



NMSU Engineering and Construction Design Guidelines Volume 4
Last Revised on May 15, 2020

INTRODUCTION

This document is offered to Design Teams for information and guidance. It will be used by NMSU Facilities & Services (FS) as a guideline for submission review.

The guidelines set forth in these documents are intended to serve as design and construction guidelines for NMSU facilities system-wide.

These guidelines are not intended to be all-inclusive but are intended to highlight specific NMSU requirements and concerns. Applicable items shall be addressed at the appropriate submission phase. All designs are expected to meet or exceed code requirements and follow good professional practices.

For convenience, this document is organized using the CSI MasterFormat 2010.

These guidelines are developed and maintained by NMSU Facilities & Services at 1530 Wells Street, New Mexico State University, Las Cruces, New Mexico 88003-3545, 575-646-7114.

DISCLAIMER

These design guidelines are minimum standards applicable to University projects. They do not relieve the design professional of following sound design principles that protect the health, safety, and welfare of the public.

SCOPE OF GUIDELINES

These guidelines establish a minimum standard of quality.

Any requested deviations from these guidelines will be discussed with NMSU throughout the design process. Any variance from these guidelines shall not set a precedent for future variances.

STANDARDS VS. GUIDELINES

These standards are established as a rule for the measure of quantity, weight, extent, value, or quality, whereas, a guideline is a recommended practice that allows some discretion or leeway in its interpretation, implementation, or use and forms the basis of project design and specifications.

The use and inclusion of these guidelines in bid documents does not relieve the consultant or architect of the responsibility and legal liability for any bid documents created from these guidelines.



TABLE OF CONTENTS

GENERAL NOTES TO THE DESIGN PROFESSIONAL 3

DESIGN DOCUMENT SUBMITTAL REQUIREMENTS 14

DIVISION 01 – GENERAL REQUIREMENTS 21

DIVISION 02 – EXISTING CONDITIONS 25

DIVISION 03 – CONCRETE..... 27

DIVISION 04 – MASONRY..... 30

DIVISION 07 – THERMAL AND MOISTURE PROTECTION..... 31

DIVISION 08 – OPENINGS..... 34

DIVISION 09 – FINISHES..... 40

DIVISION 10 – SPECIALTIES 41

DIVISION 11 – EQUIPMENT 42

DIVISION 12 – FURNISHINGS..... 45

DIVISION 14 – CONVEYING EQUIPMENT 47

DIVISION 21 – FIRE SUPPRESSION 49

DIVISION 22 – PLUMBING 57

DIVISION 23 – HEATING, VENTILATING and AIR-CONDITIONING 60

DIVISION 25 –INTEGRATED AUTOMATION – BUILDING CONTROLS..... 73

DIVISION 26 –ELECTRICAL 110

DIVISION 27 – COMMUNICATIONS 153

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY..... 154

DIVISION 31 – EARTHWORK 164

DIVISION 32 – EXTERIOR IMPROVEMENTS..... 165

DIVISION 33 – UTILITIES 168



GENERAL NOTES TO THE DESIGN PROFESSIONAL

STANDARD DRAWING SIZE

Drawings shall be prepared in accordance with the fully executed “AGREEMENT between The REGENTS of NEW MEXICO STATE UNIVERSITY and the ARCHITECT”, the terms of the Agreement will take precedence.

PLANNING OF SUPPORT SERVICES AREAS

During the planning and design stages of the project, the Design Professional shall consider the need to provide certain support service areas that may be required for a particular project but not necessarily identified in the program. The need for the following types of areas shall be reviewed, and where appropriate, included as part of the project:

- Vending Machine Location
- Employee Lounge
- Central Mail Room
- Central Copy Area
- Loading Dock
- Custodial Closets and Storage

EQUIPMENT SCREENING

All exposed exterior mechanical and electrical equipment is to be screened from view. The screening method to be employed will be determined on an individual project basis.

FIRE RATED CONSTRUCTION ASSEMBLIES

All construction assemblies which require a specific fire rating; i.e., 1-hour, 2-hour, etc., shall be so designated on the construction drawings. In addition, the governing agency or applicable code, edition, and date shall also be indicated.

SUSTAINABLE DESIGN & ENERGY CONSERVATION

All new and renewed facilities shall be Leadership in Energy and Environmental Design (LEED) certified and shall meet a minimum LEED Silver Certification 15,000 square foot requirement, per NMSU Climate Action Plan. <https://sustainability.nmsu.edu>.

1. All facilities shall achieve a minimum of at least 25% energy savings over the latest version of the ASHRAE 90.1 standard. Documentation of compliance shall be according to the Energy Cost Budget Method as prescribed in ASHRAE 90.1 utilizing a whole building energy simulation.

SPACE PLANNING FOR BUILDING SYSTEMS

1. General
 - a. Always design with maintenance in mind.
 - b. Design team shall fully coordinate all requirements to ensure easily accessible, unobstructed, safe access for mechanical and electrical equipment rooms and general maintenance storage when developing the building floor plans.
 - 1) Designated mechanical/electrical equipment rooms, mezzanines and platforms shall have at least the minimum headroom/ceiling height required by building code for occupied spaces.
 - 2) Crawlspace (either basement or attic) are not acceptable plant equipment rooms.
 - c. Design for Safety: The plant and systems must be located and arranged to permit adequate means of escape and access for maintenance without exposing the maintenance staff to undue safety risk.
 - d. Design for Cost Effective Replacement: All mechanical and electrical rooms shall have adequate floor area and door sizes and be arranged with clear aisles to permit the removal and replacement of the largest piece of equipment without dismantling other equipment or permanent building components.
 - 1) Primary aisles intended to be kept clear for equipment replacement shall be clearly indicated on construction drawings with painted boundaries on floor finishes in mechanical/electrical rooms.
 - 2) Building design may require a crane to replace systems components. It is the Project Manager's responsibility to make this determination.
 - 3) In buildings with elevators, an elevator with sufficient capacity shall extend to all levels to facilitate equipment/component replacement.
 - 4) Include roof access hatches, hinged or easily removable louvers, knockout panels, or similar other architectural features as necessary for major equipment replacement that cannot be otherwise handled through routine means.
 - 5) Provide adequate structural strength in all areas where heavy equipment is passing through the building.
 - e. Allow adequate dedicated spaces for building system control panels such as BAS network controllers/panels, security/access control panels, fire alarm control panels, and lighting control panels. Control panels shall be placed in dedicated spaces with limited access controlled by FS.

2. Mechanical

- a. Mechanical rooms shall be sufficiently sized and equipment arranged to accommodate efficient and safe access conditions for routine maintenance and replacement.
 - 1) There shall be adequate space around equipment for activities such as filter and coil replacement, removal of fans, shafts, motors, bearing assemblies, without moving other equipment.
 - 2) Provide a minimum of four feet around all sides of large equipment.
 - 3) Minimize the need to do maintenance from ladders.
 - 4) Where possible, provide permanent ship ladders, equipment platforms, safety rails, etc. to safely access overhead equipment.
 - 5) Provide overhead structural steel with portable chain hoists and anchor points to rig and lift heavy equipment/components.
 - 6) Consider space for general maintenance storage in mechanical rooms.
 - 7) Arrange equipment and floor drains to avoid tripping hazards caused by running pipes across walking paths.
- b. To the greatest extent possible, mechanical equipment shall be located indoors. Outdoor and rooftop equipment is not allowed without written permission from FS PD&E. Exceptions are:
 - 1) Renovations to existing facilities where it's not possible to provide adequate indoor mechanical space.
 - 2) Unitary DX units without hydronic or steam coils that are subject to freezing.
 - 3) Unitary DX units with hydronic systems subject to freezing shall be protected with separate piping loops with antifreeze solution, heat exchangers, pumps, and expansion tanks to minimize and isolate portions of systems from the main hot and chilled water loops in the event of an extended power outage. Alternatively, all sections of piping exposed to freezing shall be completely electrically heat traced on normal/emergency standby power circuits.
 - 4) Steam traps and drip legs shall be located below the thermal insulation envelope of the roof assembly.
 - 5) Provide adequate safety and visual screening.
- c. Locate primary air handling equipment, all pumps, and heat exchangers in dedicated mechanical rooms and never above ceilings.

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- d. Acoustically treat rooms and equipment to reduce equipment noise.
 - e. Provide stairway or ship ladder to any approved equipment on the roof. Review with FS and obtain approval if vertical ladders are the only practical solution for existing facilities.
3. Electrical
- a. Service entrance electrical room:
 - 1) A dedicated switch shall be located on the perimeter of the building in close proximity to the pad-mount transformer.
 - 2) The electrical room will have a physical separation from the other spaces in the building (including mechanical equipment rooms) with a minimum fire resistance rating of one hour (review code for stricter requirements). In the event where this is not possible, contact Facilities and Services for determination.
 - 3) Heating and ventilation of the main electrical room will be dedicated to that room, and ventilation air shall not be acquired from or at the detriment of the adjacent spaces.
 - 4) Electrical service shall be sized to allow for future growth of the service entrance equipment. There shall be adequate initial space and “future” space to allow the installation of additional sections equal in size to the switchgear required for this project.
 - b. If the service requires switchgear, it shall allow for working clearance on ALL four sides of the equipment and conform to current applicable electric codes.
 - c. Electrical distribution panel rooms/closets shall be dedicated spaces, with room for additional panel board sections in the future. In the event where this is not possible, contact Facilities and Services for determination.
 - d. Transformers shall be floor mounted on a housekeeping pad. In the event where this is not possible, contact Facilities and Services for determination.
 - e. If the project requires a generator, FS must be notified as early as possible so that they may work with NMSU EH&S to obtain a modified or new air quality permit from the New Mexico Environment Department (NMED), as required.
 - f. Engine generators, when required, shall be placed on grade at the exterior or within the building. At no time will this equipment be installed above or below grade level or on a roof.

JANITORIAL FACILITIES

1. Janitorial facilities will vary according to size, type, and use of the building, but in general 200 sq. ft. of useable custodial space shall be provided. The number of rooms, size and location shall be considered during preparation of preliminary studies and specific needs shall be determined in consultation with FS Operations. At least one janitorial room per floor is required.

2. Equipment: Mechanical, ICT, computer, or electrical equipment or controls shall not be located in janitorial facilities. A janitorial area shall not be used as access to mechanical equipment or other service areas.

3. Main Janitor Room:
 - a. Location: The preferred location for the main janitor room is on the ground floor close to a service entrance, delivery area, or elevator.

 - b. Size: The minimum size shall be 200 square feet to be increased accordingly depending on the size of the building. The following guidelines apply:
 - 20,000 sq. ft. and less - 200 sq. ft.
 - 20,000 sq. ft. to 100,000 sq. ft. - 300 sq. ft.
 - 100,000 sq. ft. to 200,000 sq. ft. - 500 sq. ft.
 - 200,000 sq. ft. plus - consult with FS Operations

 - c. Sufficient space shall be provided for the storage of the custodial equipment.

 - d. In buildings with 50,000 square feet and greater this space shall be subdivided to provide a separate locker and break area and an equipment/supply storage area.

4. Locker Area: The locker area shall be of sufficient size to accommodate all of the janitors for the building, based on one janitor for each 30,000 square feet of floor area to be cleaned. The room shall be sized to permit furnishing with locker and chair for each janitor and a 28 inch x 42 inch table or desk. The room shall be heated, lighted, ventilated and equipped with sink, and cold water, 36 inch x 42 inch bulletin board, paper towel dispenser, soap dispenser, two electrical receptacles (110V), and door with separate keyed lock. The door shall be 36 inches wide with proper ventilation where required. Locker size: 15" wide, 18" deep, 72" high and slanted top. Minimum size of locker rooms shall be 75 square feet.

5. Equipment/Supply Storage Area: The equipment/supply area shall be of adequate size to provide space for janitor's carts, broom racks, mop racks, ladder racks, vacuum cleaners, floor care equipment, and shelving for a minimum of two weeks supply of soap, toilet paper and paper towels. There shall be space under the bottom shelf for storage of mopping units, metal tubs and pails. The room shall have a cold water hose bibb and floor sink/floor drain. The room shall have heat, light, ventilation, bulletin board, and a double door from the corridor with lock. Provide 110-volt, single-phase, 20-amp outlets on a separate circuit in these rooms for charging battery-powered equipment.

6. Satellite Custodial Areas:

- a. Location: Satellite custodial areas shall be located on the upper floors of multistory buildings preferably near restrooms. In major buildings more than one space per floor is necessary for efficient time management of work force and emergency situations.
- b. Size: In general, 50 sq. ft. is minimal. The combined square footage of satellite spaces plus the main janitor room determines the adequacy of a building's janitorial facilities. Unusual design or shapes of satellite custodial space (i.e., long and thin, triangular, etc.) shall be avoided in order to maximize the useable space.
- c. Equipment: Satellite custodial areas shall be equipped with a terrazzo floor level service sink, a small storage area, and shelving for small supplies. The closets shall have light, ventilation, two electrical receptacles (110V), and door with lock. The light shall have a protective lens that radiates light.
- d. Doors: All doors to janitorial facilities shall swing out to maximize useable space. They shall be keyed to the Maintenance and Operations janitor room keying system. The doors shall be 36 inches wide with proper ventilation where required.

7. Other:

- a. Outlets in corridors every 25 feet if carpeted and every 50 feet if non-carpeted. Also provide outlets within 10 feet of building entrances and on every floor landing in the stair wells.

All-Gender Restrooms

- 1. All buildings shall have unisex toilet rooms in the following locations:
 - a. On the main floor level.
 - b. On every floor level other than the main level, except where a unisex toilet room exists on the floor above and the floor below.
 - c. Where required by code.
- 2. All unisex toilet rooms shall meet the requirements of the Americans with Disabilities Act Accessible Guidelines.
- 3. Contact FPC for signage, plumbing fixtures and toilet accessories requirements. Coordinate signage requirements with the current NMSU Wayfinding standards.

LOADING DOCK FACILITIES

The Professional's attention is directed to the installation at loading docks and shipping and receiving areas where a canopy or roof structure may interfere with the loading and unloading of freight. The height of loading dock platforms and the height of overhead structures should be such that trucks may gain access to the dock in both loaded and unloaded conditions, compatible with facility use requirements.

REFUSE CONTAINER LOCATIONS

1. Containers should not be located under roof overhangs, immediately next to combustible building construction or next to window openings. Additionally, containers shall not obstruct doorways or fire protection system devices (hydrants, siamese connections, sprinkler control valves).
2. A 31 cubic yard refuse truck measures 30'-3" long overall and has a wheel base of 158 inches and an overall height of approximately 12 feet, 6 inches. An overhead clearance of approximately 20 feet is required to dump a six-yard box. The gross weight on front axle is 15,000 pounds, rear tandem axles 38,000 pounds.

Note: Measurements will vary depending on cubic capacity size of vehicle.

3. It is preferred that the trash and recycling containers be located at road level immediately adjacent to the loading platform of the building for convenient top loading from the platform.
4. A concrete pad, 9 feet square, shall be provided for each container required. The surface of the concrete pad shall be on a plane parallel to the road surface where the truck stops to service the container. This is necessary to properly engage the lifting forks of the truck in the sockets of the container to be lifted.
5. The service road to the container shall be a minimum of 12 feet wide and of suitable construction to support the axle loads mentioned.
6. To turn the packer truck requires a 45 foot radius and a minimum road width on the curve of 20 feet. If servicing of the container requires turning the truck, then the above turning radius and minimum road widths should be provided.
7. Refuse: In general, NMSU requires one 8-yard container for every 100,000 sq. ft. of building space for every 8 hours of use. For each project, the Design Professional shall consult with the FS Solid Waste Management to determine exact needs, based on facility type, size, and location.

INTRODUCTION TO ROOM NUMBERING GUIDELINES

New Mexico State University Facilities and Services Space Management prepared the following room numbering system for use at all University locations, on both new construction and renovation projects. This system provides a consistent method for identifying and managing University building space.

ROOM NUMBERING ON WORKING DRAWINGS

During the Design Development Phase of working drawings, rooms and areas shall be numbered in accordance with the guidelines below. Each submission phase is reviewed by the user group for the accommodations of their space needs. Facilities and Services Space Management will also review for conformance with the room numbering guidelines. Facilities and Services Space Management must approve any alternative numbering scheme before it is used. The design professional shall prepare a room numbering schedule for each development phase of the drawings. All room numbering controversies are resolved by Facilities and Services Space Management.

IDENTIFICATION OF FLOOR AND LEVELS IN A FACILITY

The main or first floor of a facility is identified as the location of the major pedestrian level and should be at the same level as the outside grade or the lower level of a split-level entry. For example, the main level or floor would be 100 series numbers with successive levels above being 201, 301, etc. Floors below the main level would be 001. Levels such as penthouses, mezzanine, etc., or any part thereof, will be a part of the total facility number system.

CONSISTENT ROOM NUMBERING

Room numbers in a facility must follow a consistent room numbering system that provides information and logical sense of direction and continuity. Room numbering should facilitate pedestrian movement within the facility. Each room or space in a facility must have a unique room number.

Room numbering should reflect a general location within the facility, one that relates to circulation elements and is consistent from floor to floor. Every attempt should be made to “stack” similar numbers by floor levels so that room 132 is in the same relative position in the facility as are room 232, 332, and so on. Interior graphics should also be taken into consideration, assigning ranges of numbers to facilitate directional signs. The location of the main entrances, secondary entrances, interior stairs, and elevators are the keys of pedestrian movement within a facility. Room numbering should be consistent, compatible, and relative to key movement elements at all levels.

Room numbers should indicate a consistent orientation from a public circulation element within a facility such as an exterior entrance, stair, or elevator. They should indicate the same sense of direction (increasing or decreasing) from the primary circulation elements, for example, the main elevator lobby.

FLEXIBILITY OF ROOM NUMBERING SYSTEM

Room numbering systems should be flexible enough to allow for possible changes. If the facility is being developed on modular system, future room numbers should be reserved for possible room subdivisions.

EVEN AND ODD ROOM NUMBERING

Normally, odd room numbers shall be assigned to rooms on one side of the corridor and even room numbers on the other. Numbers on one side of the corridor shall correspond with room numbers on the other side (e.g., 112 across the hall from 111 or 113). Room numbers may be skipped to maintain this correspondence. Skipping room numbers will often facilitate renumbering after subsequent renovations.

NUMBER OF DIGITS ALLOWED IN ROOM NUMBERING

1. The first digit is a suffix and mainly pertains to facility purposes. Mechanical rooms, janitorial areas, utility closets, and public restrooms are included in the room number sequence with a facility services space suffix. Example (J102).
2. The first without a facility suffix, most common digit is used to identify floor levels. Example (102).
3. The second and third digits without a suffix (01 through 99) are primary room numbers for rooms on the same level that are entered from a public circulation corridor. Example (102).
4. And last, prefixes should only be used if there are too many rooms on a floor to allow rooms to be numbered without using a prefix. And in which case a large room is subdivided in to many smaller rooms, prefixes will be used in order to go with the natural room numbering flow. Example (102A).

BASE ROOM NUMBERING AND SUFFIXES

Each room entered from a public corridor should have a unique base room number without a suffix (e.g., 101, 102, 103, ect.). Where rooms are not entered from a public corridor, the room number should be keyed to the primary room. The number of an interior room shall carry the same number as the room through which it is entered, plus an alpha suffix to uniquely identify it. It is more reasonable to look for room 101B inside room 101 than it is to look for room 103 inside room 101. Room number suffixes shall reflect a logical system of identification as one enters a room i.e., right to left, left to right, clockwise, or counterclockwise. When it is necessary to enter a room from a room whose number already has one suffix, a second suffix should be added to identify this interior room, such as 101A1. No more than two suffixes are allowed. The first suffix must be a letter. The second suffix may be a number.



ROOM NUMBERING FOR FACILITY SERVICE SPACE

Rooms associated with facility service space (restroom, janitor closets, mechanical rooms, etc.) will be uniquely identified by a designated suffix that corresponds with that room’s use and follows the numerical sequence of the floor. For example, a janitor’s closet on the first floor that appears between rooms 101 & 105 will be identified as J103.

Stairway number 1 on the main entrance level ST100 can go from 100 all the way through the building, if there is a break, for example stairway 1 goes to level 2 and then a completely different stairway starts somewhere else on level 2 than that stairway shall be labeled ST201 etc.

Alpha suffix characters for numbering facility service space

E	ELEVATORS
H	HALLWAYS
J	JANITORIAL AREAS
M	MECHANICAL ROOMS
ST	STAIRWAYS
R	RESTROOMS
T	TELECOMMUNICATION

MISCELLANEOUS DESIGN ITEMS CHECKLIST

1. Reference Project Check List to incorporate all NMSU requirements into the design.
2. Consult with NMSU representative for integration of Master Plans, Water Model and Utility Tunnel interface.
3. Operation and Maintenance manuals shall be delivered no later than 50% of construction completion.
4. Existing and new paths of fire rated egress shall be designed and constructed per current applicable building and fire codes.
5. It is desired that all required contractor-provided systems training provided for NMSU Maintenance employees be video-taped for future use in training.
6. On applicable projects, a budget line item for FS Operations - Energy Management Department of 0.3% of the total construction cost shall be included.
7. Depending on site location and type of utility, the design professional of record or AHJ shall inspect all utility installation. This also applies to utility trenching. Utility lines are defined as

supply mains to the meter or building penetration.

