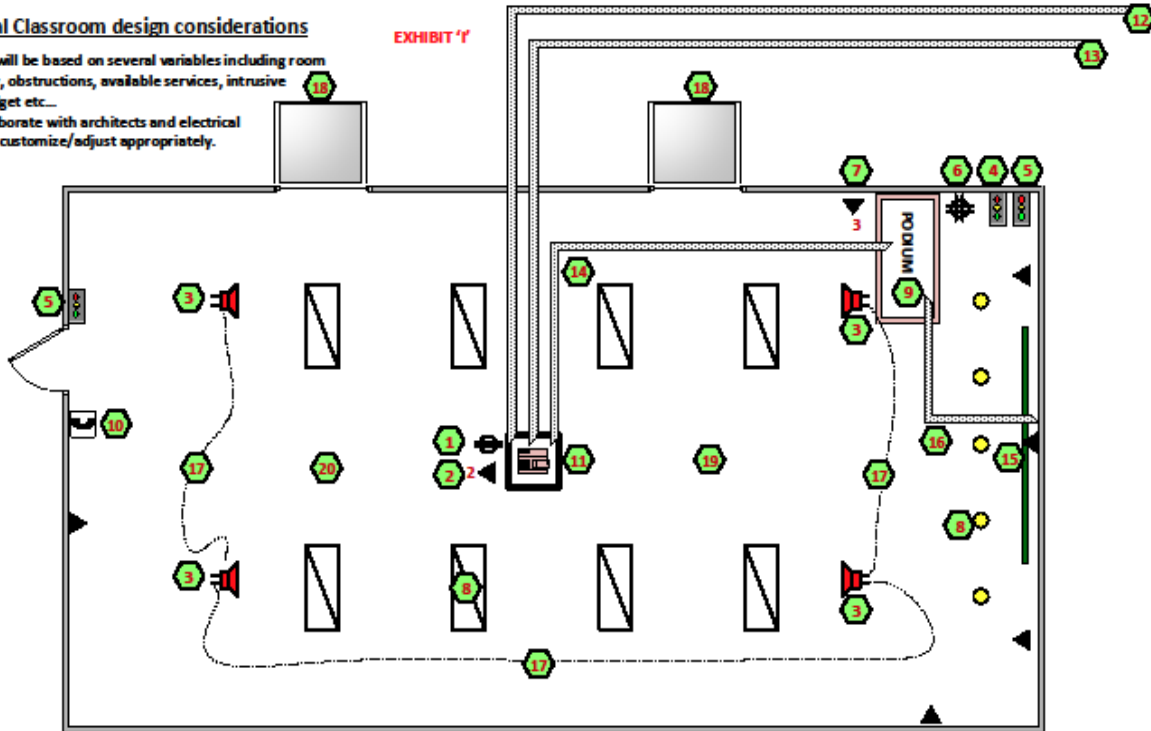
**Exhibit I**

4-15-2015/tw  
 4/15/2015 MM

**Typical Classroom design considerations**

Final design will be based on several variables including room size, capacity, obstructions, available services, intrusive sunlight, budget etc...  
 TSS will collaborate with architects and electrical Engineers to customize/adjust appropriately.

EXHIBIT 'F'



**NOTES:**

- |   |  |   |  |
|---|--|---|--|
| <p>1 110v. 20 amp Dedicated Duplex Electrical Ckt.</p> <p>2 2 – Cat.5e/6a routed to nearest network W/C</p> <p>3 Speaker system per TSS specifications</p> <p>4 Screen control</p> <p>5 Lighting controls</p> <p>6 110 v.20 amp Dedicated Double Duplex Electrical Ckt.</p> | <p>7 3 – Cat.5e/6a routed to nearest Network W/C</p> <p>8 Integrated Classroom Lighting System (ICLS)<br/>       -Control via IP or serial</p> <p>9 Teaching podium (adjacent to wall)<br/>       Size and specifications by TSS. No obstruction of the audience view of the projection screen</p> <p>10 Cat.5e for future wall phone @ 54"</p> <p>11 Projector (By TSS)</p> | <p>12 3/4" conduit for electrical service</p> <p>13 1" conduit for telecommunications<br/>       Routed to nearest network W/C</p> <p>14 2" conduit to podium location</p> <p>15 Powered Projector Screen with Low Voltage Control (Sized by TSS) 16:9 aspect ratio</p> <p>16 1" conduit from wall behind Screen to podium location</p> <p>17 18/2 shielded plenum speaker wire</p> | <p>18 Window Shades/Filters per TSS specifications. Shade controls to be integrated with AV control system</p> <p>19 Ceiling height must allow the screen to drop no lower than 3' 6" above finished floor</p> <p>20 Occupancy sensor tied in with lighting with NO and NC relay controls for integration with AV control system</p> |
|---|--|---|--|



**Exhibit J**

		EXHIBIT 'J'			
<b>Wirecloset build 'Task Management' Schedule</b>					
<i>(SAMPLE)</i>					
		Signoff Date			
Task I.D.	Task (Contractor)	Completed			
<b>1.10</b>	<b>(Building Name) - 1st floor (MDF Rm. # nnn)</b>				
1.11	At least three walls lined with plywood - painted fire retardant gray				
1.12	All underground dressed, terminated & tested (if necessary)				
1.13	A/C environmental competed and turned on				
1.14	All power & lighting installed per spec				
1.15	All wirecloset overhead basket tray installed				
1.16	Equipment rack + cable mgmt. installed				
1.16a	Rack(s) appropriately bonded				
1.17	Fiber (MM & SM) terminated & tested				
1.18	Fiber (MM & SM) to ALL IDFs installed & tested				
1.19	Cat6a cables installed and terminated at W/C PP				
1.19a	Cat6a Patch panels appropriately labeled				
1.1A	Cat6a terminated & labeled at the jack FP				
1.1B	Completed testing of all Cat5e or Cat6a station drops per spec				
1.1C	All copper and FO distribution cables installed & tested				
1.1D	Install 2200va UPS (NEO)				
1.1E	Room nnn cleaned and secured				
1.1F	Access to building ground per spec				
		Signoff Date			
Task I.D.	Task (NDSU/NEO)	Completed			
<b>N1.10</b>	<b>(Building Name) - 1st floor (MDF Rm. # nnn)</b>				
N1.11	Equipment mounted & energized				
N1.12	All Racking bonded				
N1.13	Equipment/stack online to Core				
N1.14	Cable/wire distribution in place				
N1.15	Cat5e of Cat6a cross connects to equipment installed				
N1.16	All labeling completed				
N1.17	Port documentation brought back to NEO				
N1.18	W/C properly secured				