8. All final and revised as-built drawings and closeout documents are to be delivered to the project architect within five calendars days of substantial completion.
9. Management of "universal" building waste: Mercury Thermostats/Switches, Non-Green Tipped Light Bulbs, and Light Ballasts are Hazardous Wastes. Contact NMSU EH&S for proper disposal procedures.
10. Acoustical lay-in ceiling earthquake compression struts shall be designed and constructed per current applicable building codes. The use of 2" studs is NOT permitted for vertical strut bracing.
11. Electronic files of all submittals and equipment schedules/drawings are required.

DESIGN DOCUMENT SUBMITTAL REQUIREMENTS

This outlines the general requirements and scope for project design phase document submission. It will be used by PD&E and FS Operations as a guideline for submission review.

PROGRAMMING PHASE

Provide a written description of the major project components. Additionally, any unusual or special information related to mechanical, electrical, civil and structural engineering should be identified.

SCHEMATIC DESIGN PHASE

The following items shall be addressed graphically in the Schematic Design Phase.

1. Conflicts and conditions not covered by the NMSU guidelines should be clearly noted and resolved during this phase.
2. Address the applicable items listed on the technical design checklist.
3. Architectural building plans and elevations, and building components.
4. Plumbing, HVAC, HVAC controls, electric power, lighting, sprinkler and special systems.
5. Soils conditions and anticipated foundation requirements. Include report from geotechnical engineer to support this description.
6. Preliminary Site Utility Plan indicating sanitary disposal, storm drainage, domestic water, gas, electric power, fire protection, chilled water, steam, exterior lighting, and special systems. Clearly indicate points of connection to existing systems.
7. Indicate site drainage pathways to on-site retention areas. Include analysis of on-site drainage.
8. Statements outlining the mechanical/HVAC design criteria to include outside air and ventilation, filtration, humidity, exhaust, noise and any other significant design requirements based on seasonal temperatures and degree day analysis.
9. Statement outlining the Electric Power Design Criteria to include voltages, grounding, special power quality requirements, lighting levels and any other significant design requirements.
10. LEED Silver Green Building design criteria shall be incorporated into the design.
11. Preliminary heating and cooling load estimates for yearly energy consumption and energy costs based on current regional rates.
12. Updated design and construction schedule.

13. Define any conditions that might affect design or construction.

DESIGN DEVELOPMENT PHASE

1. Design Development plans to include floor plans; general notes and specifications; updated building code analysis; room names and numbers; interior and exterior elevations; equipment schedules; window, door and hardware schedules; finish schedules; materials research; foundation and structural components; site plan to include staging areas and routing; and drainage plan.
2. The Design Development submission shall define the main HVAC and Electric systems and how they coordinate with other architectural and structural design features. Include design details and sizes to insure the system and distribution plan is clearly defined. Significant main distribution systems should be located to ensure they allow access for maintenance.
3. Proposed electric power riser and one-line diagram must indicate service, new service equipment, generator, and associated components. Design shall include preliminary building load calculations and transformer size. Consult with University Engineer for appropriate NMSU supplied transformer sizing.
4. HVAC design criteria shall be updated when changes from the schematic submission occur or when criteria is added. The design criteria for all spaces shall be defined.
5. Verify the total building energy budget in BTU's per year and calculate heat losses and gains for yearly energy consumption and energy costs using current rates.
6. Confirm adequate space exists for congested areas. Accommodate major duct layout and sizes. Coordinate space and layout with other facilities and construction activities.
7. Confirm adequate space exists for congested areas. Accommodate major piping layout and sizes. Coordinate space and layout with other facilities and construction activities.
8. Layout mechanical and electrical rooms with sufficient space and access equipment for maintenance.
9. Equipment schedules at a minimum shall include equipment manufacturer, identification, location, sizes, capacities and trade responsible for furnishing.
10. Further development of the Site Utility plans with all connection points, including sanitary disposal, storm drainage, domestic water, gas, electric power, fire protection, chilled water, steam, exterior lighting, and special systems, to include completed Utility Impact Studies for each connected utility.
11. Any suggested deviations from the NMSU guidelines will be discussed throughout the design process.

50% CONSTRUCTION DOCUMENTS PHASE (in addition to the above requirements).

1. Floor plan layout for power, lighting, emergency lighting, telecommunications, data and mixed media devices.
2. Lighting and electrical equipment schedule reflecting all fixtures, equipment, sizes and manufacturer.
3. Complete electric service design and all panel locations.
4. Preliminary riser diagrams.
5. Final grounding scheme and solutions to power quality issues.
6. Generator, transfer switch and all associated conduit and wiring, if required.
7. Duct layout including all terminal units, valves, sectioning valves, balancing valves and other components.
8. Mechanical schedules reflecting all equipment, sizes and manufacturer.
9. Piping layout including all terminal units with CFM, dampers and other components.
10. Plumbing schedules reflecting all equipment, sizes and manufacturer.
11. Equipment room shall include locations of all equipment, piping and conduit.
12. Roof plan or surrounding building area shall include locations of all equipment, piping and conduit scheduled for exterior installations.
13. Initial controls diagrams with start of sequence of operation.
14. HVAC detailed calculations indicating design parameters, minimum and maximum air flows.
15. Final summary of utility loads (gas, water, steam, chilled water and electric power).
16. Indicate the final anticipated energy costs and energy consumption.
17. Final site utility plans with sizes, utility connection points, valves, vaults, and details.
18. Complete specifications including all applicable sections for each division. Division 1 should be complete including unique conditions associated with the project.
19. Proposed drainage topographic drawings shall be complete with critical spot elevations, drain pathway arrows, and cross-section volumetric flow analysis completed.



95% CONSTRUCTION DOCUMENTS PHASE

1. Complete Drawings and Specifications.
2. Complete details
3. Complete HVAC control diagrams with sequence of operation.
4. Final short circuit and coordination calculations.

ADDENDA

NMSU shall be afforded the opportunity to review and contribute to all addenda proposed by the Design Professional.

POST CONSTRUCTION

Provide as-built drawings which have included the contractor's field mark-ups. This shall be transmitted to the Project Manager in AutoCAD format, per the following CAD Criteria.

The New Mexico State University (NMSU) Supplement to Facilities and Services CAD CRITERIA and the United States National CAD Standard

Updated: January 16, 2018
NMSU CAD STANDARDS

1. Introduction

These standards are based on the United States National CAD Standard (USNCS) V 4.0 and provide further clarification of NMSU CAD specific requirements.

The New Mexico State University (NMSU) Supplement to Facilities and Services CAD CRITERIA and the United States National CAD Standard.

1.1 Purpose

The purpose of this document is to provide a Project Standard, Leadership, Guidance, and consistency within but not limited to the University Architect and Space Planning Office. In addition, to provide consultant architects, engineers and landscape architects with the standard for project and standard plan CAD drawings. This document is based on and utilizes the standards established by the National CAD Standard (NCS) and the New Mexico State University project record drawings, operations and maintenance manuals with CAD drafting standards. Space Planning AutoCAD/AiMCAD standards represent best practices for the University Architect, Space Planning, Project Development and Engineering Offices.

1.2 Scope

The standard is a guide for developing architectural, engineering, landscape CAD and AiMCAD drawings for project and standard plan documents. This document is intended as a CAD standard reference and not as a CAD training manual.

1.3 CAD System

The CAD software used as a basis for this Standard is:
AutoCAD 2015 with AiMCAD

1.4 Disclosure

The purpose of this document is to ensure the consistency of CAD and AiMCAD procedures for Space Planning office. This document is a working document and may be subject to frequent updates at the discretion of the Space Planning office.

2. Software Licensing & Data Sharing

2.1 CAD Software

CAD software for the Space Planning is AutoDesk® AutoCAD® 2015. All CAD drawings are required to be delivered in AutoCAD® (.dwg) file format.

2.2 License

The Space Planning office strongly prefers that the delivered CAD files be usable without any additional software licenses or installation. If additional software (CAD Application Software, menus, symbol libraries, etc.) will be required, it

must be approved by the NMSU Facilities and Services CAD department prior to its use.

2.3 Requesting CAD Materials from the University

Consultants may request copies of the existing CAD materials from University facilities. CAD material is provided for the convenience of the recipient only. These materials have been gathered from a variety of sources, and it may or may not conform to University CAD standards. The material may be incomplete, or may not accurately reflect current facility conditions. The University makes no representation as to the data's completeness or accuracy. Consultants also should acknowledge that CAD material appears to be accurate and that the accurate appearance does not guarantee that they truly represent existing conditions. CAD materials submitted by consultants to the University must be accurate and must conform to the current National CAD standards, to the best of their knowledge. At **NO** time will the Space Planning office release CAD data to outside bidding consultants and/or firms prior to bid being awarded from the University.

2.4 Record Drawings (Deliverables)

Upon project completion, the Projects Design & Engineering (PD&E) shall provide the Space Planning office with complete project as-built record documentation including but not limited to construction drawings, construction specifications, addenda, change order attachments, change directives, supplemental information, clarification drawings or written text or similar documents. Written documents (such as construction specifications, addenda, change directives, etc.). CAD record drawings submitted by PD&E must clearly be labeled "**AS-BUILT RECORD DOCUMENT**". Record drawings shall be delivered in the following format: **Electronic (AutoCAD DWG and PDF) format (on CD)**. Electronic files may also be placed on a consultant FTP site. When digital media are provided, they will be clearly labeled with, at minimum, the following information: Project name, project number, architectural / engineering firm name, date issued, drawing phase, and sequence number (for multiple discs). See appendix – A for AS-Built Record Deliverables.

2.5 Folder Organization

The Space Planning office reserves the right to create and maintain its folder organization with in an organized and consistent manner with the direction of the Facilities Space Manager and/or Planner.

2.6 CAD Layering Standards

The Space Planning office reserves the right to create, maintain and update its layering configurations in AutoCAD and/or AiMCAD. See Appendix-B for current layer configuration.

2.7 Approval and Acceptance

In order for submitted documents to be approved and accepted by the Space Planning office the provider must submit the record drawings adhering to this



standard. Any discrepancies with the submitted documents will be returned to the design consultant for revisions, or obtain approved consent from Space Planning.

DIVISION 01 – GENERAL REQUIREMENTS

01 11 16 WORK BY NMSU

FS Operations personnel are the only parties authorized to operate NMSU utilities equipment. This includes all devices connected to piping and electrical distribution systems such as valves, switches, pumps, breakers, etc. Any party that requires operation of a NMSU utilities device must coordinate that operation through the NMSU Project Representative by requesting a utility outage, see F & S outage procedure OPS-015.

01 30 00 ADMINISTRATIVE REQUIREMENTS


- A. Provide title strip along right vertical margin with lettering at least ½” high.
- B. Plans are to include design standards common to the architectural and engineering professions.
- C. Indexes shall match actual documents.
- D. Legends shall be project specific and accurately depict individual features displayed on the plan.
- E. Verify that dimensions, labeled column gridlines, room numbers, key plan, scale, and all necessary labels are indicated on the plans.
- F. New work shall be adequately differentiated from existing facilities. (line, width, symbols, etc.)
- G. Avoid duplication of information. Provide only key notes that are specific to the plan, section, and large scale drawing.

01 35 00 SPECIAL PROCEDURES

- A. Smoking is prohibited in NMSU buildings under construction, see [NMSU policy 3.98](#) – Smoking.

01 35 23 NMSU SAFETY REQUIREMENTS

- A. It is the General Contractor’s responsibility to ensure that all sub- contractors comply with all safety regulations. Also note that the Contractor is fully responsible for having an Environmental, Health and Safety compliance program for NMSU records and review.
- B. For any work areas that are posted as biohazardous, the NMSU Environmental Health and Safety Office (575) 646-3327 must be contacted for clearance prior to start of work.

- C. All persons performing mechanical, electrical, plumbing, and utility work at NMSU must coordinate with NMSU Project Representative to ensure adherence to NMSU “Lock-out/Tag-out” procedures, see [Energy Lockout/Tagout Program | Environmental Health Safety & Risk Management | New Mexico State University](#)..
- D. The contractor will be responsible for providing an onsite welding permit system according to  OSHA 29CFR1926 and NFPA 51B.

01 35 43 ENVIRONMENTAL PROCEDURES

- A. Chemical Safety - All hazardous materials and wastes shall be properly labeled and stored while on site. Bulk chemical storage for drums or other containers of hazardous or otherwise regulated liquids larger than 25 gallons requires secondary containment and grounding for flammables.
- B. Contractor shall maintain on-site copies of Material Safety Data Sheets (MSDSs) for all hazardous material brought onto the site. These MSDSs must be kept readily accessible for employee use.
- C. Chemical spills shall be reported to the NMSU Project Representative. Hazardous materials that could cause illness if released or not properly used shall be kept properly stored.
- D. SWPPP: Contractor must obtain and submit for approval of a Construction Storm Water Pollution Prevention Plan (SWPPP). The approved plan must be executed and all erosion controls must be in place prior to any excavation.
- E. Disposal of liquids shall follow manufacturers' recommendations, local, state, and federal laws. At no time shall oils, solvents, paints, cleansers, etc. contaminate the soil.

01 41 13 CODES

Design criteria must include the use of IFC standards.

01 41 16 LAWS

All NMSU buildings shall comply with NM Executive Order 2006-001, State of New Mexico Energy Efficient Green Building Standards for State Buildings

01 50 00 TEMPORARY FACILITIES AND CONTROLS

Indicate construction work site limits, fencing, lay down yard, etc. in contract documents.

01 55 00 VEHICULAR ACCESS AND PARKING

Ensure special requirements for work site entrances, handicap access, walkways to remain open, fire truck and emergency vehicle access etc., are noted and must be maintained at all times.

Parking Stripes and other devices shall comply with the MUTCD standards.

Prior approval is required from NMSU Project Representative.

01 55 26 TRAFFIC CONTROL

Indicate that if traffic flow or road access must be interrupted or roads closed, the contractor shall obtain approval not less than 14 days prior. Request road closure policy from NMSU Project Representative.

01 55 19 TEMPORARY PARKING AREAS

Temporary parking areas shall be designated for use by Contractor during construction. Contractor must purchase NMSU parking permits to allow vehicles (personal or otherwise) to be parked in existing campus parking areas, see [NMSU policy 2.95.5](#) - NMSU Permit or Placard Issuance Requirement.

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

- A. The contractor will be responsible for preventing access to the building site to unauthorized persons.
- B. Do not obstruct existing streets, walkways, access corridors, etc. unless specific written permission is granted by NMSU Project Representative.

01 56 16 TEMPORARY DUST BARRIERS

- A. Required dust controls must be maintained over project duration, including site watering, track-out prevention, street sweeping and covering all truck loads of soil to/from site.

01 57 00 TEMPORARY CONTROLS

- A. For projects disturbing more than 1 acre of soil or pavement, prior to breaking ground, the Contractor must make required EPA notifications, obtain an NPDES- MS4 permit or waiver, and develop and comply with the NPDES permit and any required site-specific SWPPP. NMSU may be required to collect damages for Contractor non-compliance with the NPDES of up to \$1000 per day per violation.
- B. Any required erosion/dust controls must be regularly inspected & maintained over project duration.



01 81 13 SUSTAINABLE DESIGN REQUIREMENTS

Refer to the [NMSU LEED Policy](#) for our sustainable design philosophy.

- A. New construction larger than 15,000 square feet and/or using over 50kW peak electrical demand shall build to and achieve a minimum rating of LEED Silver. In achieving its LEED rating, the project must achieve a minimum delivered energy performance standard of one half the U.S. energy consumption for that building type as defined by the U.S. Department of Energy.
- B. New construction and renovation projects of public buildings between 5,000-15,000 square feet in size shall achieve a minimum delivered energy performance standard of one half the U.S energy consumption for that building type as defined by the U.S. Department of Energy.
- C. Renovations of buildings in excess of 15,000 square feet and/or use over 50 kW peak electrical demand and comprising upgrades or replacements of two of the three major systems (HVAC, lighting, and plumbing), shall achieve a minimum rating of LEED Silver and a minimum delivered energy performance standard of one half the U.S. Department of Energy.
- D. All other new construction, renovations, repairs, and replacement or state buildings shall employ cost-effective, energy-efficient, green building practices to the maximum extent possible.

END OF DIVISION 01



DIVISION 02 – EXISTING CONDITIONS

02 01 00 MAINTENANCE OF EXISTING CONDITIONS

- A. Photographs and/or videotapes of existing conditions including adjacent structures shall be taken and submitted. Existing conditions before the start of work shall be documented.
- B. Support and protect existing structures & utilities.
- C. Promptly repair damages to adjacent structures and facilities if incurred.

02 21 00 SURVEYS

Require that a professional surveyor document the existing conditions of adjacent structures prior to start of work. Establish benchmarks including elevations and maintain a project log to become part of the as-built records. Survey/resurvey to verify no adverse project impact. Notify the Architect and NMSU of changes in elevations, cracks, sags, or other damage in adjacent structures.

02 32 00 GEOTECHNICAL INVESTIGATIONS

- A. Soils testing laboratory and other required specialty testing to be retained by NMSU.
- B. Concrete testing laboratory to be retained by NMSU. Specifications shall indicate required testing; i.e. number of cylinders, maximum fill lifts, etc.

02 60 00 CONTAMINATED SITE REMOVAL

Prior to start of work; verify that there are no hazardous materials at the site with NMSU Environmental Health & Safety department through the NMSU Project Representative. If hazardous materials are found during the performance of work, stop work and contact NMSU and the Architect for direction.

02 80 00 FACILITY REMEDIATION

- A. It is the Contractor's responsibility to ensure that workers comply with all safety regulations. Also note that the Contractor is fully responsible for having an Environmental, Health and Safety compliance program for NMSU records and review.
- B. Prior to start of work; verify that there are no hazardous materials at the site with NMSU Environmental Health & Safety department through the NMSU Project Representative. If hazardous materials are found during the performance of work, stop work and contact NMSU and the Design Professional for direction.



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- C. Ozone Depleting Substances (e.g., Freons & related refrigerants) - Follow all regulatory requirements.
 - D. Prior to demolition or removal of equipment containing hazardous or otherwise regulated materials, those regulated materials must be abated/removed.
 - E. Installation and/or application of lead-based paint and asbestos-containing materials during renovation are prohibited.

END OF DIVISION 02

DIVISION 03 – CONCRETE

03 00 10 NMSU GENERAL REQUIREMENTS AND DESIGN INTENT

.1 GENERAL

- A. Air-entraining is to be specified for all concrete exposed to weather.
- B. The use of admixtures will be permitted only for air-entraining agent in specified type concrete. In this event, the concrete mix shall be adjusted to compensate for the admixture in a manner approved by the design Professional.
- C. Antifreeze and other admixtures will not normally be permitted.
- D. On all exposed concrete floors, a hardener and dustproofing agent shall be used.
- E. All suspended concrete floors, including those in penthouse mechanical rooms, shall be watertight.
- F. Required compressive strength for all new concrete shall be determined by the Design Professional. However, the minimum concrete compressive strength shall be no less than 3,000 psi at 28 days. A detailed concrete mix schedule shall be provided if more than one strength or type is required for the project.
- G. A non-slip nosing shall be installed on all exterior stairs. A Nosing with grooves or other depressions tending to form trip hazards shall not be permitted. (Carborundum or similar abrasives are not permitted.)

.2 FIELD TESTING OF CONCRETE

- A. During the progress of construction, tests will be required to determine whether the concrete being produced complies with the standard of quality and strength as specified.
- B. The Owner shall retain and pay for the services of a qualified laboratory to perform all testing.
- C. Compressive Strength Tests: Four cylinders will be made for each class of concrete used in any one day's operation or for each 100 cubic yards or portion thereof of concrete placed.
- D. The standard age of the tests shall be 7, 14 and 28 days and tabulated results shall be furnished to the Design Professional and Project Representative.
- E. Air-Entrainment Tests: Tests of air-entrained concrete shall be made to determine the percentage of air entrained in the concrete. These tests shall be performed in accordance with ASTM C260, by a qualified testing laboratory

retained by the Contractor. Test results shall be furnished to the Design Professional and NMSU Project Representative.

.3 PRODUCTS

- A. To alleviate flooring material concerns associated with moisture transmission and emission through concrete slabs on grade the following preventive measures shall be prescribed.
- B. An under slab vapor barrier should be specified and detailed directly under the concrete slab and on top of any subgrade or sand grading material to minimize moisture transmission through the slab. Vapor barriers shall meet the requirements ASTM E-1745 Class “C”. Acceptable vapor barriers are “Stego Wrap” by Stego Industries and “Moistop Plus” by Forfiber Building Products Systems. Don’t agree this needs work.
- C. A low water to cement ratio, low slump concrete should be specified for all interior slabs where flooring is anticipated to minimize the amount of free water in the concrete. Sufficient time should be allowed with the project to allow the emission of any free moisture to evaporate from the slab. Split
- D. Surface sealers such as “Para-Seal” by Parabond may be considered for re-flooring applications on existing slabs. Visit product. Design Professional?
- E. Curing compounds and form release agents shall be non-staining and be compatible with the wall and floor finishes specified. Once selected for a project, they shall be used for the entire project. Ok.
- F. Sealers on exposed interior concrete floors shall be compatible with Waxie “Floorstar”, or approved equal.
- G. Penetrating sealers (silicon, epoxy, etc.) shall not be used when a custodial effort is intended to maintain the finish of the floor. Ok.
- H. Sealer or finish should be applied immediately after the dissipation of the curing compound in order to protect floors during construction and then cleaned and reapplied prior to final acceptance. Move to section 3.

.4 CONCRETE MIX DESIGN

The Contractor shall submit a copy of an approved concrete mix design to the NMSU Project Manager. The submitted mix design must be an original (no photocopies) and embossed with the seal of and signed by the licensed New Mexico Professional Engineer certifying the mix design. No concrete shall be placed on any project until the Design Professional has approved the concrete mix design.

.5 ASPHALT MIX DESIGN

The Contractor shall submit an asphalt mix design to the Design Professional for approval. The submitted mix design must be original (no photocopies) and embossed with the seal of, and signed by, the licensed New Mexico Professional Engineer certifying the mix design. No asphalt shall be placed on any project until the Design Professional has approved the asphalt mix design.

.6 REMOVALS

Disposal of all removed concrete and asphalt, become the responsibility of the contractor to dispose of off NMSU property.

.7 SAW CUTTING AND PATCHING EXISTING PAVEMENT

- A. The Contractor shall make pavement cuts by full depth saw cutting the existing pavement in neat, straight lines, producing square, clean and straight edges while being of uniform width throughout.
- B. Pavement cuts shall be kept to the minimum width necessary to perform the required utility, roadway, or drainage work, or to accommodate the Contractors paving equipment.
- C. If the Contractor does not intend to repave (patch) for a period in excess of one (1) week, the base course must be immediately primer-sealed to prevent water infiltration.
- D. If the Contractor does not repave (patch) for a period during which the weather changes radically, or in excess of one (1) week, density tests shall be performed at the Contractor's expense. Any rework or further testing to bring the sub grade to the required 95 percent of Modified Proctor will be at the Contractor's sole expense.

.8 VAULT LIDS

Concrete electrical vault lids - Type 'A', model #6CA14 are university standard. Pictures can be made available on request.

END OF DIVISION 03

DIVISION 04 – MASONRY

04 00 10 NMSU GENERAL REQUIREMENTS AND DESIGN INTENT

.1 GENERAL

- A. A sample brick panel of 100 face bricks selected for the project shall be laid up with specified jointing for approval by the Design Professional and the University prior to starting exterior face brick installation.
 - 1. Should the initial sample panel be unsatisfactory, the Contractor will be required to erect additional samples until the brick work and jointing are approved by both the Design Professional and the University
- B. Admixtures: Setting accelerators or antifreeze compounds will not be permitted.
- C. Unless adequate protection against freezing is provided, no masonry work is to be done when the temperature is below 40^o36°F or predicted to be below 36°F overnight per ACI 530-05.
- D. Water Repellent Treatment: All exterior masonry work shall receive a water repellent treatment after cleaning with a non-staining, water repellent, gum resin solution.
 - 1. Silicone coatings are not acceptable.
- E. Coping Stones:
 - 1. All coping stone joints shall be raked to a depth of 1/2" and caulked.
 - 2. Thru-wall flashing shall be installed beneath all coping stone installations.
- F. Efflorescence: Particular care must be taken in the selection of materials and in design and detailing of exterior walls to prevent efflorescence in brickwork. Certification shall be provided that brick and any masonry trim material have passed the "wick" test (ASTM C67).
- G. Do not use scored CMU block. If deemed absolutely necessary, gain written approval through NMSU representative at Vice-President level.

END OF DIVISION 04



DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 00 10 NMSU GENERAL REQUIREMENTS AND DESIGN INTENT

.1 ROOFING SYSTEMS

- A. No black roofs are allowed.
- B. NMSU relies on proper design, materials selection, and rigid inspection for adequate performance of roofing systems. Roofing systems shall be installed according to manufacturer's recommended installation procedures.
- C. All roofing systems shall meet the appropriate FM Global criteria for wind loss prevention.
- D. All roofing systems shall have a class "A" rating as listed by Underwriters Laboratory, Inc., for fire resistance and all products shall bear the appropriate listing mark or classification marking and the company's name, trade name, trademark, or other recognized identification.
- E. Roofing systems will be reviewed with the Design Professional on a project-by-project basis, and NMSU reserves the right to change details as job conditions dictate.
- F. All roofs must have a minimum of 1/2" per foot slope (6" in 12 feet). Roofs limited by parapet height can slope a minimum of 3/8" per foot. Should 1/4" or less per foot slope be required contact NMSU Project Representative prior to design and construction.
- G. Provide special surface treatment such as walk way pads that do not block drainage, at roof areas subject to foot traffic.
- H. NMSU will not accept the use of APP (Atactic polypropylene) modified bitumen systems.
- I. Warranty Period 15 years. (Minimum)
- J. All proposals shall be provided with a copy of the final Warranty. (Note: This requirement shall be placed in the invitation to bid and appropriate roofing section.
- K. Specify a maximum roof pond size equal to 1 square foot in area and 1/8" deep.
- L. Eliminate or minimize use of tapered insulation to create the required roof slope, establish slope through roof structure. If tapered insulation is required, provide a minimum slope as described in paragraph "F" above.

07 10 00 DAMP-PROOFING AND WATER-PROOFING

.1 DAMP-PROOFING AND WATER-PROOFING

- A. At all suspended interior floor areas where restrooms, toilets, showers, and similar water-use facilities are located, a membrane waterproofing material shall be used.
- B. Below-grade tunnel or foundation walls and masonry work shall be dampproofed and/or waterproofed to meet design requirements and site conditions.
- C. Exterior slabs and/or deck areas which allow weather exposure to building interior shall be waterproofed by use of a waterproofing admixture placed within the concrete mix, and use of positive water stops of metal, plastic, and/or membrane waterproofing built into the work.

07 20 00 THERMAL PROTECTION

.1 ROOF INSULATION

- A. NMSU will not accept the use of vegetable or cane fiber-type board insulation with the exception of agriculture facilities where roof top livestock grazing is desired.
- B. Expanded plastic can be installed unprotected on concrete roof decks. On metal decks, a base layer of 5/8" moisture resistant, fire-rated gypsum board may be used prior to installation of expanded plastic insulation or a combination expanded plastic and gypsum or perlite base layer-type insulation may be used.
- C. All proposed roof insulation systems shall be reviewed by NMSU during the project design stage.

07 60 00 FLASHING AND SHEET METAL

.1 FLASHING

- A. The specifications and details of the National Roofing Contractors Association shall be used as guidelines for all roof flashing systems.
- B. All flashing shall have a minimum height of twelve inches (12") above finished roof membrane. Design Professional shall design and Contractor shall install flashing as necessary to obtain the required roof warranty in those locations with less than 12" of parapet height.



07 70 00 ROOF AND WALL SPECIALTIES AND ACCESSORIES

.1 ROOF PENETRATIONS

- A. Pitch pockets generally will not be permitted. If pitch pockets are to be used they must be reviewed by the Design Professional with NMSU. Design of all roof penetrations shall be in accordance with the recommendations and details of the National Roofing Contractors Association.
- B. All roof penetrations shall have a minimum 12" clear between penetrations, and all roof penetrations shall have a minimum 12" clear between penetrations and perimeter of roof.
- C. Mechanical equipment stands shall be designed and constructed to eliminate water infiltration through any portion of the equipment or stands.
- D. The Design Professional shall provide detail drawings of equipment stands for review with NMSU.

.2 ROOF DRAINS

- A. Roof inlets generally shall be of Dura-coated cast iron body, dome strainers, setting and clamping rings, extension sleeves, and sump receivers.
- B. Roof drains shall be installed at designed or natural low points, or mid-span, and not at column locations.
- C. Flexible connectors shall be used between drain bodies and rainwater conductors.
- D. Dome strainers shall be metal. Plastic or composite dome strainers will not be allowed.

07 84 13 PENETRATION FIRESTOPPING

All penetrations through fire rated walls, floors, ceilings, barriers and partitions will be appropriately filled with approved "FIRE STOP" material. The material must carry an Underwriters Laboratory and Factory Mutual listing/approval for the application to be used. Documentation from the manufacture must be approved by the Design Professional for the application.

END OF DIVISION 07

DIVISION 08 – OPENINGS

SAFETY CONSIDERATIONS

- A. All glass and glazed doors used at entrances, stairwells, etc., shall have adequate push plates or bars and proper glass as required by applicable building codes or regulations.
- B. On all windows where the stool of the window is less than two feet from the floor, there shall be bars or other approved means provided to eliminate the possibility of falls through the windows. Casement windows or other outward projecting sash will not be used at the ground floor.

08 10 00 DOORS AND FRAMES

- A. Doors and Frames shall be designed for the intended use considering, application, durability, life safety, and current applicable building codes.
- B. Visual panels in doors may be used when needed for safe travel through a high traffic area. The visual panel will be limited to a maximum of 100 square inches and be installed by the door manufacturer. The glass panel and frame must be stamped as a fire rated unit equal to the rating for the door.

08 50 00 WINDOWS

- A. Windows shall be designed for the intended use considering, application, durability, life safety, and current applicable building codes.
- B. Window panels in fire rated walls must be stamped by the manufacturer, as meeting the fire rating requirements of the adjacent door/wall. The stamp must be visible when installed.
- C. LEED: If operable windows are installed, have the HVAC controls connect to the window position. (Have the HVAC turn off if a window is opened).

08 60 00 ROOF WINDOWS AND SKYLIGHTS

All skylights will incorporate skylight guards, handrails or other guarding mechanism that meets OSHA standards.

08 71 00 DOOR HARDWARE

- A. Door hardware shall be designed for the intended use considering, application, durability, life safety, and current applicable building codes.
- B. Self-closing devices will be installed on all fire rated doors. The devices will be manufactured and installed as an Under Writers Laboratory (UL) listed unit. Self-closing hinges, which meet the intent of NFPA 80, may be used with prior

approval from the Authority Having Jurisdiction (AHJ).

- C. Doorstop devices will not be installed on any fire rated door. If the user requires/requests an open flow of traffic through the area with a fire rated door, normally required to be kept closed in an emergency, magnetic door hold open devices shall be incorporated and must be connected to the building fire alarm system, as required by NFPA 80 & 101. The magnetic devices must release when any part of the fire alarm/notification system is activated. All magnetic devices will incorporate smoke detection on both sides of the door.

08 10 00 DOORS AND FRAMES

.1 EXTERIOR DOOR FRAMES

- A. Exterior door frames shall be heavy duty, gauged to match the application. Door frames shall be a minimum of 16 gauge, unless otherwise approved by NMSU.
- B. Coordinate the head style to match masonry applications.
- C. Door frames shall have reinforcement plates for the attachment of all hardware.
- D. All exterior doors to be prepped for NMSU door access hardware. Verify opening locations and preparation requirements with NMSU Project Representative.
- E. Aluminum shall be anodized in selected finish
- D. All exterior frames shall be weather stripped.

.2 EXTERIOR DOORS

- A. All exterior doors should be of metal, heavy duty, galvanized, and seamless construction. Doors shall be 18 gauge, unless otherwise approved by NMSU.
- B. Aluminum doors shall be anodized in selected finish.
- C. Narrow stile type metal doors are not acceptable. Stiles and top rail shall be a minimum of eight (8) inches and bottom rail shall be a minimum of ten (10) inches. Coordinate stiles and top rail to the closer and automatic operator requirements. Intermediate rails where required shall be sized to accommodate hardware application.
- D. Automatic hold-open devices are not permitted on exterior doors.
- E. Use of single doors or multiple doors with keyed removable mullion is preferred.

- F. Provide a handicap access door actuator and 110 volt power on at least one exterior entry door. Coordinate location with NMSU Project Representative.

.3 INTERIOR DOORS – WOOD

- A. Specifications for interior doors of wood shall be adapted from industry standards.
- B. Doors to be 1 3/4” thick solid core, flush.
- C. It is preferred that wood doors be prefitted and prepared for approved hardware at the place of manufacture.
- D. It is preferred that wood doors be prefinished for natural finishes and presealed for doors to receive paint.
- E. Doors from corridors to stairwells and classrooms shall have a vision panel.
- F. All cut-outs for vision panels, louvers and similar items shall be accomplished at the factory. Manufacturers shall provide reinforcement members (if required), prefitted, prefinished moldings, trim and all glazing beads.
- G. Provide removable keyed mullion for all multiple door openings.
- H. Louvers, if required, shall be provided by the door manufacturer.

.4 INTERIOR DOORS - METAL

- A. Interior metal door frames to be 16 gauge with 20 gauge door minimum.
- B. Narrow stile type metal doors are not acceptable. Stiles and top rail shall be a minimum of eight (8) inches and bottom rail shall be a minimum of ten (10) inches. Coordinate stiles and top rail to the closer and automatic operator requirements. Intermediate rails where required shall be sized to accommodate hardware application.

08 50 00 WINDOWS

.1 WINDOWS

- A. All sash and frames are to be anodized in a selected finish with thermal barrier construction. If operable, using projected, or awning windows with integral weather stripping; no outward projecting sash will be permitted on the ground floor. Windows shall be double glazed.
- B. For maintenance purposes, all windows should be arranged, manufactured, and installed, so that complete maintenance can be accomplished from the room side. This should include glazing, screening, and normal repairs.

- C. Consideration should be given to the use of tinted glass or special structural design at certain areas where orientation will lead to excessive solar heat gain.

08 70 00 HARDWARE

.1 FINISH HARDWARE REQUIREMENTS

The following hardware items (or applicable model number should they change) shall be used, without substitution, except when:

- 1) Matching existing hardware;
- 2) Physical conditions or Code requirements mandate the use of other items.

Hardware items not listed below, such as weather-stripping, thresholds, hinges, etc., shall remain as “or approved equal”, subject to the submittal and approval process.

A. Hardware

Mortise Locks: Preferred Schlage, Schlage L9000 Series, Levon or Rhodes Trim Yale 8600 or 8700 Series, Augusta Trim;

Cylindrical Locks: Yale Lever, 5400 Series, Augusta Trim

Finishes: All Hardware Finishes US10 or US26D

Deadbolts: Lori, Single or Double Cylinder to accept the Yale Mortise Cylinder

Door Closers: LCN 4010

Exit Devices: Rim or Mortise Type only; Von Duprin 99 Series, no vertical rods.

Door Operators: Horton Operators will be used on all applications. 4100 heavy duty, 7100 standard duty operators, blackboard application uses 6R1 hardwired Larco 6” round push buttons, wireless uses 6R1U4 buttons.

Anderson Hall (PSL): Has its own special "BEST" key cores. The lockset we have in stock and normally provide for PSL is a Yale Best REM Core Lockset BAU 5407LN 626 Bar Code #201981

Alamogordo: Requires Schlage locks. Contact the user for keying requirements.

Housing: bedroom doors shall be Marks. Coordinate special card access with user group, for example; Housing dorm facilities and secured labs.

B. Hinges:

All doors shall be equipped with proper type, size, and number of hinges as recommended by Stanley or McKinny Hinge Division. All hinges shall have button tips and non-removable pins for exterior doors opening out.

C. Door Stops, Holders and Bumpers:

1. All doors shall be provided with stops similar to Glynn Johnson GJ-WB-50C, where possible, unless specifically prohibited by applicable fire codes. Where required, floor stops shall be similar to GJ-FB-13 or GJ-FB-17, overhead stops and holders GJ-90 series and holders and bumpers GJ-F9X, F20, or GJ-W-20.
2. Do not specify automatic holders for exterior doors.

D. Finishes:

1. All hardware shall be satin chrome (US26D), except pulls, push plates, kick plates and mop plates shall be satin-finish stainless steel (US32D), unless otherwise specified.

F. Miscellaneous Requirements:

1. All push plates where possible shall be 8" x 16" in size.
2. All doors with push plates and pulls with the cylinder on the push side shall have recessed pulls.
3. Provide rubber silencers, similar to GJ-64 for all doors in hollow metal frames, except exterior doors.
4. All doors with closers shall be provided with kick plates.
5. All door closers for wood doors to be furnished with thru bolts and grommet nuts.
6. All doors as specified shall have surface-mounted overhead closers, full rack and pinion type, with back check, as manufactured by LCN or equal.
7. All flush bolts to be installed in edge of doors.

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8. Non-metallic insert type latch bolts will not be acceptable as antifriction unless used with curved lip strike.
 9. "Total Door System" hardware is not acceptable.
 10. All hardware for aluminum doors shall be specified under the finish hardware section.
 11. No automatic hold-open devices permitted on vestibule doors.
 12. Hardware schedules shall be done in the vertical format type. Horizontal format will not be accepted.
 13. Coordinate the door operator activation buttons to fit the HC door location.
This may include extension of conduit and bollards to mount the operator.
 14. Blackboard system obtain all specification from Access Control.

08 80 00 GLAZING

.1 GLASS AND GLAZING

- A. Windows are to be double glazed, flush-type molding preferred.
- B. Glazing, glazing compounds and sealants. (1) Refer to manufacturer's requirements and Flat Glass Jobbers Association (FGJA) "Glazing Manual" for special applications using elastic compounds, tape, polysulfide elastomer sealants, and compression materials.
- C. All glass and glazing shall be in compliance with applicable codes.

END OF DIVISION 08

DIVISION 09 – FINISHES

For NMSU piping color code and the usual painting called for under the mechanical trades, NMSU uses a "Color Code" for the identification of certain equipment and piping. Piping will include labels and flow directions according to building standards.

09 03 00 CERAMIC TILE

- A. A non-slip nosing shall be installed on all interior stairs. Nosings with grooves or other depressions tending to form trip hazards shall not be permitted. (Carborundum or similar abrasives are not permitted.)
- B. All tile placed on exterior walking surface to be porcelain slip resistant.

09 51 00 LAY-IN CEILINGS

- A. Provide fire rated lay in ceiling in electrical rooms (preferred over gypsum board ceilings) or fire rate the structural open structure.
- B. Armstrong ceiling solutions “fissured-755” in all locations unless otherwise noted; solid surface ceiling tiles in clean areas such as kitchens and laboratories; is the standard for all lay-in ceilings unless otherwise approved by NMSU Project Representative.

08 06 00 SCHEDULES FOR FINISHES

- A. Chemical Emissions - Only “low-VOC” architectural coatings, adhesives & solvents can be specified and used. Verification of “low-VOC” content and SDS documentation to be maintained by the contractor during construction and provided upon request by NMSU Project Representative.
- B. All interior finish materials shall comply with NFPA 101 Chapter 10 Interior Finish, Contents, and Furnishings or pertinent NFPA Standard to material. Documentation of flame-spread ratings will be made available and provided to NMSU Project Representative. Requests for flame spread data may be made if a questionable material is noted during the specification review or during construction site visits.

09 90 00 PAINTING AND COATING Note: insert the correct CSI section number.

Use of oil base paint must be prior approved by NMSU Project Representative prior to design. Design Professional to determine all locations that require oil base paint during design.

END OF DIVISION 09



DIVISION 10 – SPECIALTIES

10 14 00 SIGNAGE

Signage (plaque, interior and exterior signs) – Include room sign schedule reflecting quantity, specifications, and colors. Refer to NMSU wayfinding guidelines provided by Project Representative for additional information.

10 28 00 TOILET, BATH AND LAUNDRY ACCESSORIES

Toilet paper, paper towel, and soap dispensers will be supplied by NMSU Operations and installed by the contractor on all Main Campus projects. Include these items as Contractor Furnished and Contractor Installed at all branch campus sites with guidance from the NMSU Project Representative.

10 28 13 TOILET ACCESSORIES Need to find CSI section #.

All urinal screens and toilet partitions to be stainless steel (primary choice) or manufactures standard painted steel (secondary choice), floor mounted, and overhead braced. Use manufactures standard hardware and mounting sinks

10 28 40 Hand Dryers

Xcelertor

10 74 00 MANUFACTURED EXTERIOR SPECIALTIES

Any exterior lettering on doors or windows, no dimensional letters on buildings are allowed beginning 2018. Coordinate design with the current NMSU Wayfinding standards.

Need to find CSI section #

END OF DIVISION 10

DIVISION 11 – EQUIPMENT

11 40 00 FOOD SERVICE EQUIPMENT

- A. Kitchen hood testing shall be in compliance with all applicable codes and the authority having jurisdiction. At a minimum independent testing shall verify the operation of air flow, controls, fire protection, and fire alarm.
- B. Kitchen hood exhaust duct - design access door locations for duct cleaning and inspection. Roof mounted hood exhaust fan to be designed with a hinged housing and capable of cleaning without hood removal or disconnect.
- C. Kitchen hood - Specify hood fire protection system to be included in the project design. Coordinate control requirements with NMSU Fire Department.

11 50 00 EDUCATIONAL AND SCIENTIFIC EQUIPMENT

- A. Refer to NMSU Information & Communication Technologies (ICT) guidelines for all classroom and communication technology, see [\(ICT\) Information & Communication Technologies | New Mexico State University](#) .

11 53 00 LABORATORY FUME HOODS

Chemical and flammable liquid storage and usage areas will be ventilated sufficiently to remove all fumes and shall be constructed in accord with all applicable codes and University requirements.

- A. Manifold Fan Systems
 1. Must be sized to provide a flow rate of 80-150 fpm at sash height of 18 inches for all hoods in the building. When installed a smoke containment test must also be performed. The hood and exhaust system shall be installed and tested per ASHRAE 110 and ANSI Z 9.5 .
 2. The airflow for each individual fume hood (VAV) shall be sized to provide 100 linear feet per minute face velocity at a sash height of 18 inches.
- B. Sash stops must be provided at the 18-inch level.
- C. Face velocity monitors must be hot wire pressure differential types.
- D. Hood exhaust must be labeled hazardous.
- E. Variable air volume hoods are recommended in high hood density locations.
- F. Ducted fume hoods are preferred.
- G. Auxiliary air hoods are not acceptable. Fume hoods exhaust must be integral to laboratory ventilation.

H. Special Considerations: Examples of situations that will require additional considerations and consultation from NMSU Project Representative and EH&S are as follows:

1. Perchloric acid hoods – wash down; exhaust separate from general lab exhaust.
2. Hydrofluoric acid – polymer lined.
3. Iodination – Stainless steel lined filtered inserts inside the fume hood.
4. Glove box for Chemicals.
5. Under hood storage cabinets for storage of corrosive/flammable are preferred. 6. Chemical Storage cabinet doors (flammable liquid and others) must not have automatic closers.
6. Non-ducted (filter type) fume hood.

I. Energy considerations

1. Proximity sensors may be installed on chemical fume hoods to provide a setback to 60lfpm at all sash heights in an unoccupied mode. Overrides must be provided.
2. Fume hoods may be put on a night set back to 60 =lfpm system for unoccupied mode. Overrides must be provided.
3. Occupancy sensors or light switch are acceptable
4. Occupied air changes for labs should be minimum of eight for BSL 2 labs and below. For BSL 3 and specialty labs consult with NMSU EH&S for occupied air changes. An Unoccupied mode of 6 air changes per hour minimum is acceptable.

J. Energy recovery systems are acceptable; however chemical fume hood exhaust or biosafety level 3 laboratory exhaust must not be routed through energy wheels.

11 80 00 COLLECTION AND DISPOSAL EQUIPMENT

Trash and Recycling Collection Point: State Health Department regulations require an enclosed facility for trash. Trash must be protected from the elements and free of rodent and insect harborage. Minimum size is 120 sq. ft. Trash rooms shall have double doors from the outside loading area and double doors are preferred from the interior corridor into the trash room. Trash rooms shall have a dedicated 110 volt outlet in addition to other required power facilities. Trash rooms shall have sealed concrete floors, a floor drain connected to the sanitary sewer, hot and cold water hose bibb, gyp board ceiling and 4' fiberglass reinforced panel wainscot on all walls. Trash rooms shall have interior lighting and control switch. Trash rooms shall have adequate ventilation and be protected from freezing and high heat



temperatures; exhaust return air to the outside.

END OF DIVISION 11

DIVISION 12 – FURNISHINGS

12 93 13 BICYCLE RACKS

BICYCLE RACK STANDARDS

NMSU shall select, configure, and locate bicycle racks and parking areas per the requirements detailed below. These NMSU bike friendly standards are summarized from the bicycle parking guide adopted by the Association of Pedestrians and Bicycle Professionals.

SHORT TERM BICYCLE PARKING SELECTION

A. RECOMMENDED racks include:

1. “INVERTED U” RACKS (each rack element supports and secures two bikes at two points and meets the above requirements).
2. “A DESIGN” RACKS (rack element supports and secures two bikes at two points and meets the above requirements)
3. “POST AND LOOP” RACKS (rack element supports and secures two bikes at two points and meets the above requirements).

B. NOT RECOMMENDED racks:

1. Comb, toast, schoolyard, wave and similar racks that provide no support or security for the bicycle frame are NOT recommended;

CONFIGURATION

- A. A rack area is a bicycle parking lot where racks are separated by aisles. A “bicycle parking lot” is an area where more than one rack is installed. Aisles separate the racks. The aisle is measured from tip to tip of bike tires across the space between racks.
- B. Aisle Separation
 1. 48 inches is the minimum separation between aisles.
 2. In heavy use area, e.g. college classroom, 72 inches is the recommended minimum aisle width.
 3. Large rack areas with a high turnover rate should have more than one entrance
- C. Rack separation. Racks should be installed at least:
 1. 24 inches from obstacles to front, rear or the side of the rack

-
2. 30 inches on center from other racks or rack elements in a row.

LOCATION

- A. Racks are not to be placed so that they block the entrance or inhibit pedestrian flow in or out of the building, but the best location for a rack area is immediately adjacent to the entrance it serves. Adequate space must be provided to allow for the dismount, unload and lockup transition. Racks that are far from the entrance, hard to find, or perceived to be vulnerable will not be used by most cyclists.
- B. A rack area should be as close as or closer than the nearest car parking space to the building's main entrance. A rack area should be clearly visible from the main entrance, no more than a 30-second walk (120 feet), and should preferably be within 50 feet. In general, multiple buildings should not be served with a combined, distant rack area. It is preferred to place smaller rack areas in locations that are more convenient

LONG TERM BICYCLE PARKING

Enclosed bicycle parking should be installed where appropriate. Enclosed bicycle lockers shall be mounted on a hard surface with proper drainage to prevent condensation inside and rusting of contents.

Contact NMSU Project Representative for use and design of long term bicycle parking.

END OF DIVISION 12

DIVISION 14 – CONVEYING EQUIPMENT

14 20 00 ELEVATORS

- A. The authority having jurisdiction will have final authority over all matters in regards to fire suppression, detection and notification. At a minimum, all elevator shafts will incorporate fire suppression and fire detection. Fire detection, notification and fire suppression is required at each level outside the elevator and in the elevator room. Passenger elevators will also incorporate fire department recall for all elevators. Elevator lobbies must include smoke guards. A recall key will be provided in a location as determined by NMSU Project Representative.
- B. Signage will consist of written/visual signs noting Fire Dept. elevator operation and "IN CASE OF FIRE, USE NEAREST STAIRWAY DO NOT USE ELEVATOR". The signage will be posted in a conspicuous location. Signage will not be placed near or under bulletin boards or in other areas where hanging material will obscure the signage. All fire rated doors will have the appropriate signage (provided by the manufacturer) indicating its fire rating. This signage will be in the way of a metal placard, attached to the side of the door. The placard will not be covered/painted or otherwise obscured.
- C. Consider providing a vestibule for any elevator that is exposed to the outside and/or harsh environment. Elevators exposed to the outdoor elements will be fully rated for the application.
- D. Require a full elevator load test to be conducted prior to final acceptance.
- E. Specify the elevator exterior emergency access key (tool) to be included in the closeout package.
- F. Verify design contains sill angles or floor offset to accommodate the elevator door's offset. Verify the structural design contains a hoist beam located above the elevator shaft.
- G. Field verification for the authority having jurisdiction to determine the primary and secondary landing point during an active fire alarm. Upon reaching the area of refuge floor the elevators doors will open and remain open.
- H. The inside of the elevator cart floor, must measure greater than 70 inches in either depth or width. The intention is for EMS gurneys to be placed in the elevator for movement of patients who are non-ambulatory. If a secondary elevator exist this requirement is at the discretion of NMSU Fire Chief. Contact NMSU Project Representative for instances of areas that require an ADA non-standard opening width.

I. ALL ELEVATORS:

1. In addition to all ANSI A17.1 requirements.
 - a. Contractor will provide maintenance manuals for each hydraulic elevator to include operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Submit to NMSU Project Representative at date of substantial completion.
2. Maintenance service:
 - a. Beginning at substantial completion, provide 12 months of warranty maintenance by skilled, competent employees of the elevator installer to include repair or replacement of worn or defective components, lubrication, cleaning and adjusting as required for proper operation at rated speed and capacity. Use only parts and supplies as used in the manufacture and installation of original equipment.
 - b. During the warranty period, include 24-hour-per-day, 7-day-per-week, call back service for any emergency situation as defined by the NMSU Project Representative. Callback service will require a response time of 2 hours.
 - c. During the warranty period for non-emergency maintenance issues, a response time of 48 hours is required.

END OF DIVISION 14



DIVISION 21 – FIRE SUPPRESSION

Note that the Authority Having Jurisdiction (AHJ) may determine that some projects or planned modifications to existing systems may require more stringent requirements than those listed here. These requirements are usually conveyed during plan review. NMSU Fire Department is the AHJ for NMSU Main Campus and DACC Main Campus as per New Mexico Public Regulation Commission.

NMSU FIRE DEPARTMENT FIRE PROTECTION GENERAL NOTES

- A. Fire protection design shall comply with the latest applicable editions of NFPA 13 Standard for the Installation of Sprinkler Systems, International Building Code, and the International Fire Code.
- B. Consult with NMSU FD for location of:
 - 1. Backflow preventer (double check backflow assembly)
 - 2. Fire department connection (FDC)
 - 3. Test valves
 - 4. Standpipes (only Class 1 allowed)
 - 5. Electric waterflow bell
 - 6. Knox box
- C. No post-indicator-valve required.
- D. Backflow preventers will be located exterior of the building.
- E. All flow switches and tamper switches must be connected to the building fire alarm system.
- F. Install tamper switches on all valves.
- G. Flow switches, tamper switches, sectional control valves, inspector's test valve, and area drains will be located on each vertical floor.
- H. Fire alarm control valves will be installed on all new systems.
- I. Inspectors test valve will be at the farthest/highest point or floor of the system.
- J. All drains and inspector valves will drain to the outside with proper construction as not to disrupt landscaping, sidewalks, entrances or driveways.
- K. Submit all approval requests to NMSU FD through the project architect and NMSU project manager.
- L. Submit the required number of copies, to include at a minimum: fire protection shop drawings, hydraulic calculations, with related equipment and component specifications, or data information.

- M. All shop drawings containing piping and material layouts must be provided on a minimum paper size of 24-inch by 36-inch.
- N. All related equipment and component specifications or data information submitted for approval must be highlighted to reflect only those items proposed for use.
- O. All submitted plans must contain the appropriate engineers stamp.
- P. Submittal drawings shall contain all previous notes and corrections determined by the AHJ incorporated into this final submittal.

21 00 00 FIRE SUPPRESSION SYSTEMS

A. Preliminary Design Stage:

1. Architect and/or Design Engineer, together with the Project Manager, shall meet with the NMSU Fire Chief (AHJ) or designee, and Facilities and Services, Electric Shop Supervisor to review preliminary plans, code requirements, scope of the work, design parameters and building or campus needs.
2. Architect and/or Design Engineer must review available water supply and pressure through verification of the existing capacity of utilities and surrounding systems, and, available building fire protection systems. Water supply line to fire suppression system must meet NFPA and AWWA Standards.
3. When the project is New Construction (free-standing or major addition), fire protection plans shall be complete with full drawings and specifications for the system. Submittals for this system shall be submitted for approval as outlined below.
4. When the project is a remodel of an existing facility, a performance specification may be used, requiring the Contractor to supply a designed system for approval as outlined below, prior to manufacture.

B. Final design / Before Advertisement:

1. Architect and/or Design Engineer, together with the Project Manager and Construction Coordinator, shall meet with the Fire Chief or designee, and Facilities and Services, Electric Shop Supervisor with final bid documents for review and comment prior to proceeding to advertisement.



C. Construction Contract Phase:

1. The Fire Protection Subcontractor shall submit shop drawings and other submittals through the General Contractor to the Architect. The Architect and/or Design Engineer, together with the Project Manager and Construction Coordinator, shall review the submittals and shop drawings with the Fire Chief or designee, and Facilities and Services, Electric Shop Supervisor, and shall obtain their approval before returning them through the General Contractor to the subcontractor.
2. In addition to any interim inspections the Fire Chief may make, there shall be a final inspection of the completed work by the Fire Chief or designee, and Facilities and Services, Electric Shop Supervisor, coordinated by the Architect. The Fire Chief must review the completed work before CID will issue a Certificate of Occupancy.


21 00 10 FIRE ALARM SYSTEMS & STANDARDS

NMSU FIRE DEPARTMENT FIRE ALARM SYSTEM GENERAL NOTES

- A. Fire alarm system design shall comply with the latest iterations of NFPA 72: National Fire Alarm and Signaling Code, International Building Code, and the International Fire Code.
- B. Consult with NMSU FD for location of:
 1. Alarm control panel
 2. Annunciation panels if needed
- C. The locations of all initiating and notification devices must be clearly indicated on all plan submittals.
- D. Provide the candela rating for all strobes.
- E. Decibel ratings on horn strobes must meet OSHA compliance.
- F. All devices will be installed to provide reasonable access for maintenance.
- G. Provide details of ceiling height and construction to include mounting height of any devices on all plan submittals.
- H. Provide details of power connection on all plan submittals.
- I. Electrical breaker controlling the alarm system must be equipped with a breaker lock and properly identified at the breaker and panel.
- J. Provide details of electrical wiring type and size on all plan submittals.

- K. Provide details of the interface of all fire safety control functions.
- L. Submit all approval request to NMSU FD through the project architect and NMSU Project Representative.
- M. Submit the required number of copies, to include at a minimum: fire alarm system shop drawings, all battery and voltage drop calculations, the total number and amperage of the batteries to be utilized, with related equipment and component specifications, or data information.
- N. All related equipment and component specifications or data information, to include: manufactures, model numbers, and listing information with related equipment, submitted for approval must be highlighted to reflect only those items proposed for use.
- O. All shop drawings containing wiring and material layouts must be provided on a minimum paper size of 24-inch by 36-inch.
- P. All submitted plans must contain the appropriate engineers stamp.

FIRE ALARM EQUIPMENT REQUIREMENTS

- A. Firelite Panel (standard), Gamewell, Siemens, or verify 
- B. Fire alarm panels are to be located in a secured room in close proximity to the riser room and an area easily accessible to individuals in need to access the panel during fire alarm activation.
- C. Annunciator Panel at the main entrance or approved by AHJ.
- D. Surge protector: Ditek Model DTK-HW at the Firelite Panel and surge protector at all FCPS (Fire Control Power Supplies).
- E. Pull stations- must be covered with a tamper box.
- F. Duct detectors- must be on a separate power supply than the supply fans.
- G. Fire alarm system is to have life safety components only, not allowed to be used for any other type of detection devices.
- H. Field verification of 15 db above ambient noise in all areas when fire alarm is active.
Active alarms are to be above 60 db and below 105 db except were allowed due to environmental conditions.
- I. In areas of high ceilings, such as atriums, smoke detectors can be ineffective. Heat or beam detectors must be used in place.



21 10 00 WATER-BASED FIRE SUPPRESSION SYSTEMS

21 12 00 FIRE SUPPRESSION STANDPIPES

Fire Department connections (FDC) will be installed in a location, which will provide the quickest/easiest access to fire department vehicles – location directed by the AHJ. Connections must not be remote and placed on the building; exceptions can be made due to obstacles but must be cleared by NMSU DF&ES Fire Chief.

21 12 16 FIRE SUPPRESSION HOSE REELS

NMSU has adopted a policy (which has been approved by the State Fire marshal) of not installing Class I or II fire hose cabinets in any NMSU facility if required by code. Class III cabinets for fire department standpipe connections will be permitted and labeled for Fire Department use only.

21 13 00 FIRE SUPPRESSION SPRINKLER SYSTEMS

- A. Compliance of NFPA 13
- B. The Riser Room must be a standalone closet or room. Risers shall not be placed in a dual purpose room; such as janitor closet, storage or work areas. Mechanical rooms will be permitted if areas are clear for unrestricted movement
- C. Inspector Valves - must be remote of the riser; typically at the furthest part of the fire system. The valve location is to be a reasonable height (be assessable) on the wall, in a marked wall cabinet. Any piping including the main drain must be piped to the outside of the building in ground level and water flow away from the building.
- D. Tamper Switches are to be used on all shut off valves; at riser, PIV, HotBox, OS&Y and back low preventer.
- E. Electronic Water Gongs shall be used in place of mechanical water activation.
- F. Placement of a flow switch not pressure switches on the system above the valve on the riser.
- G. Field verification of sprinkler head location.
- H. Note on dry systems- pressure switches are permitted at the riser.
- I. Multistory buildings- each floor is to have an isolation valve and a drain valve. Drain valves are to comply with 21 13 00 C. Intention is to allow placing a floor out of service and allow other floors to remain in service.

- J. Pending- Installation of a valve downstream of the back flow prevention valves for flow test of system demand NFPA 817.4.6.1

21 13 13 WET-PIPE SPRINKLER SYSTEMS

- A. All new construction will comply with NFPA 13 requirement that all structures will incorporate full fire sprinkler systems. Sprinklers in conjunction with full smoke/heat detection or other suppression systems will be considered on an individual basis.
- B. Fire protection system - -- To obtain current hydrant flow rates each agency will have to obtain their own flow rates. NMSU Fire Department will facilitate and assist as possible, comparative flow rates can be provided for comparative flow rates only. NOTE: This applies to Main Campus only. Branch campuses must coordinate with State Fire Marshal's office or local fire authority.
- C. The minimum detection and protection requirements for storage, custodial and trash rooms will be smoke detection and wet pipe fire sprinkler systems connected to the fire alarm panel.
- D. Fire sprinkler system drawings (contract drawings) shall indicate the service entry, the siamese connections, the supply manifold assembly with all alarms and switches, the vertical and horizontal distribution piping and valves and supply piping to all protected areas. Indicate test drains piped to reasonable central locations. Drains cannot simply be left to drain anywhere. Indicate head coverage as part of the specification with proper accounting for drop soffits, special conditions, etc. It is recommended that head locations, or at least head locations at special conditions be detailed. Provide zone isolation valves that for maintenance. On any multi story building label maintenance drain valve, electronically supervised through the panel
- E. Risers to be located in conditioned spaces (i.e. mechanical rooms) to ensure against freezing.
- F. Fire sprinkler shop drawings shall be reviewed and approved by the design engineer. The drawings with professional engineer's wet seal and mechanical P.E. with NM fire protection design endorsement shall also be transmitted to the AHJ for review. Proof of submission and approval is necessary for work to commence.
- G. Verify good riser location and accessibility
- H. All sprinkler systems will incorporate a backflow preventer to be located external to the building, double check backflow preventer, pressure gauges on both sides of check valves. Tamper switches tied into the fire alarm system as per 20 1300 D.

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- I. Wet systems; check valve needs to be in place at the riser this is in addition to the backflow preventer in a HotBox.
 - J. Pipe joints may be welded, threaded or Victaulic grooved-rigid couplings. No Plain End, Pressfit or FIT type couplings permitted
 - K. Standard pendent/upright wet sprinkler systems will be used in all facilities unless justified recommendations for alternative systems are presented.
 - L. Alarm check valve to be included in the design.
 - M. Inspector test valve to be included in design.
 - N. Include a fire sprinkler head in Elevator shafts.
 - O. It is preferred that fire pumps not be used in designs.

21 20 00 FIRE EXTINGUISHING SYSTEMS

- A. The standard type fire extinguisher to be specified in all projects shall be:
 - 1. 10 lb. ABC Dry Chemical
 - 2. For Automotive and Industrial areas: 15-20 lb. ABC Dry Chemical
- B. The cabinet's style and features will be specified during plan reviews of each project. NMSU does not specify a particular style, but each cabinet will have the following features:
 - 1. Be of a size which will accommodate the extinguisher.
 - 2. Window port for visual inspection of the pressure gauge.
 - 3. The outside of the cabinet will have, in clear contrasting color to the cabinet, the words FIRE EXTINGUISHER regardless of the type/size of the visual panel.
 - 4. The door will be a straight pull-to-open type without a locking mechanism unless specified by SRS for a specific application.

21 22 00 CLEAN-AGENT FIRE EXTINGUISHING SYSTEMS

FM 200 or similar alternative systems will be used in computer rooms requiring such protection.



21 23 00 WET-CHEMICAL FIRE EXTINGUISHING SYSTEMS

Only Wet Chemical hood systems will be installed in cooking facilities. Kitchen Hood Systems installed must be compliant with UL Standard 300 minimum.

21 24 00 WET-CHEMICAL FIRE EXTINGUISHING SYSTEMS

- A. Knox Box is to be in place. The location of the Knox Box is to be determined by NMSU Fire Chief. Fire Department has a standard Knox Box. Knox Box is to be obtained from NMSU Fire Department. The base cost of the Knox Box is to be paid by the contractor in service for the construction.

END OF DIVISION 21



DIVISION 22 – PLUMBING

For all new installations:

- A. Provide adequate building wall thickness to accommodate piping and fittings.
- B. Provide adequate maintenance access.
- C. PVC may be used for Vent lines and sanitary sewer if encased in fire rated enclosure – refer to the code requirements.
- D. If laboratory treated water (RO, DI, Pure) is required, ensure non-metallic pipe, fittings, and valves are specified. Stainless steel is acceptable. Also, specify di- electric union/connections between dissimilar metals.
- E. Provide housekeeping water-hose in janitor’s closet or restroom. Also provide floor drains in restrooms.
- F. Contractor to provide Chemical Cleaning documentation of all piping systems before final connection and introduction of water from and to the central utility systems operation.
- G. Install sewer lines at the proper slopes. Min. ¼” per foot (required for grease laden wastes). Must obtain written approval from FS Vice President to run at less slope. Ensure debris does not enter open lines during construction.
- H. Post equipment Sequence of Operation in Mechanical Rooms.

22 08 00 COMMISSIONING OF PLUMBING

Pipe testing, flushing and treatment shall be specified.

22 11 00 FACILITY WATER DISTRIBUTION

- A. Isolation valves at each branch take-off for chilled water and domestic water supplies and returns.
- B. Isolation valves at each item of equipment which are separate from balancing and control valves.
- C. Provide accessible isolation valves at major branch take-offs, at each floor, and in long runs of pipe.
- D. Reasonable drain valves and caps.

22 13 00 FACILITY SANITARY SEWAGE

- A. Areas or rooms used for storage of hazardous or otherwise regulated liquids in

- quantities larger than 5 gallons may not have floor drains
- B. Specify 4-band worm clamps on cast iron no-hub sanitary piping.
 - C. Sanitary sewage sump pumps shall only be used to convey waste generated below grade and only where gravity flow is impossible.
 - D. All sanitary waste generated above grade shall drain via gravity.
 - E. Neutralizing tanks shall not be installed /utilized for chemical capture. NMSU chemical recovery policy is capture and contain chemicals for proper disposal by The Environmental Health and Safety Office.
 - 1. Identify chemical waste areas that may result in chemical wastes that will need to be disposed of.
 - 3. It takes approximately 60 days for EH&S to obtain a quote and service for removal of chemical wastes.
 - F. Trap prime shall not be utilized to maintain a wetted trap in floor drains or area drains. In lieu of trap primers utilize trap guards.

22 13 19 SANITARY WASTE PIPING SPECIALTIES

22.13.19.26 GREASE REMOVAL DEVICES

Design of grease traps shall be per the current adopted building code.

22 14 26 FACILITY STORM DRAINS

- A. Storm drain system shall be designed so that sump pumps shall only be used to convey storm water generated below grade and only where gravity flow is impossible.
- B. Indicate an adequate water management plan consisting of swales, retention, facilities, volume control, overflow considerations, etc.
- C. Identify interior roof drain piping and discharge layout on design drawings when roof drains are located within the building envelope.
- D. No exterior building entrances shall be allowed below the exterior grade unless such entrances are protected by an adequate storm drainage system.

22.14.26.13 ROOF DRAINS

- A. Indicate roof drain and drain outfall locations.
- B. All roof drain piping shall be cast iron or PVC as allowed by current adopted building code and application.

- C. Roof drains should direct water into plantings or be used for other beneficial uses whenever possible before discharge to the storm retention system.

22 30 00 PLUMBING EQUIPMENT

22 35 00 DOMESTIC WATER HEAT EXCHANGERS

Shell and tube heat exchanger to be connected to 1/3 to 2/3 steam pressure reducing station. Steam must be present in the shell of the exchanger. Water flows through the exchanger tubes. Heat Exchanger will be capable of operation via DDC control system.

22 40 00 PLUMBING FIXTURES

- A. Provide plumbing fixtures from manufactures customarily sold in the local market.
- B. Ultra-low flow urinals and water closets are required in white ceramic, wall hung units, unless otherwise approved. Detention level fixtures will be placed in those areas deemed as high vandal areas.
- C. Install white ceramic, counter mounted sinks, with ultra-low flow, automatic activated faucets. Restroom water faucets should turn off automatically after 4 seconds.
- D. Contact NMSU Project Representative for use of either manual or automatic flush operators.
- E. Dependent on application, specify electronic 120 volt hard-wired sensor activated toilet, urinal and lavatory fixtures.
- F. Drinking fountains will be bottle fill/drinking fountain combination units, 120 volt, with manufactures standard water supply inlet.

22 45 00 EMERGENCY PLUMBING FIXTURES

- A. Contact NMSU Project Representative for plumbed eyewash, deluge showers.
- B. All emergency eyewash, deluge showers must comply to OSHA and ANSI standards, and have adequate floor drainage connected to building sanitary sewer. Floor drain shall be located directly below the output of the emergency shower.

END OF DIVISION 22

DIVISION 23 – HEATING, VENTILATING and AIR-CONDITIONING

23 00 00 HEATING, VENTILATING and AIR-CONDITIONING (HVAC)

- A. The building architectural design shall provide adequate ceiling space and equipment room area for a well-coordinated layout of ductwork, piping systems, electrical conduits, cable tray, special plumbing systems, etc. as necessary to provide accessible and maintainable components.
- B. Areas or rooms used for chemical storage shall have appropriate ventilation.
- C. Provide composite equipment room, mechanical room, etc. drawings, including all trades, to be sure all facilities fit and are accessible. Provide an overall plan with plumbing, piping systems, fire protection, HVAC, major electric boxes, etc. to ensure adequate space. Include piping and racks.
- D. Provide section cuts and details on drawings showing each of the systems in elevation, to include available designated space. .
- E. Contractors' installation assembly/coordination drawings are required.
- F. Calculations: In addition to the information provided in the schedules, provide basis of design and peak load calculations on the plans as applicable for the following systems: electricity, natural gas, chilled water, steam, domestic hot and cold water, and fire protection water. Provide sufficient information for future designers and engineers to establish flows, temperatures, pressures, areas, and safety and design factors. Refer to other areas within the contract documents which may require copies of actual calculations.
- G. Steam systems: Metallic spiral wound gaskets, and, B7 Stud bolts with 2 H nuts per ASTM A193, shall be used on steam flanges. Verify fail safe, closed position, computer control valve in all steam space heating applications. Verify actuators which are rated to operate under high temperature conditions with a mean temperature operating range of approximately 250° F (Siemens or approved equal).
- H. Steam Heating Applications -high pressure steam, low pressure steam, steam trap temperature, hot water supply temperature, hot water return temperature transmitters. Reflect all transmitters on EMCS graphics. Provide an adjustable alarm set point within the EMCS for steam and hot water supply transmitters.I. General Mechanical
 - 1. Install blowdown valves in all pipeline strainers.
 - 2. Design zone isolation valves in readily accessible locations as to allow for equipment maintenance and emergency isolation of selected areas without shutting down the whole building.

3. Specify all pipes must be marked with industry standard labels including direction of flow, utility type, and purpose.
4. Install exhaust/vent/AC units in all electrical and communication closets.
5. Kitchen hood exhaust duct - design access door locations used for duct cleaning and inspection at all changes in direction. (Note: This has become a NM CID Mechanical inspector requirement.)

J. Utility/Building Tie-ins

1. Provide isolation points for all utilities in the building mechanical rooms. A means shall be provided to drain the building utilities within the mechanical room to an approved drain.
2. System Drain Valves sized to fit the application but no smaller than 1” (Ball Type) on both Supply and Return, utility lines.
3. Provide Temperature and Pressure ports on both Supply and Return lines.
4. On chilled water systems, provide a mechanical control valve on the return line which will be located in the mechanical room. Only FS Operations personnel will operate system valves that tie in to the Central Chilled Water and Steam systems.

23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

- A. The test and balance report must be obtained from a third party vendor licensed in the State of New Mexico.
- B. Provide balance and report as part of deliverables to a project (unless specifically relieved of this requirement in writing).

The following are required of the test and balance report.

1. The test and balance contractor shall be responsible for all adjustments, including replacement of sheaves as necessary to obtain the specified results based on the design intent of the engineer of record.
2. Test & Balance shall be performed by an AABC certified, third-party independent from mechanical contractor. Install fixed sheaves in conjunction with and as part of test and balance.
3. Provide dynamic grade 5 baseline vibration of mechanical equipment systems as part of the test and balance phase. Provide baseline vibration reports with close-out documentation.

4. Specify new filter change out 3 calendar days prior to substantial completion. Specify additional filtration to protect equipment and ductwork during construction. Specify duct cleaning before final inspections. Provide a complete filter list and one full set of each size and type HVAC filters for owners use after substantial completion.

23 06 00 SCHEDULES FOR HVAC

- A. Selection of the building HVAC system must be made at the schematic design phase. The mechanical engineering design team must be actively involved in the project design prior to submission of the schematic design drawings and specifications so that the HVAC system selected will fit and function within the architectural scheme.
- B. The system selected shall be as simple in configuration and design as possible, yet durable to satisfy the building needs. It shall emphasize ease of maintenance activities and flexibility to accommodate future renovation. Evaluation and justification of sustainable system designs is encouraged.
- C. The design intent is to create a facility that meets LEED Silver requirements and **complies** with New Mexico Executive Order 2006-001. High SEER rating components shall be preferred.
- D. The design shall comply with latest accepted version of ASHRAE Standards unless a specific waiver is approved by NMSU.
 1. Note that unless otherwise agreed upon in writing, the NMSU standard is AHU's with VAV control, and Hydronic Hot and Chilled water coils. Economizer coils/heat reclaim coils are desired.
 2. For construction outside the distribution system (or in proximity of the Master Plan distribution), options will be evaluated individually. A life cycle cost analysis will be required.
 3. The second preference then becomes standalone chiller and industrial hot water boiler(s) depending on the projected size of the equipment. The design professional will generate the square foot heating and cooling calculations in the schematic design/preliminary design phase of project.
 4. Split systems, water source heat pumps, and/or Rooftop AHUs may be acceptable and approved by the NMSU Project Representative
 5. Electric reheat is not acceptable.
 6. Evaporative cooling design is allowed where high ventilation rates are required such as the Meat Processing rooms, weight lifting areas,

welding operations, or shop areas.

7. Chilled water and hydronic hot water pumps shall be frame mounted, end suction, split case, non-close coupled. Woods couplings are preferred.
8. Building chilled water delta Temperature preferred equal to 16 °F. NMSU Central Utility plant is typically consistently able to provide 42°F supply chilled water.
9. System pumps shall not be stacked. System pumps will designed with 100% redundancy and will utilize high-efficiency motors.

23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC (Refer to Division 25)

- A. Direct Digital Controls shall be employed.
- B. HVAC systems shall interface with campus EMCS (Energy Management and Control System)
- C. Variable volume laboratory designs shall be used.
- D. Chilled water and heating water pumps shall be equipped with VFDs.
- E. Heating water and discharge air temperature set points shall be based upon Outside Air (OA) temperature., optimized or fixed-temperature and must be selectable through the EMCS.
- F. Minimum OA intake reset shall be based upon ASHRAE 62.1.
- G. An unoccupied/occupied building schedule shall be provided.
- H. Building occupancy over-ride shall be provided at room temperature sensor.
- I. Provide utility metering of chilled water, steam, domestic water, natural gas in accordance with FS Utilities Metering Guidelines provided specific to the project during the design phase.
- J. Thermostat locations shall be specified to ensure even temperature distribution in the conditioned space.

23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

- A. All points included in the HVAC system shall be labeled in accordance with the NMSU Point Naming Convention, available from FS Operations. Contact NMSU Project Representative for the current version.

- B. This applies to all components of the HVAC system that are integrated with the control system including but not limited to air handlers, heat exchangers, fans, terminal units, dampers, thermostats, pumps and valves.
- C. This naming convention shall be reflected in all drawings, control sequences, programming, graphics and field labels.

23 09 13 23 SENSORS & TRANSMITTERS

All water temperature sensors shall be installed in wells in the proper size for the application.

23 09 13 43 CONTROL DAMPERS

CO₂ measurement and control shall comply with the latest accepted version of ASHRAEI 62.1 Standards.

23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

See controls information for HVAC in Division 25.

23 10 00 FACILITY FUEL SYSTEMS

23 21 00 HYDRONIC PIPING AND PUMPS

- A. Process cooling shall be isolated as necessary through the use of plate & frame heat exchanger interface with the campus distribution chilled water system.
- B. A reduced pressure backflow preventer shall be utilized to isolate building process systems from domestic water supplies.

23 21 13 ABOVEGROUND PIPING

23 21 13 23 ABOVEGROUND HYDRONIC PIPING

- A. Locate utility meters per manufactures installation requirements.
- B. Install isolation valves on each supply and return branch take-off.
- C. Install isolation valves at each item of equipment, coil, reheat VAV box, etc, which are separate from balancing and control valves.
- D. Install pipe unions for ease of equipment repair and replacement.
- E. Install drains at low points routed to nearest floor drain.

- F. Install vents at piping high points and at equipment.
- G. Pipe reheats and air handling coils rigid unless unit is supported by springs.
- H. Where used (primarily at pumps), use braided flexible stainless steel connectors (no rubber connectors). Include di-electric insulation gasket seals between dissimilar metals.
- I. Reverse return heating system piping preferred.
- J. Piping shall be of type “L” copper or at least schedule 40 steel.
- K. Use metal insulation jackets in exposed areas.
- L. Lace-up insulation or pre-formed plastic jacketing around all hot piping appurtenances such as steam pressure reducing valves, check valves, flanges, valves, etc.
- M. Label all utilities and flow directions. (Valves labeled with metal tag and beaded chain)

23 21 23 HYDRONIC PUMPS

- A. Dual heating water pumps shall be provided at 100% capacity each and shall be provided with VFDs.
- B. Chilled water pumps shall be provided at 100% capacity each and shall be provided with VFDs.

23 25 00 HVAC WATER TREATMENT

- A. Specify pipe testing, flushing, and treatment.
- B. Equipment must be included to allow addition of water treatment chemicals to all hydronic systems.
- C. Bypass chemical feeders shall incorporate full port isolation valves.

23 30 00 HVAC AIR DISTRIBUTION

- A. Base system design for typical variable air systems for classroom spaces, administrative spaces, and common spaces shall be single duct VAV system with hot water re-heat coils in terminal units. Electric reheat is not allowed.
- B. Alternative systems shall be studied where constant volume airflow is required such as in laboratory spaces. Economic evaluation shall be made of constant volume reheat and dual duct constant volume with separate fans on each deck.

- C. Return air duct/path design shall insure that the free open area required is not restricted. Return air design velocity through ceiling grilles shall not exceed 300 fpm of free open area. Return air design velocity through wall transfer openings shall not exceed 450 fpm of free open area.
- D. All exhaust ducts shall be under negative pressure inside buildings.
- E. Design velocity for general exhaust ducts shall not exceed 1500 fpm except as required for special systems. Special exhaust systems shall be designed in accordance with Industrial Ventilation guidelines.
- F. Variable flow systems with variable frequency drives shall be used wherever possible.

23 31 00 HVAC DUCTS AND CASINGS

- A. The maximum velocity for medium pressure supply duct shall not exceed 2,500 fpm
- B. The maximum pressure drop for low pressure supply duct shall not exceed 0.07" w.c./100 ft.

23 31 13 METAL DUCTS

No spin-in duct take-offs. Use conical or 45° flare fitting

23 32 00 AIR PLENUMS AND CHASES

- A. Vertical duct shafts shall be accessible from each floor, and be provided with an additional 25% area for future construction.
- B. Return air paths and grille shall be sized adequately

23 33 33 DAMPERS

23 33 33 16 FIRE DAMPERS PER NFPA

Fire/Smoke Dampers (FSD)

- A. FSDs will be operated by a duct type smoke detector/tube device. Fusible links will NOT be acceptable unless access doors are provided
- B. All FSDs will be tied into the building fire alarm system as addressable nodes.
- C. Smoke/fire dampers between different occupancies.

- D. Ducts entering or leaving electrical & IT equipment rooms will require a FSD.
- E. All FSD will incorporate access doors for inspection. The access doors will:
 - 1. Be of fire rated construction when penetrating a fire rated wall.
 - 2. Be rated for smoke seal when penetrating a fire/smoke rated wall.
 - 3. Have ceiling access doors measuring a minimum of 24"x 24" for inspection access labeled "fire/smoke damper" on the outside of the access door and/or the access tile or ceiling area as appropriate and determined by SRS.
 - 4. Incorporate smoke detection activation on both sides of the damper.
 - 5. Duct access panels shall be tightly sealed with a mechanical latching mechanism. Designer to locate for duct cleaning and inspection. Clearly label access panels below ceiling, in corridors, and at device.

23 33 46 FLEXIBLE DUCTS

- A. Flexible ductwork shall be limited to 90° of bends and a length of 8 feet
- B. Use rigid ductwork elbow at diffusers
- C. No flexible ductwork on high pressure side of terminal

23 33 53 DUCT LINER

No internal acoustical duct lining shall be used in any supply air system.

23 34 00 HVAC FANS

- A. Fan speed shall be less than 1750 rpm
- B. Supply fan external static pressure less than 3" w.c. Static pressure shall be controlled by a VFD. Must be verified with test and balance.
- C. Exhaust fan static pressure shall be adequate for hood and fan discharge requirements. Static pressure shall be controlled by a VFD.
- D. Must be verified with test and balance.

23 36 00 AIR TERMINAL UNITS

- A. Balancing damper at branch take-off on low pressure side of terminal box
- B. Ensure proper access to terminal boxes

- C. Ensure that electrical, computer & telecom rooms have proper ventilation and cooling.
- D. Zoning of terminal units shall be laid out such that interior and exterior zones are supplied separately.

23 36 16 VARIABLE-AIR-VOLUME UNITS

- A. Three duct diameters straight length of rigid ductwork shall be installed on the supply to VAV boxes
- B. Appropriate VAV minimum airflow settings shall be provided to minimize energy consumption.

23 38 00 VENTILATION HOODS

- A. Chemical Fume Hoods shall be designed to meet NMSU air flow requirements. Face velocity across sash shall be 100 fpm at the working height. Hoods must pass this acceptance/requirement to meet air balance acceptance at project close out. (Note: NMSU EH&S personnel check all hoods periodically to ensure they are operating from 80 to 150 fpm)
- B. Low Volume hoods are preferred (Kewaunee model H50 or equal) – Dynamic Barrier by-pass
- C. Submit 2 copies of written instructions for fume hoods
- D. Constant volume chemical fume hoods must be capable of maintaining 100 fpm minimum face velocity through the sash opening with the sash door at 13 inches, measured from the top of the airfoil, or 14” above work surface if airfoil in not present.
- E. Variable air volume chemical fume hoods shall be capable of maintaining 100 fpm at all sash heights below 18 inches as measured from the work surface.
- F. Floor Mounted (walk-in) fume hoods – HVAC Design Engineer shall consult EH&S and NMSU Engineering for minimum face velocity at specified sash position(s).
- G. Provide facility’s ventilation system with adequate heating and air conditioning so that room air and auxiliary air temperatures can be maintained within the desired ranges.
- H. No return air from laboratory spaces.
- I. No positive exhaust ductwork inside building.

- J. Avoid filters in exhaust ductwork.
- K. Fume exhaust fan up blast discharge velocity 3,000 fpm minimum.
- L. Exhaust valve shall be interlock to sash position feedback and also be integrated into the BAS via BACnet protocol.

23 57 16 STEAM-TO-WATER HEAT EXCHANGERS

- A. All steam-to-water heat exchangers shall be of the tube-and-shell steam converter type.
- B. Control of converters shall be resettable through the DDC system and each converter shall be supplied with 1/3rd and 2/3rd DDC control valves on the steam supply.
- C. Each converter shall be supplied with a vacuum breaker on the steam lines downstream of the control valves.
- D. Pressure relief valve discharge piping shall be routed to ensure the protection of personnel in the mechanical room (e.g., no discharge to a sump or drain in a small mechanical room).

23 70 00 CENTRAL HVAC EQUIPMENT

- A. O.A. (Outside Air) intakes shall be located so they are not in close proximity to streets, loading dock, exhausts, food service exhaust, fume hoods, and mansard situations that has the potential of creating a circular vortex. West facing areas are subject to extreme dust and dirt therefore discuss with the NMSU Project Representative during design.
- B. O.A. duct shall be long enough to pre-heat outside air to assist in avoiding freezing temperatures being introduced over coils.
- C. Install O.A. metering device that is accurate to the minimum specified O.A. required of the project.

23 72 00 AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

Heat recovery systems shall be considered when economically justified. Energy balance calculations shall be provided as part of the justification.

23 73 00 INDOOR CENTRAL-STATION AIR-HANDLING UNITS

- A. Air Handling Units (AHUs) must be enclosed in an equipment room with enough clearance to allow for coil removal.
- B. Air handling unit chilled water coils shall be selected for optimal, multi-

seasonal discharge air temperature at airflow of no more than 400 fpm. Coils shall be selected at 20°F water temperature rise.

- C. Cooling coils shall use 2-way energy valves selected with a differential pressure shut-off rating of 50 psig. minimum.
- D. Chilled water coils shall be 6 rows maximum. If conditions require greater coil capacity, two coils in series shall be used to achieve required duty, and shall be placed a minimum of 30 inches apart (with access between) to allow coil cleaning.
- E. AHUs shall be selected to require no more than 10 bhp per 10,000 CFM inclusive of both return and supply fans. This power requirement shall be at mid-life filter pressure drops.
- F. AHUs shall be selected to not require sound attenuators inside the unit.

23 76 00 EVAPORATIVE AIR-COOLING EQUIPMENT

- A. Evaporative cooling shall be used only for spaces requiring considerable amounts of Outside air (i.e. large open areas, large amount of make-up air)
- B. Do not mix evaporative cooling with conditioned refrigerant air.

23 81 00 DECENTRALIZED UNITARY HVAC EQUIPMENT

23 81 23 COMPUTER-ROOM-AIR-CONDITIONERS

- A. Electronics rooms (computer rooms, electrical rooms, telecom rooms and similar spaces) shall be properly conditioned. Below floor laminar flow to cabinets is preferred in new construction where practical.
- B. All electronics rooms with the exception of small Telecom closets shall be equipped with humidifiers to maintain a minimum of 30% relative humidity in the space.
 - 1. The upper limit is 50% relative humidity. In the NM climate, dehumidification beyond the amount already obtained from a DX or CHW cooling coil is not necessary.
 - 2. Water quality (hardness, conductivity, etc.) supplied to the humidifier shall be in full accordance with the humidifier manufacturer's requirements.
 - 3. Humidifiers shall be placed outside of the electronics room, and shall be located where they can be easily accessed for maintenance.

- C. Electronics rooms shall be equipped with standalone dedicated cooling systems that are independent of the central air handler(s).
1. In all cases, an in-room thermostat shall be used to control the system and the system shall be integrated with the building DDC system.
 2. If there is no DDC system in the building, the electronics room shall be controlled by local programmable controls.
3. System shall be a DX split system shall be installed.
- a. These systems shall be variable load to run reliably and efficiently at all load levels from 20% to 100% of the electronics room's full-build-out capacity.
 - b. These systems shall be the most efficient units available.
 - c. If the electronics room is small enough that ductless units are used, they shall be mounted immediately below the ceiling.
 - d. If ducted units are to be used, supply air shall be distributed within the electronics room to the back of the telecom equipment racks.
 - e. NMSU Project Representative and NMSU ICT must both approve the layout at each stage of design.
 - f. Units requiring condensate pans with gravity drain drips to be installed outside of the computer room and must incorporate high level limit switch per current code requirement.
 - g. If the space pressurization is required, make-up air must be integral to the DX unit.
- D. Large server rooms shall be equipped with standalone dedicated cooling systems that are independent of the central air handler(s).
1. A dedicated air handler to be installed outside of the computer room.
 2. Where CHW is available, a CHW coil shall be used as the primary cooling, and DX coil with air cooled condensing unit for emergency backup. In areas without CHW availability, air cooled condensing equipment will be utilized.
 3. The NMSU Project Representative and ICT must both approve the layout at each stage of design.
 4. Supply air shall be distributed within the electronics room to the equipment racks and a cold/hot aisle concept shall be used.

5. Provide BAS and local monitoring, with alarms, for shutdown interface, must be provided to avoid saturation of the space in the event of a water leak or over humidification . A supplemental high humidity safety switch is required via a duct humidistat with user adjustable set point.
6. Units requiring condensate pans with gravity drain drips to be installed outside of the computer room and must incorporate high level limit switch per current code requirement.
7. All piping must be routed to eliminate exposure within the server room.

An in-room thermostat shall be used to control the system and the system shall be integrated with the building DDC system.

8. If the space pressurization is required, make-up air must be integral to the unit serving the space.

23 84 13 HUMIDIFIERS

- A. Avoid the use of humidifiers except where essential for programming requirements.
- B. Provide the appropriate length and size of stainless steel duct, with integral catch basin and drain, immediately downstream of the humidification injection point. The drain must be piped to the nearest floor sink or floor drain.
- C. The standard for humidifiers is an electrode steam humidifier. The humidifier must interface to the BAS allowing for remote monitoring and control. The humidifier BAS interface must provide an overview of the system to include rapid and early operating response.

END OF DIVISION 23

DIVISION 25 –INTEGRATED AUTOMATION – BUILDING CONTROLS

25 10 00 INTEGRATED AUTOMATION NETWORK EQUIPMENT

PART 1 - GENERAL

1.1 OVERVIEW

- A. This Section describes the desired elements for development of the BACNET Protocol Building Automation System (BAS) at New Mexico State University.
- B. At the building level, the BAS system architecture utilizes intelligent distributed control modules located in each building which communicate using BACnet/IP (preferred) over Ethernet or BACnet MS/TP over EIA-485 Local Building Automation Networks. A given building commonly contains several such Local Building Automation Networks. A typical single network might serve all the terminal units on a single floor of the building. Another typical network might serve the various pumps, valves, VFDs, etc., making up the central mechanical system of a building.
- C. The Local Building Automation Networks communicate with each other and NMSU central monitoring and control system primarily through NMSU- provided Tridium Niagara AX Network Area Controllers (NAC) on NMSU Building Automation Network. These are BACnet Building Controller (B-BC) devices which provide standard BACnet router and BBMD functions as well as BACnet/IP and MS/TP (master) connectivity. They also provide connectivity to the NMSU central monitoring and control system. (The PICS information for these devices is available upon request to FS Operations). All Local Building Automation Networks must be designed, configured, and installed for successful operation in this environment. The Local Building Automation networks are private networks internal to NMSU and are not accessible for remote connections. All activities which require network connections (including but not limited to commissioning or maintenance) must be accomplished by the use of direct on-site physical connections. Any contractor or vendor equipment to be used on these networks must be registered in advance with FS Operations.
- D. All NMSU user interface and Operator Workstation capabilities are provided by NMSU as part of its central monitoring and control system.
- E. The equipment connected on each Local Building Automation Network shall be designed, configured, and installed so as to maintain stable and safe operation of the equipment in the event of any failure of network communication with any other Local Building Automation Network or NMSU central system. If it is necessary that data be exchanged between equipment on different Local Building Automation Networks, even while

normal network connections through the controls contractor BAS Network Area Controller (NAC) are disrupted, then such interconnections shall be accomplished using hard-wired I/O points.

- F. All installed equipment must be fully compliant with ANSI/ASHRAE Standard 135-2004 (BACnet) and all published addenda at the time of installation. No protocol gateways, non-compliant or proprietary equipment, or communication techniques of any kind are to be used on the Local Building Automation Networks without prior approval from FS Energy Management shop.

1.2 RELATED DIVISIONS AND SECTIONS

- A. See Division 25 30 00 for field devices.
- B. Other related divisions and sections as applicable to the project as determined by the Design Firm. Additional references should include electrical, test and balance, submittal requirements, valves, sheet metal products, and commissioning, as applicable.

1.3 SCOPE

- A. It is the intent of this Section to describe elements necessary to provide, install, connect, program, and calibrate the additions and/or modifications to the BAS as necessary to provide fully automatic control for all systems as shown in the Control Drawings, stated in the sequences of operation, indicated in the electrical ladder diagrams, or as otherwise required by the Contract Documents. Some equipment controls are specified to be provided in other portions of the Contract Documents, including NMSU-furnished equipment. Work related to this Section must be coordinated by the Contractor with other suppliers and trades to provide a complete and fully functional BAS.
- B. Appropriate engineering, installation supervision, programming, calibration, startup, test and balance, and checkout necessary for a complete and fully operational BAS, shall be provided as part of the work scope by the Contractor with no dependency on NMSU Niagara system. Any request for Niagara component dependency must have prior approval from FS Energy Management.

1.4 SUPPLIER AND EQUIPMENT REQUIREMENTS

BAS Supplier will be the authorized factory representative or branch office of the product manufacturer proposed. All software and hardware products shall be BACnet compatible to the level specified.

NMSU Approved Brand Name Equipment (to be) Specified:

- Automated Control Systems (Alerton)** – Albuquerque, NM
- Control and Equipment Co. (Schneider Invensys)** El Paso, TX
- PC Automated Controls (Automated Logic)-** El Paso, TX
- Trane (Trane)** – El Paso, TX
- Energy Control Inc. (Delta)** – Las Cruces, NM
- GEW Mechanical (Reliable)-** Albuquerque, NM
- NSW Controls (Reliable)** – Albuquerque, NM
- Johnson Controls (Johnson Controls)** – Albuquerque, NM
- ThermAir (Distech)** Mesa, AZ

1.5 SUBMITTALS

- A. One set of electronic Shop Drawings and Submittal Data shall be submitted in accordance with the General Contract Requirements. These are usually submitted within 30 days of Contract award.

- B. Submittals shall consist of Shop Drawings, Catalog Data Sheets, Graphic Displays, and Software Development parameters as defined in the following paragraphs. No materials shall be purchased and no work shall be conducted at the job site until submittals have been reviewed and approved by FS Operations.
 - 1. Shop Drawings shall be provided which show detailed communications architectures (including the existing communication network), control devices, electrical ladder diagrams, control system schematics, Protocol Implementation Conformance Statements (PICS), sequences of operation, point lists, and a material list. All systems and the associated control components as well as all connections between components shall be clearly indicated. The submittal shall indicate the required coordination with all other equipment. The intent is for Shop Drawings to be comprehensive enough for the installation crew to complete all aspects of the installation without the need for supporting documentation, except third-party equipment installation manuals. All wiring shown on the Drawings shall be labeled on both ends and these labels shall be used in the installation process for ease of comparing the Shop Drawings to the actual field installation. Each control component shall be given a unique identifier. This identifier shall be used in creating equipment field device labels and in the Sequence of Operation so that reference to the Drawings can be easily made.
 - a. Electrical Ladder Diagrams shall be shown on the Shop Drawings. Electrical Ladder Diagrams shall show the specific details of all switches, relays, motor starters, etc. The Electrical Ladder Diagrams shall show the correct control wiring and interlock wiring of all equipment provided under the Contract. Each diagram shall reference the correct power

source by breaker panel and circuit number.

- b. The Sequence of Operation for each controlled system shall be provided with reference to the actual control device identifiers. The Sequence of Operation shall break down the control operation by function (e.g., mixed air control, occupied/unoccupied, smoke purge, etc.) and describe in detail the correct operation and interaction with other system functions.
 - c. A complete Material List shall be included on the Shop Drawings which show the device model numbers, control device identifiers, quantities, manufacturers, etc., of all equipment provided under this Section. The Material List shall be organized in alphabetical order so that it can be easily compared to the associated Catalog Data Sheets.
2. Catalog Data Sheets will be provided for each different piece of equipment provided. At a minimum, the Data Sheet shall contain sufficient information so that compliance with the design intent can be verified. Where multiple models or options are indicated on the same Catalog Data Sheet, the equipment proposed shall be highlighted or otherwise indicated. The Catalog Data Sheets shall be organized in alphabetical order to match the Material List on the Shop Drawings.
 3. Point Verification forms shall be submitted for all points that will be installed as part of the BAS. Once approved, the Contractor shall complete the forms during startup to document successful point functionality. The completed forms shall be included as part of the record documentation. NMSU reserves the right to designate a representative to monitor completion of the Point Verification.
 4. An Interface Specification shall be submitted as a Microsoft Excel spreadsheet describing each Local Building Automation Network including its BACnet network number, the complete list of devices to be placed on each such network, the BACnet Device Object instance number for each device, the BACnet object names and identifiers to be used within each device including identification of those objects for which commissioning trend logs will be provided, the MAC addresses of MS/TP devices, and all BACnet object cross-references between the devices on the complete set of Local Building Automation Networks (a sample spreadsheet in the required format can be obtained from NMSU Project Representative). The BACnet network numbers and Device Object instance numbers must be selected from ranges requested by the Contractor from NMSU Project Representative. The object names must have a <facility>.<system>.<point> structure such as “WELLS.AHU_1.CWS_TEMP”. The Interface Specification must be accompanied by a Microsoft Word or Adobe PDF document presenting the Protocol Implementation Conformance Statements (PICS) for all devices to be provided. No automation devices are to be installed prior to approval of the Interface Specification’s complete contents by NMSU Project Representative. The Interface Specification

must include the MAC address for each Ethernet device. NMSU Project Representative will then provide the IP address to be used by each of these devices.

5. All Graphic Slides proposed for use shall be submitted to NMSU Project Representative for review and approval. The submitted slides shall be printed in color. All real-time display fields, user input fields, etc., shall be clearly indicated.
6. Software Development parameters including all trend logs, reports, point alarm parameters, passwords, and scheduling shall be submitted as described here. The information contained in the submittal will be followed during development of the programming code and shall be used for evaluation of the system's performance during the commissioning phase by utilizing the controls contractor design computer application.
 - a. Report templates shall indicate what information will be presented on each report, how the information will be presented, report hard disk upload parameters, and report log file names.
 - b. NMSU FS Energy Management personnel shall have user accounts within the contractors design engineering application for purpose of reviewing point names, equipment sequences, graphics and network architecture. .
 - c. NMSU will provide blank schedule forms for each air handling unit for completion and submittal by the contractor for review and acceptance by FS Energy Management. Additionally FS Energy Management will identify schedule groups of HVAC equipment.
7. The controls contractor will provide personnel names, phone numbers, e-mail addresses, job descriptions, , mobile phone numbers, etc., will be provided for position titled project manager, project engineer, project programmer(s), installation foreman, and any other individuals key to the completion of this project. If at any time during the project the assignment of personnel changes, NMSU shall be notified and the previously listed information will be updated for the newly assigned individuals.

1.6 RECORD DRAWINGS

- A. Record Drawings shall be provided as required by the general Contract Requirements. Record Drawings will be started and updated through out the construction period and completed upon the contracts substantial completion date. Any changes made during installation shall be recorded on the Contractor's master record drawings as the changes are made so that a current Record Drawing is constantly being updated. These As-built Drawings shall be available at all times for inspection by NMSU, or NMSU Project Representative.

- B. The Contractor shall furnish a complete spare parts lists, operating instructions, maintenance literature, and completed point verification forms.
- C. At completion of the Project, all hand-drawn field changes shall be incorporated into an AutoCAD version of As-built Drawings.
- D. Non-drawing project data shall be provided electronically as Microsoft Office documents. These As- built Drawings shall be used during the training sessions.
- E. Upon final occupancy , the Contractor will deliver to NMSU all project-specific design control software programs in an usable electronic format acceptable to NMSU. The contractor will deliver a final set of all project-specific design control software programs reflecting all updated and final settings. NMSU will use this control software to program, configure, install, commission, expand, or maintain any element or aspect of the installed system. All software packages must be permanently licensed in the name of NMSU and include full no-added-charge support by the manufacturer for the duration of the project warranty period.

1.7 EQUIPMENT START-UP

- A. During the initial startup phase of the project, the BAS Supplier shall permit NMSU's operating personnel to be involved with the troubleshooting, initial startup, point verification testing, and performance trending

1.8 SYSTEM TESTING

- A. At the termination of the point verification process, the Contractor shall submit completed and approved Point Verification as-built forms for each point.
- B. Upon successful completion of all Point Verification testing, the Contractor shall submit hard copies of the Trend Logs called out in the approved Interface Specification (see section 1.5. B. 4.). The Trend Logs shall trend at least 48 hours of normal uninterrupted operation (non-weekend or holiday) for the purpose of documenting proper implementation of the control sequences of operation.
- C. NMSU reserves the right to participate in, or assign a representative to participate in, the startup, testing, programming, or any other aspect of the construction of this project. Contractor to provide notice of any or all phases listed above to the NMSU Project Representative no less than fourteen calendar days prior to the event.

1.9 TRAINING

- A. Required training shall be provided by the Contractor as specified in the Contract documents. The duration of each phase of training shall be appropriate for the scope of the project.
- B. Prior to the final system trending, the Contractor shall provide training for NMSU-designated operating personnel. The training shall cover all general aspects of the BAS system installation, wiring, calibration techniques, programming, troubleshooting, etc. The training shall provide the same structure and depth as that provided to factory-authorized representative's installation and programming personnel. This training shall be conducted on site and shall focus on the specifics of the project. A complete training booklet shall be provided and used during the training period. The booklet shall include the As-built Drawings.
- C. The BAS Supplier shall provide additional on-site training during the warranty period, at no additional cost to NMSU. The Contractor shall provide this training at the request of the NMSU. NMSU will give at least one-week notice of the need for additional training. Warranty and service time shall not constitute training hours.

1.10 SERVICE AND WARRANTY

- A. The system supplier shall maintain a maintenance support facility complete with system technicians, diagnostic and test equipment. Emergency service shall be available in the local office on a 24-hour, 7-day a week basis. The service agent shall provide a continuously monitored local service telephone number for emergency service.
- B. If the manufacturer's material, equipment, or hardware has a standard warranty that exceeds the specified requirement then the longer manufacturer's warranty shall be provided. Warranty shall be for all materials and labor provided as the Scope of Work of this Section.
- C. During the warranty period, include 24-hour-per-day, 7-day-per-week, call back service for any situation as defined by the NMSU Project Representative. Callback service will require a response time of 48 hours.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products shall be selected in accordance with Part 2 of this Section. Installation of the components shall be in accordance with Part 3 of this Section.
- B. Also see section 25 30 00 for field devices.

2.2 NETWORKING/COMMUNICATIONS

A. Campus Networks

1. NMSU's Building Automation Network shall be used for access to the Local Building Automation Networks and the NMSU central monitoring and control system.
2. The Building Automation Network and the Campus Local Area Network shall be extended as required by the Contract drawings and specifications.

B. Local Building Automation Networks

1. All BACnet controllers shall reside on a Local Building Automation Network. NMSU's Network Area Controllers are used for monitoring and interacting with the Local Building Automation Networks, and between the Local Building Automation Networks and the NMSU central monitoring and control system.
2. All devices that reside on a Local Building Automation Network shall communicate in native BACnet. Proprietary protocols will not be permitted.
3. NMSU's preference is that no more than 35 BACnet devices shall be placed on a single Local Building Automation Network. Approval will not be given for more than 60 BACnet devices on a single Local Building Automation Network network.

2.3 BACnet COMPATIBILITY

- ### **A. All controller devices supplied to meet the functional and operational requirements shall conform, at a minimum, to one of the BACnet device profiles contained in BACnet, Annex L:**
1. BACnet Building Controller (B-BC), or
 2. BACnet Advanced Application Controller (B-AAC) or
 3. BACnet Application Specific Controller (B-ASC).
- ### **B. The interoperability requirements of such devices are contained in Annex L of the BACnet standard. B-BC controller devices shall communicate using BACnet/IP. BACnet/IP is also preferred for other devices, but BACnet over MS/TP at 78.4 Kbps is acceptable. ARCNET at 156 Kbps is acceptable but only when accessed via a BACnet/IP router. No other protocols or techniques are acceptable.**

2.4 INPUT/OUTPUT AND INTERLOCK WIRING

A. Class I Circuits

1. All materials required for installation of Class I circuits or circuits operating at greater than 48 VAC or VDC shall meet the requirements stated in Division 26, National Electric Code, and all applicable building codes as they apply to Class I circuits.

B. Class II Circuits

1. All materials required for installation of Class II circuits shall meet all requirements of the National Electric Code and all applicable building codes as they apply to Class II circuits.
2. All cables shall be run in dedicated conduit no smaller than 3/4" or a metallic raceway, and shall contain conductors per the manufacturer's recommendation for the application. The number of conductors shall be as required by the application and an overall foil shield with stranded drainwire shall be provided in all cases. The cable shall be factory stamped with a clear indication of the cable classification. The cable jacket shall be PVC. Metallic raceway and conduit shall be as specified in Division 26.
3. Local Building Automation Network cables shall be in dedicated conduit containing no other signal or power wiring.

PART 3 - EXECUTION

3.1 GENERAL

- A. All field hardware, control devices, conduit, wiring, etc., shall be provided as specified in Part 2 of this section and in section 25 30 00 Field Devices.
 1. The installation of all aspects of the system shall comply with all applicable codes, regulations, and all related Contract Documents.
 2. The installation of all materials shall be in accordance with the published manufacturer recommendations.
 3. Where miscellaneous materials are required to complete an installation, i.e., isolation valves for pressure switches, wall switches for an exhaust fan control circuit, etc., the materials shall be supplied as defined in the relevant sections of these Guidelines.
 4. Coordinate with other trades where installation of a particular component requires other trades to be involved. Installation coordination includes location of the correct placement of thermowells, flow switches, dampers, control valves, control power circuits, etc. Care must be exercised to

identify locations that meet the requirements of the manufacturer including upstream and downstream distances, pressures, temperatures, etc.

5. All signal wiring requiring shielding shall have the shield terminated at the controller end only.
 6. Label all wiring with permanent labels indicating the point device identifier. Install a phenolic label mounted at the device indicating the device type and point identifier name.
 7. All field devices shall be labeled with 1" x 3" phenolic labels. Labels shall include the point name and device name. Labels for BAS controllers shall indicate the breaker and panel number of the power source. Labels shall be glued, attached with screws, or factory attached labels in the case of valves and actuators.
 8. On each terminal unit and fan control unit, provide an adhesive label showing the unit identification of the device exactly as it appears on the construction drawings. The label shall be approximately three inches high by five inches wide, with the identification characters approximately one inch high. The characters shall be printed in black on an orange background. The label shall be placed on the unit at a location easily observable by maintenance personnel.
- B. All software development shall be completed by BAS programmers that have been factory trained in programming and graphic development techniques of the BAS.

3.2 NETWORKING/COMMUNICATION

A. General

1. All LANs shall strictly be installed in a manner recommended by the manufacturer and in accordance with NMSU ICT network standards based on the environment, communications speed requirements, and distance. All LAN media shall be installed in a manner that provides protection from physical damage and interference from RF or other electrical sources. Campus Networks

B. Campus Networks

1. All media required to connect Operator Workstations or Network Area Controllers to NMSU's networks shall be installed with materials and procedures that comply with the requirements of NMSU ICT network standards and the BAS equipment manufacturer. [See Division 27].

C. Local Building Automation Networks

2. The Local Building Automation Networks shall be installed with materials and procedures in strict compliance with the requirements of the BAS equipment manufacturer.

3.3 BACnet COMPATIBILITY AND OBJECT REQUIREMENTS

- A. All BAS software shall be developed in accordance with the approved PICS for the device. See Part 1 of this Section.
- B. The Out_Of_Service property shall be writable using BACnet services for all Analog, Binary, Multi-state, Loop, and Program objects.
- C. All Analog (Input, Output, and Value), Loop, and Multi-state (Input, Output, and Value) objects shall have the capability of using the Change of Value reporting mechanism and the COV_Increment shall be writable using BACnet services.
- D. PID loops shall be represented by Loop objects, with writable tuning constant properties.

3.4 BAS CONTROLLERS

A. General

1. New controllers will be installed where required or indicated on the Drawings. However, in no case shall more than 90% of the maximum attached potential node limitations be designed, nor shall more than 75% of the controller RAM be utilized by the programming code specified herein, including trending, and global programming. If these limits are met, additional controllers or RAM must be added.
2. All controllers shall be installed in accordance with manufacturer's instructions. Electrical power shall be provided to each device at the appropriate voltage and frequency. All power shall be verified prior to powering the controllers.
3. All BAS controllers shall be installed in a NEMA rated enclosure appropriate to the environment in which it will be installed that provides protection from the environment and is adequately ventilated to protect against excessive temperature exposure. If located outdoors or in mechanical rooms or similar harsh environments all penetrations of the enclosure shall be made through the bottom of the enclosure and not the top or sides.

B. Communications

1. All devices shall be installed and connected to Local Building Automation Network in a manner recommended by the manufacturer based on the

environment, communications speed requirements, and distance.

C. Input/Output

1. All BAS field control components and the associated I/O wiring back to the respective controller will be installed and each point shall be checked by the Contractor for voltage, short circuit, etc., prior to termination to the controller to prevent any damage to the controller.

D. Software Requirements

1. All Sequences of Operation as stated in the Contract Documents are to be implemented.

E. Alarms

1. Alarms shall be provided as stated in the Contract Documents.
2. Alarms shall be suppressed when equipment has been intentionally forced to an inoperative status (e.g., night setbacks).

F. Minimum Runtimes

1. All digital output points shall have a minimum runtime as stated in the Contract Documents Sequence or Operations, otherwise as appropriate to the application, to prevent unintentional short cycling of the equipment.

G. Trend Analysis

1. The system shall be configured to trend those system points stated in the Contract Documents. Date and time stamps shall accompany all trend data. The initial interval for all trend logs shall be configured to be 15 minutes.

3.5 INPUT/OUTPUT AND INTERLOCK WIRING

- A. See Part 2 of this Section.

3.6 EQUIPMENT CONNECTIONS

- A. BAS Class II field wiring for all non-control device applications shall be installed by the Contractor. This includes equipment such as VFDs, chillers, boilers, etc., which may have point types including status or alarm monitored from an equipment supplier Class C contact or analog control signals to equipment, etc.

25 30 00 INTEGRATED AUTOMATION INSTRUMENTATION & TERMINAL DEVICES

PART 1 - GENERAL

1.1 RELATED DIVISIONS AND SECTIONS

- A. See Section 25 10 00 for environmental management system.
- B. Other related divisions and sections as applicable to the project as determined by the Design Firm. Additional references should include electrical, test and balance, submittal requirements, valves, sheet metal products, and commissioning, as applicable.

1.2 SCOPE

It is the intent of this Section to describe the field devices necessary to provide fully automatic control for all systems as shown in the Control Drawings, stated in the sequences of operation, indicated in the electrical ladder diagrams, or as otherwise required by the Contract Documents. Some equipment controls are specified to be provided in other portions of the Contract Documents, including NMSU-furnished equipment. The Contractor shall coordinate with these other suppliers and trades to provide a complete and fully functional EMS.

1.3 SUBMITTALS

- A. See Section 25 10 00.

1.4 RECORD DRAWINGS

- A. See Section 25 10 00.

1.5 SYSTEM TESTING

- A. See Section 25 10 00.

1.6 TRAINING

- A. See Section 25 10 00.

1.7 SERVICE AND WARRANTY

- A. See Section 25 10 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Preferred brand names:
 - 1. Variable Frequency Drives (VFDs) shall be manufactured by ABB, or equal. The drives shall be located in the Electrical or Mechanical room

close to the equipment. Equipment on VFDs that is identified as critical to maintain operational if the VFD fails shall have bypasses. This equipment is to be identified with the owner (NMSU F&S). Equipment with bypasses must be capable of full speed operation, i.e. if bypass is provided the ductwork must be designed for 100% of fan volume, so not to over pressurize the duct.

2. Steam Control Valves shall be manufactured by Siemens Building Technologies, Inc., or equal. Steam valve actuators must be rated to operate under high temperature conditions with a mean temperature operating range of approximately 250 deg F (Siemens SDK electro-hydraulic type actuator or approved equal).

1.2 FIELD DEVICES

- A. All devices and equipment shall comply with all applicable local code requirements.
 1. Temperature Sensors - with accuracy of + .5°F @ 77°F).
 2. Humidity Sensors - Duct Sensor with accuracy of + 3% RH @ 77°F, range of 10% to 90% RH, including hysteresis, linearity, and repeatability. Room Sensor 5% RH @ 77°F, range of 0% to 100% RH.
 3. Pressure Sensors – sized as needed for best accuracy.
 4. Dampers- sized for specific application.
 5. Damper Operators- sized for specific application.
 6. Automatic Control Valves- sized for specific application (provide separate Valve Schedule). All valves must be installed with plastic engraved name tags to match Valve Schedule. Attach with stainless chain. Sequence staging shall be provided via the DDC system. Control valves over ½” shall be provided with a means to manually position the valve.
 7. Low Temperature Detection Stat – Manual reset. Must be hard-wired to motor control center or VFD with a second contact for DDC alarm generation.
 8. All field mounted valves- damper actuators, and sensors must have plastic engraved type nameplates attached by stainless braid or other permanent type attachment. ID tag shall identify the device as shown on submittal drawings. Dymo type labels shall not be acceptable.
 9. Field devices such as relays shall be located in each equipment’s respective control panel. Wall mounted devices are not acceptable. All field control panels containing devices shall be equipped with a hinged,. Each panel, and all devices inside each panel, shall bear engraved identifications as shown

on submittal drawings. Do not attach nameplates to devices, rather attach to mounting back plane. All devices shall be wired through a wiring terminal strip located within the panel. Each terminal shall be identified to match submittal drawings.

B. Sensors.

1. General: Temperature sensors for duct, immersion, remote probe, and outside air applications.
 - a. Sensor time constant response to temperature change time shall be less than 3 seconds per degree change. Sensors requiring field-calibration shall not be acceptable. All sensors shall be precise and accurate so that they do not require adjustments or calibrations. Linearizing, ranging, and resistance change versus temperature curve interpretations, where required, shall be made by software programming.
 - b. Minimum sensor operating ranges shall be as follows:
 - 1) Chilled Water 30°F to 100°F.
 - 2) Condenser Water 30°F to 150°F.
 - 3) Air Systems 0°F to 150°F.
 - 4) Outside Air 0°F to 120°F.
 - 5) Hot Water 40°F to 240°F
 - c. Sensor accuracy shall be $\pm 0.1\%$ at 32°F for platinum and nickel sensors and $\pm 0.4^\circ\text{F}$ for thermistor sensors. Sensor to controlling device end to overall system accuracy, including errors associated with the sensor, lead wire and analog to digital conversion shall be $\pm 0.5^\circ\text{F}$ for platinum and nickel sensors and $\pm 1^\circ\text{F}$ for thermistor sensors.
2. Duct Sensors: Flanged or threaded probe type sensors designed for duct type mounting shall be used. Sensor shall be encapsulated in an aluminum probe and extend 25% into the widest cross sectional duct area except where averaging sensors are specified. Sensors shall include a suitable junction box for terminating sensor wiring and shall include a lagging protrusion where installed in externally insulated ducts. Adjacent to each sensor provide a test hole plugged with a removable cap or plug to be used for test and calibration purposes. All sensors shall be located in the most easily accessible location while providing accurate sampling. The air side sensors need to be in the dependable section of the air path. The device shall dampen the reading and the response.
3. Immersion Sensors: Immersion type sensors with a 1/2" OD threaded fitting for direct installation in a thermo well shall be used. The probe shall be encapsulated in an aluminum, brass or stainless steel jacket and shall be

installed in a stainless steel thermowell suitable for installation in a 3/4" NPT threaded fitting. Sensors shall include a suitable junction box for terminating sensor wiring. Thermowells shall have pressure and temperature ratings suitable for their application and to be installed by manufactures recommendations. Wells for insulated piping shall have a 2-1/2" lagging protrusion. Locate wells so the sensing probe will give a true and correct reading. Install wells on the sides of pipes and so as not to cause undue restriction in small piping. Where wells are located in pipe lines 1-1/2" and smaller, provide a section of pipe of such diameter that the net area of the pipe line will not be reduced by the thermometer well. All wells shall be filled with silicon and complete with caps and chains. . Temperature probes and wells shall have the following insertion lengths.

<u>Pipe Diameter</u>	<u>Orientation</u>	<u>Insertion Length</u>
4"	Horizontal	2-1/2"
4", 6"	Vertical	4-1/2"
6", 8"	Horizontal	4-1/2"
8", 10"	Vertical	6-1/2"
>8"	Horizontal	6-1/2"
10"	Vertical	10"

4. Remote Probe Sensors: Remote probe sensors with sensing elements encapsulated in a nominal 2" stainless steel sheath suitable for return air or strap-on mounting shall be used. Sensors shall include a nominal 3' lead section and a suitable junction box for terminating sensor wiring.
5. Outside Air Sensors: Shielded, weatherproof outside air sensors with sensing elements encapsulated in a nominal 2" stainless steel sheath suitable for outdoor applications shall be used. Sensors shall include a waterproof junction box or conduit body for terminating sensor wiring and a removable sun shield. Location shall be on exterior North-facing sidewall at a level requiring a 6' stepladder for servicing. Do not install at ground accessible level.
6. Space temperature sensors shall be electronic type with a range measuring near midpoint of the control process . These sensors will have no field calibration, but will be provided with a zero and span adjustment. They will have an accuracy of $\pm 0.4^{\circ}\text{F}$. All sensors shall use shielded cable between the sensor and the controller. Space temperature sensors for use with ASC's shall only be provided with, local occupancy switch and occupancy status indication.

C. Pressure Sensors

1. Overpressure Protection: Provide pressure sensors impervious to instantaneous pressure changes of 150 percent of working pressure.
2. Adjustment: Provide sensors with external adjustable span, adjustable zero and pulsation suppression (averaging type).
3. Finished Spaces: Conceal pressure sensors in recessed stainless steel housing with removable perforated brushed stainless steel cover.
4. Sensor Characteristics: Provide pressure sensors with the following characteristics:
 - a. Must withstand an Ambient Temperature: 40 to 140 degrees F.
 - b. Isolation Valves: Provide pressure sensors with ball type isolation valves between each sensor and sensor pressure source..
 - c. Siphon: On steam systems provide pressure sensors with a pigtail siphon between the sensor isolation valve and sensor. Provide condensate wells and blowdown valves for differential pressure sensors.
 - d. Provide switching type sensors with platinum alloy, silver alloy or gold plated wiping contacts rated for the application, voltage and power levels.
 - e. Provide valved calibration taps adjacent to each pressure sensor for calibration.

D. Differential Pressure Analog Sensors

1. Types: Provide differential pressure analog sensors of the solid state preamplifier types for electronic systems.

E. Flow Sensors

1. General: Provide sensors for measuring flow in piping and ductwork that are compatible with static pressure and differential pressure analog inputs of the electronic controllers served.
2. Turndown: Provide sensors with an output which gives a continuous mathematical function over the full range of flow from maximum to minimum required.
3. Location: Mount flow sensor concealed in public spaces or exposed in mechanical equipment room. All devices must be accessible for service.

F. Water Differential Pressure Sensors.

1. Types: Provide digital electronic pressure sensors as required by the Sequence of Operations and control diagrams.
2. Provide sensing elements of the differential type measuring controlled medium and standard reference pressures.
3. Water differential pressure sensors shall have a minimum range of 0 to 50 psid with overpressure protection as required by the application.

G. CO₂ Sensors.

1. The CO₂ sensor for demand control ventilation must use technology appropriate to the application. If sensor is designed to have a life span beyond 5 years, all adjustments to the sensor including output signal, output scaling, relay set point, relay dead-band, resetting CO₂ calibration, and full two point calibration capabilities should be made via a user friendly PC based program or factory hand held device that can communicate with the sensor.
2. Sensor shall have 20-30 VAC power input, 0-10V or 4-20mA analog output max. range, 0-10,000 ppm max. or factory set 0-5000 ppm measuring range.
3. Sensor shall be manufactured and warranted for 1 year by the controls vendor. During the initial 1 year period, recalibration required to keep instruments within 10% of the original manufactures specifications shall be performed by the controls vendor at no cost to NMSU.

H. Actuators

1. Electric Actuators: Provide hydraulic or gear type electric actuators.
 - a. When operated at rated voltage, each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.
 - b. Provide an integral end switch to limit travel, and design the actuator to continuously stroke without damage.
 - c. Operators shall function properly within a range of 85% to 120% of line voltage. For actuators with input power greater than 100 watts, gears shall be ground steel, oil immersed, shaft shall be hardened steel running in bronze, copper alloy or ball bearing and operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.

- d. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.
 - e. Two position actuators shall be of the single direction, spring return or reversing type.
 - f. Proportioning operators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
 - g. Reversing and proportioning operators shall have limit switches to limit travel in either direction.
 - h. Electric valve operators shall be equipped with a spring yield device to maintain control pressure on the valve disk when the actuator is in a relaxed position.
 - i. For actuators with greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
 - j. Modulating Control Operators: Provide all modulating control valves 2" and larger and all sizes of butterfly valves with a positive positioning power device. Such device shall operate independently of valve spring range or stem friction to ensure the repetition of valve position when related to the same signal increment value of controller output. Positioner sensitivity shall be sufficient to produce a stem travel reversal loss not exceeding 7% of the controller output range as it goes from its full to no-load position within its proportional band operation. Provide positioners whenever required to obtain close-off ratings or proper sequencing of valves.
2. **Damper Operator Mounting:** Mount damper operators where accessible for maintenance.
- a. If located outside the duct or casing, mount operators on a 14 gauge reinforced support plate arranged to allow insulation between the support plate and the face of the duct or casing.
 - b. Brace damper operators rigid to show no deflection or movement over the full range of the damper stroke.
- I. **Differential Pressure Switches (Hydronic)**
- 1. **Differential Pressure (DP) Water Flow Switches:** Switches shall be double bellows type differential pressure switches with brass bellows directly actuating a snap-acting Double Pole Double Throw (DPDT) switch.

Switches shall have visible set point adjusters. Switches exposed to weather shall be weatherproof. Switch ranges and set points shall be appropriate to the manufacturer's recommendations for the pressure at the point of application and the differential pressure being monitored. (install at approximately 2/3 to 3/4 of the distribution system away from the pumps.)

J. Current Sensing Relays

1. Relays shall monitor AC current of motor loads. Switch shall have self-wiping, snap-acting Form C contacts rated for switching controller DC current as required. The set point of the contact operation shall be field adjustable.

K. Static Pressure Safety Switch

1. Air pressure switch shall be manually reset type, Double Pole Double Throw (DPDT) designed to sense static pressure and break an electrical circuit when the setpoint is exceeded. The setpoint shall be adjustable from 0.4" to 12" W.C. Unit shall be furnished and installed with a static pressure tip.

L. Duct Static Pressure Probes

1. Provide at each location indicated a duct static pressure probe capable of continuous monitoring of air static pressure. Each probe shall contain multiple static pressure pick-up points along the exterior surface of the cylindrical probe, internally connected to the averaging manifold. The station shall produce no measurable system pressure drop.
2. Each probe shall be constructed of extruded aluminum with threaded end support rod and nut and mounting plate gasket.
3. The probe shall produce a non-pulsating signal with a total accuracy of 0.5 percent of the total span.

M. Building Static Pressure Probes

1. Outside air static pressure probe shall be constructed of 10 gauge, anodized aluminum with a 2" diameter FPT connection. The probe shall be capable of sensing the outside atmospheric air pressure to within 2% of the actual value when subject to radial wind velocities up to 80 miles per hour with approach angles up to 30 degrees to the horizontal.
2. Indoor static air probes shall be provided for each indoor air pressure measurement location. They shall be flush mounted with a concealed connection. They shall be constructed of 10 gauge aluminum with a 1/8" coupling for output signal connection.

N. Chilled Water Meters

1. Chilled water meter capacity specification will be determined by the design engineer. Specification and typical guideline drawings will be provided by NMSU Project Representative for design of equipment installation.
2. Chilled water meters shall have a maximum operating pressure of 150 psig. Flow meter shall be installed with ball valve for hot insertion. Temperature sensors shall use immersion wells. BTU meter shall have LCD display for BTU flow rate and flow totalization.
3. Flow meter shall be furnished with a BACnet IP communications interface. (install per manufacturer's recommendations).
4. A minimum of 5' clearance shall be maintained to facilitate the ease of repair, maintenance, removal and replacement of the flow meter without the need for specialized equipment.
5. Meter shall not incorporate any moving parts on the flow sensing element.

O. Condensate Meters

1. Condensate meter capacity specification will be determined by the design engineer. Specification and typical guideline drawings will be provided by NMSU Project Representative for design of equipment installation.
2. Meter will consist of a full-bore body with encapsulated and rigidly retained set of coils. Meter will provide instantaneous and totalized flow available at local indicator or remotely through outputs. Meter shall be installed to insure full liquid emersion at all times. Meter will measure fluids with conductivity greater than or equal to 5.0 us/cm2.
3. Meter shall be equipped with electronics capable of interfacing with an energy management system via BACnet IP communication protocol.
4. A minimum of 5' clearance shall be maintained to facilitate the ease of repair, maintenance, removal and replacement of the flow meter without the need for specialized equipment.
5. Meter will have uniform magnetic field flux distribution eliminating piping straight run and flow profiling.

P. Natural Gas Meters

1. Natural gas meter capacity specification will be determined by the design engineer. Specification and typical guideline drawings will be provided by NMSU Project Representative for design of equipment installation.
2. Meter shall be equipped with electronics capable of interfacing with an energy management system via BACnet IP communication protocol.

O. Actuators General

1. General: Provide electric motor driven actuators (operators) arranged "Fail Safe" in the event of power failure.
2. Electric Actuators: Provide hydraulic or gear type electric actuators.
3. When operated at rated voltage, each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.
4. Provide an integral end switch to limit travel, and design the actuator to continuously stroke without damage.
5. Operators shall function properly within a range of 85 to 120% of line voltage. For actuators with input power greater than 100 watts, gears shall be ground steel, oil immersed, shaft shall be hardened steel running in bronze, copper alloy or ball bearing and operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.
6. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.
7. Two position actuators shall be of the single direction, spring return or reversing type.
8. Proportioning operators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
9. Reversing and proportioning operators shall have limit switches to limit travel in either direction.
10. Electric valve operators shall be equipped with a spring yield device to maintain control pressure on the valve disk when the actuator is in a relaxed position.
11. For actuators with greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

1.3 AUTOMATIC VALVES

- A. General: Provide factory-fabricated two-way or three-way valves with two position or modulating control actuators of the type, body material, and pressure class required for each application. Where type or body material is not indicated, provide selection as determined by manufacturer for installation requirements. Valve pressure class and rating shall be selected

based on maximum pressure and temperature in the piping system in which it is installed.

B. Performance: All valves shall conform to the following minimum standards and selection requirements.

1. Valves shall be guaranteed to have bubble-tight shut off.
2. Provide heavy-duty actuators, with proper close-off rating for each individual application.
3. The valve assembly shall be suitable for throttling control and for tight shut-off against pump shut-off head. All valves shall be certified by an authorized officer of the manufacturer to shut-off bubble-tight against full system pump shut-off head.
4. All valves which are operated in sequence with damper motors, control switches, or other valves shall sequence properly without overlap. Provide positive positioners, oversized operators, or balanced trim if required for proper sequence control.
5. Valve schedules submitted for review shall clearly show shift in operator span for all valves operated in sequence and shut-off capability for all valves.
6. Valves for steam service shall be of globe style and designed for high temperature service with positive shut-off at or above normal operating pressure.
7. Valves used on main air handling units shall be equipped with manual value handle. to allow for continued operation of an AHU during control system servicing.
8. Valves used in steam applications shall operate normally under extreme heat conditions (in excess of 300° F) with no external fan or air movement required.
9. Steam valve actuators must be rated to operate under high temperature conditions with a mean temperature operating range of approximately 250 deg F (Siemens SDK electro-hydraulic type actuator or approved equal).

C. Valve Types:

1. Two-Way Valves: Provide straight through pattern-type, union globe valves. Valves 1/2" to 2" in size shall have bronze, brass, stainless steel or approved corrosion resistant bodies and screwed ends. Valves 2-1/2" and larger shall have high-tensile cast iron or cast steel bodies, bronze stainless steel with flanged connections. All seats and trim and valve stems shall be

316 or 416 stainless steel. Valves shall be designed to provide equal percentage flow characteristics at constant pressures with an operating range of 300 to one. Low-pressure valves shall be provided with a repairable valve and seat.

2. Three-way Valves: Provide straight through and perpendicular pattern-type, union globe valves. Valves 1/2" to 2" in size shall have bronze, brass, stainless steel or approved corrosion resistant bodies and screwed ends. Valves 2-1/2" and larger shall have high-tensile cast iron or cast steel bodies, bronze stainless steel with flanged connections. All seats and trim and valve stems shall be 316 or 416 stainless steel. Valves shall be designed to provide equal percentage flow characteristics at constant pressures with an operating range of 300 to one. Low-pressure valves shall be provided with a repairable valve and seat.
3. Butterfly Valves: Where indicated on the Drawings or required by the Sequence of Operations, utilize full lug butterfly-type control valves rated for the same operating pressure as the piping system in which such valves are installed. Valves shall have bubble-tight shut-off against either side of the valve when the flange is removed from the opposite side. Provide positive positioners or oversized operators if required for proper sequence control.
4. Differential Bypass Valves: Valves for control of differential bypass systems shall be of industrial quality with minimum 50:1 operating range, equal percentage characteristics, cast iron body, 316 stainless steel trim, position indicator, heavy duty operator, stainless steel stem, Teflon spring-loaded packed. All working parts (trim) of the valve shall be replaceable without removing the valve body from the line.
5. Small Valves: Small (one inch [1"] and smaller) heating hot water and chilled water valves shall be of the three-way or straight-through equal-percentage type with polished stainless steel stems, spring-loaded Teflon or rubber packing to allow the valve to be repacked.

D. Fail Position: Chilled water and steam valve fail positions shall be determined by design criteria on a case-by-case basis.

E. Valve Selection: All valves shall be suitable for the maximum design pressure temperature and flow to meet the engineer's design specification of the system in which they are installed.

1. Properly sized temperature and pressure relief valves shall be installed in all hot water systems and shall be piped to the nearest floor drain per state and/or local code for discharge water temperature of less than 140 degrees. For temperatures higher than 140 degrees, coordinate drain pipe design to meet maximum discharge temperature potential.

2. Properly sized steam pressure relief valves shall vent to atmosphere. A trip-stop valve is acceptable where venting to atmosphere is impossible or impractical.

1.4 WIRING

- A. All wiring shall conform to the requirements of the NFPA 70 and Division 26 specifications. All control, power, and communication wiring of all voltages, including wiring in mechanical rooms, shall be run in minimum ¾" EMT. Control and power cables are NOT to be placed in the same conduit with communication cables.

- B. Wiring:
 1. All wiring used must comply in every detail to wiring standards as set forth by the system and/or device manufacturer.
 2. Wire for low voltage AC shall be minimum 300 volt insulated copper No.18 AWG or larger conforming to NFPA 70, Type MTW, THHN, or TFFN.
 3. Cables carrying analog signals shall be shielded.
 4. Cables shall be terminated in solder or screw type terminal strips.
 5. Cables shall not be tapped at any intermediate points.
 6. All wire shall be color coded or numbered for identification. Identify as indicated on shop drawings and "As-Built" drawings. Cables and conductors shall be tagged at both ends with the identifier shown on the shop drawings.
 7. Wire terminating in screw type terminal strips shall have pressure connectors conforming to UL 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors, or UL 486B, "Wire Connectors for Use with Aluminum Conductors."
 8. Wire terminations without connectors or traveling pressure pads will not be accepted.

PART 3 - EXECUTION

3.1 FIELD DEVICE INSTALLATION

- A. Space temperature transmitters shall be installed 48" A.F.F., unless otherwise specified on the plans.

-
- B. All temperature sensors installed in liquid lines, tanks, etc., shall be installed in stainless steel thermowells. To be installed per manufactures requirements.
 - C. Outdoor air temperature elements shall be installed on North facing wall or structure in a location that is continuously shaded and not effected by heat generating equipment or equipment intakes or discharges. The element shall be installed under a sun shield and high enough to avoid damage from vandalism.
 - D. Duct point temperature elements shall be installed directly on ductwork and the connection between the duct and the flange shall be gasketed and secured with sheet metal screws to prevent any air leakage. Care must be taken to avoid direct contact between the temperature element and any heat transfer surface such as a coil.
 - E. Duct averaging elements will be extended across the entire duct area in a zigzag pattern covering the entire surface area. Special clips will be used to secure the elements at turns to prevent chafing of the elements. Where elements pass through sheet metals penetrations, a duct plastic tubing or similar protection will be installed on the elements to prevent damage to the elements from vibration.
 - F. Duct static pressure stations will be installed so that the direction of flow is observed when installing the probe to prevent measurement of total pressure. The connection between the duct and the flange will be gasketed and secured with sheet metal screws to prevent any air leakage. Connections from the "HI" pressure port to the differential pressure transducer will be 1/4" plastic tubing and not extend for more than ten feet. Pressure stations will be installed no less than 2/3 the distance of the main duct away from any branch ducts or change of direction.
 - G. All air differential pressure transmitters will be installed within ten feet of the pressure sensing point. The transmitters shall be installed in a NEMA 1 housing for interior conditioned spaces and in NEMA 3R housings for outside or unconditioned spaces. The transmitters and housings will be rigidly supported to prevent vibration and shall never be mounted to ductwork or piping. Transmitter will be installed so that it is easily serviced.
 - H. Outdoor humidity transmitters will be installed in a manner so that external influences will not affect the accuracy of measurement
 - I. Duct point humidity elements shall be installed directly on ductwork and the connection between the duct and the flange shall be gasketed and secured with sheet metal screws to prevent any air leakage. The sensing element will be installed per manufactures requirements.

- J. Space humidity transmitters will be installed at 48" A.F.F. unless otherwise specified on the plans.
- K. Current switches will be installed in one leg of three phase circuits and the hot leg of single phase circuits and in all cases, after the local disconnect. The switches will be adjusted to close at approximately 10% of the attached loads full load amps.
- L. Low limit thermostats will be installed with the averaging element extended across the entire duct area in a zigzag pattern. Special clips will be used to secure the element at turns to prevent chafing of the element. Where elements pass through sheet metals penetrations, a duct plastic tubing or similar protection will be installed on the elements to prevent damage to the elements from vibration. The low limit thermostat set point will be set per design requirements and field verified for fail safe operation.
- M. All liquid differential pressure transmitters will be installed within ten feet of the pressure sensing points. The transmitter will be rigidly supported to prevent vibration and will never be mounted to ductwork or piping. The piping for the sensing points will include isolation valves such that the transmitter can be removed without having to shut down the liquid system. Transmitter will be installed so that it is easily serviced.
- N. Outside air static pressure probes must be installed and piped according to manufacturer's instructions to ensure accuracy of the static pressure reading and eliminate the effects of condensation in the sensing lines. Coordinate installation of probes with the necessary trades for proper sealing of all roof penetrations.
- O. Air differential pressure switches will be connected to pitot tube pickup probes pointing into the air stream on both sides of the process variable. Connections between the switch and the pitot tubes shall be 1/4" hard copper.

3.2 ELECTRICAL CONTROL POWER AND LOW VOLTAGE WIRING

Comply with all Division 26 installation requirements. All control, power, and communications wiring shall be installed in conduit.

- A. Conceal conduit within finished shafts, ceilings and wall as required. Install exposed conduit parallel with or at right angles to the building walls.
- B. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- C. All wire-to-device connections will be made at terminal blocks or terminal strip. All wire-to-wire connections shall be at a spring cage type terminal

block.. All wiring within enclosures will be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

- D. Cap all unused conduit openings and stub-ups. Only use fire rating caulking when required by fire code.
- E. Route all conduit to clear beams, plates, footings and structure members. Do not route conduit through column footings or grade beams.
- F. Set conduits as follows:
 - 1. Expanding silicone fire stop material sealed watertight where conduit is run between floors and through walls of fireproof shaft.
- G. Cap open ends of conduits until conductors are installed.
- H. Where conduit is attached to vibrating or rotating equipment, flexible metal conduit with a minimum length of 18" and maximum length of 36" shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.
- I. Where exposed to the elements or in damp or wet locations, waterproof flexible conduit will be installed. Installation shall be as specified for flexible metal conduit.
- J. Provide floor, wall, and ceiling plates for all conduits passing through walls, floors or ceilings. Use prime coated cast iron, split-ring type plates, except with polished chrome-plated finish in exposed finished spaces.

25 50 00 INTEGRATED AUTOMATION FACILITY CONTROLS – LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This Section includes the following lighting controls:
 - 1. Panel boards containing both standard and remotely operable circuit breakers.
 - 2. Control electronics for switching circuit breakers and monitoring the status

of the system.

3. Configuration software.

B. System installation includes the following:

1. Wiring of main and branch circuit conductors.

2. Installation of external control devices and wiring to the panelboard controller.

3. Installation of communications conductors and associated hardware.

4. Installation, setup and configuration of equipment and software to NMSU's requirements as shown in the project specifications and drawings.

5. Training of NMSU personnel in the configuration and use of the system for all operating sequences as identified in the project specifications.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.

2. Block Diagram: Show interconnections between specified components and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

4. Zone Schedules: Show all lighting zones defined for each panel with references to the Lighting Zone schedules in the construction drawings. Zone names must be identical to those appearing in the schedules.

C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected Ethernet system.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.

2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
- D. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
 2. Program Software and System Configuration Backup provided electronically, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
- E. Upgrade Kit: For NMSU to use in modifying software and firmware to upgrade and to allow system expansion. Must include full technical information on all installed devices.
- F. Field quality-control test reports to be used in commissioning.
- G. Operation and Maintenance Data: For lighting controls to include operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain lighting control module and control power components through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.
- E. Manufacturer shall be engaged in the manufacture of lighting control equipment and ancillary equipment, of the types indicated, whose products have been in satisfactory use in similar service for not less than five years.
- F. System Support: Factory support shall be available free of charge during normal business hours for the duration of the warranty period.
- G. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- H. NEC Compliance: Comply with applicable portions of the NEC including

Articles 110-10 and 725.

- I. UL Compliance: Comply with applicable UL standards for panelboards, circuit breakers and energy management equipment.
- J. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15, Subpart J for Class A applications.
- K. IEC 1000: Panelboard electronic components shall meet or exceed levels specified below:

1. ESD Immunity	IEC 1000, Level 4
2. RF Susceptibility	IEC 1000, Level 3
3. Electrical Fast Transient Susceptibility	IEC 1000, Level 3
4. Electrical Surge Susceptibility – power line	IEC 1000, Level 4
5. Electrical Surge Susceptibility – interconnection lines	IEC 1000, Level 3
- L. ISO 9002: Manufacture of panelboard components shall be registered as ISO 9000 compliant.

1.5 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of lighting control functions.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Software: Failure of input/output to execute switching or dimming commands.
 - b. Failure of modular relays to operate under manual or software commands.
 - c. Damage of electronic components due to transient voltage surges.
 - 2. Warranty Period: Cost to repair or replace malfunctioning parts in accordance with the manufacture warranty beginning from the date of

Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

2.2 SYSTEM REQUIREMENTS

A. Expansion Capability: Adequate to increase the number of control functions in the future by 25 percent more than those indicated. This expansion capability applies to equipment ratings, housing volumes, spare relays, terminals, number of conductors in control cables, and control software.

B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

1. Alternative Line-Voltage Surge Suppression: Field-mounting surge suppressors that comply with UL 1449 and with IEEE C62.41 for Category A locations.

2.3 FUNCTIONAL SYSTEM DESCRIPTION

A. Material and Components:

1. The lighting control system shall consist of microprocessor-based control electronics.
2. Each master control panel shall meet or exceed the following capabilities:
 - a. Must have 2-wire input terminals for connection to external low voltage switch contacts.
 - b. Provide true status feedback by monitoring zone status.
 - c. Device must have the ability to interface via Bacnet communication protocol, check with NMSU Project Representative for communication protocol substitution.
3. All lighting control components shall be installed in factory enclosures.

2.4 Hardware

A. Lighting Control Electronics: -

1. The controller shall operate whenever voltage is within the power supply

operating range. In the event of incoming power outage, the controller shall automatically halt execution in a safe manner. Upon return of power, the controller shall automatically reboot and return to normal system operation. The controller shall include the following:

- a. Integral keypad and LCD front panel for local setup. Front panel setup shall permit local input setup and creation of time schedules without requiring separate PC-based software.
 - b. If available, be capable of communications interface to permit local connection to personal computer without having to remove panel trim.
 - c. Non-volatile memory to retain all setup and configurations.
 - d. All configurations shall allow either momentary or maintained control devices to be attached without providing any external control power.
 - e. An auxiliary power source for powering external control devices such as occupancy sensors, low voltage photo sensors, and pilot LEDs, as indicated on drawings.
 - f. Programmable input timers to permit timed override periods.
 - g. Adjustable blink notice assignable to any system zone.
 - h. Capability for accepting downloadable firmware so the latest future production features may be added without replacing the module.
2. Time scheduler shall provide, at minimum, the following:
- a. Independent schedules, each having twenty-four (24) time periods.
 - b. Clock configurable for 12-hour (AM/PM) or 24-hour format.
 - c. Schedule periods settable to the minute.
 - d. 365-day calendar, with automatic daylight savings and leap year adjustments.
 - e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
 - f. Astronomical tracker to automatically adjust sunrise and sunset times throughout the year.
3. Each master controller shall have the capability of communicating to another master controller in a peer-to-peer configuration over NMSU's

Ethernet local or wide area network.

- a. Each input connected to the controller shall be capable of controlling any branch circuit connected to any other controller.
 - b. A schedule programmed in one controller shall be capable of controlling any branch circuit connected to any other controller.
4. Master controllers shall have the capability of configuring either local or remote sources in an "AND," "OR," or "LAST EVENT" configuration. Sources shall include, but not be limited to, inputs, time schedules, or status.
 5. Master Controllers shall communicate with NMSU's Network Area Controller as an Ethernet based slave device for access to global lighting control strategies and web pages. Request appropriate communication protocol from the NMSU Project Representative. Local lighting controls system must have the capability to accept external source inputs to control zone lighting schedules. Must be capable of accepting network or hardwired input sources.

B. Lighting Control Electronics: Slave panels

1. Panels marked as slave panels shall contain the necessary busses and network hardware to allow connection of sub-net wiring between panels.
2. Sub-net wiring connections shall allow connection of wiring to a terminal that can be removed from the panel without interrupting the communications to other panels.
3. Slave panels shall contain a nameplate label attached to the deadfront trim indicating the panel designation, network address of the panel, and the panel designation of the associated master panel.

2.5 NETWORKS

- A. Sub-net wiring between master and slave panels will be indicated on all lighting control drawings.
- B. Sub-net communications shall follow Class 1 wiring practices. Communications conductors shall be factory approved communication cabling. Wiring distances shall not exceed the manufacturer's recommendations.
- C. Communications between the master panels and the NMSU Network Area Controller shall be via an extension of the NMSU Local Building Automation Network Ethernet LANs as indicated on the drawings, using the network protocol native to the panels. The IP addresses to be used by the panels will be provided by FS Energy Management upon receipt of a

panel list showing the MAC addresses for each panel.


2.6 SOFTWARE

- A. Software shall be designed specifically for the lighting control system and supported by the manufacturer and operate without restrictions in the latest supported Windows operating environment Software shall provide system and panel configuration, and monitoring and control functions.

- B. For basic setup and control, the software shall serve as a configuration and diagnostic utility. Basic features shall include support for configuring inputs, zones, circuit breaker actions, and time schedules. Software shall be able to monitor the status of the system and provide visual indication of input status, circuit breaker status, and operational parameters. Software shall be able to establish connections to the system through a controller Ethernet port.

- C. All software must be provided to FS Operations with unrestricted licenses in the name of NMSU with full manufacturer’s technical support and version upgrade coverage for the duration of the Project warranty period.

2.7 MANUAL SWITCHES AND PLATES

- A. Switches: Modular, momentary push-button, low-voltage type.
 - 1. Color: Coordinate switch plate and covers/field devices with architectural requirements. 

 - 2. Lighting override switches shall be conspicuously labeled as “Lighting Override” and also display in an inconspicuous but clearly visible fashion the unique switch identifier as it appears on the construction drawings.

2.8 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG.

- B. Classes 2 and 3 Control Cable: Must comply with manufactures recommendations

- C. Class 1 Control Cable: Must comply with manufactures recommendations.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Wiring Method: Install wiring in raceways. Minimum conduit size shall be $\frac{3}{4}$ inch.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations not having integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26.
- B. Panel software objects such as Inputs, Schedules, Breakers, and Special Days which are used in panel control shall have meaningful names and be named matching any identifiers appearing in external documentation such as the Construction Drawings and breaker names appearing on panel doors.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results developed and provided by factory-authorized service representative in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test for circuit continuity.

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2. Verify that the control module features are operational.
 3. Check operation of local override controls.
 4. Test system diagnostics by simulating improper operation of several components selected by NMSU.

3.4 ADJUSTING

When requested within 12 months of date of Substantial Completion, provide on-site assistance in reviewing NMSU's lighting panel operating configuration changes and in adjusting occupancy sensors to suit actual occupied conditions.

3.5 DEMONSTRATION

A factory-authorized service representative shall be provided to train NMSU's maintenance personnel to configure, adjust, operate, and maintain lighting controls.

END OF DIVISION 25

DIVISION 26 –ELECTRICAL

26 00 00 ELECTRICAL

All installed electrical equipment to be new specification grade and listed with UL. Electrical installations are to comply with National, State and Local Codes to include latest revision of ANSI C2 National Electrical Safety Code), NFPA 70 (National Electrical Code), NFPA 70E (workplace electrical safety) and State of New Mexico Codes.

All installed electrical equipment and exposed conduit will be installed in a neat and workman like manner per Section 110.12 of the NEC.

26 00 01 NMSU GENERAL REQUIREMENTS AND DESIGN INTENT

1.1 GENERAL

A. SERVICE VOLTAGE

1. At NMSU Main Campus, service shall be provided from the 23.9kV distribution network whenever possible. The 4.16kV network may be used where adequate capacity exists and with preapproval of FS Engineering.
2. At other locations, services may be provided by a local utility or the campus distribution network as appropriate. Details will be provided by NMSU Project Representative or local campus authority.

B. BUILDING VOLTAGES

1. Consider 480Y/277V distribution with 208Y/120V step down transformers for receptacles and other 120V loads.
2. Step down transformers shall be located in rooms with adequate fire ratings and transformers connected for sound isolation using flexible conduit, isolation pads and when supported from the building steel, spring hangers.

C. UTILITY DEMAND AND CONSUMPTION

1. The Design Professional will complete the Utility Demand and Consumption form on all projects. It is used to inform NMSU Project Representative of the impact on the distribution system capacity. Submit to NMSU Project Representative at the Preliminary Design review submission and at the Final Design submission.

D. SPECIFICATION EDITING

1. Generally, use the “listed manufacturers” option in lieu of “available

manufacturers.” Confirm any manufacturer preference with FS Engineering.

2. Note at least 3 manufacturers, unless otherwise preapproved.
3. Confirm Requirement for extra materials with NMSU Project Representative. Typical items to provide are occupancy sensors, specialty luminaire lenses, fuses, indicating lamps, enclosure keys, as needed for specific engineered lighting systems.

E. MOUNTING HEIGHTS

1. All device installations will be compliant with current codes and regulations.

F. CHECKLIST ITEMS

1. Save and return all replaced medium voltage equipment to lay down yard at Tortugas Substation, as directed by the NMSU Project Representative.
2. All Exterior medium and low voltage electrical equipment and apparatus will be painted “Back Drop” from the factory ; this includes electrical transformers, switches, MDPs, etc., as directed by the NMSU Project Representative.
3. Verify that electrical power is provided to all ADA compliant devices including door operators.
4. Provide power for AV equipment, power roll up screens, podiums, overhead roll up doors, fume hoods, etc.
5. Specify who will install telephone and data cables, and raceways on the plans and in the specifications. Contact NMSU Project Representative for specific equipment to be supplied and installed by the contractor.
6. A/E consultant to investigate NMSU documentation and report the existence of PCB in all transformers and switches so that PCB units are disposed of properly.
7. Label each electrical device (outlet switches, etc.) describing the panel and circuit number feeding it. Use clear white label with 3/16 inch high black font. This is in addition to code required labeling of electrical distribution and control equipment enclosures.
8. All medium voltage cable and equipment 1000 volts and above will be tested by a NETA certified testing agency prior to acceptance.

9. If motion sensors are installed to control restroom lights, ensure that an emergency fixture has been designated to provide minimal light in the space.

.2 LEED

Refer to the [NMSU LEED Policy](#) for our sustainable design philosophy.

.10 SCOPE (Basis of Design/Application of Systems)

A. MOTORS

1. Motors less than 3/4 hp. shall be single phase. Motors 3/4 hp. and larger shall be three phase.
2. All three phase motor will be 208V, 480V or preapproved by NMSU Project Representative.

B. ELEVATOR SERVICE AND SUPPORT CIRCUITRY

1. Service:

- a. Where required by code, service to elevator machine shall be derived from an alternate source of power, in addition to the normal source. Alternate sources of power and transfer switch will be reviewed with NMSU Project Representative for selection.
- b. Provide fusible disconnect switch in the machine room to feed the elevator motor controller.

c. Shunt Trip:

- 1.) Where required by code, elevator service shall include a self-contained, fusible shunt trip machine disconnect, Bussman Powermodule, or approved equal, installed in machine room as required by code.
- 2.) Where elevator machine service includes an alternate source transfer switch, and shunt operator is required, the shunt trip circuit shall originate from a normal/ emergency circuit. Shunt trip normal / emergency circuit shall include a voltage- sensing, time delay on release (off) relay, field set for seven(7) second delay to off. Relay shall include NC contact for tie-in to fire alarm panel to annunciate "trouble". Discuss optional methods of alarm with FS Engineering where tie-in to fire alarm system is not possible.

2. Support Circuitry:

- a. Cab lighting: Dedicated 20A Life Safety circuit. Fuse the cab lighting disconnect at 20A, slow-blow fuse. Coordinate dual cab lighting requirement with NMSU Project Representative.
- b. Emergency Phone Consolidator: Dedicated 20A Life Safety circuit shared only with elevator cab lighting. Fuse emergency phone disconnect at 5A, fast-acting fuse. Request further emergency phone installation design requirements from FS Engineering.
- c. Pit Sump Pump: Dedicated circuit and devices as required by load.
- d. Hoistway lighting and GFI receptacle: Dedicated 20A normal circuit for GFI receptacle(s) and required lighting fixtures. Provide LED luminaires in the pit. Mount pit luminaires horizontal. Mount all devices higher than 24 inches AFF in the pit.
- e. Machine Room lighting and GFI receptacle: Dedicated 20A standby power circuit for GFI receptacle and lighting. Connect lighting and related control on line side of GFI receptacle.

.20 Definitions

Provision(s) for Electrical Circuit Expansion, is built for installation of future overcurrent device without the requirement of any additional parts.

.30 Submittals

A. DESIGN CALCULATIONS

NMSU requires that the Design Professional submit calculations for all projects, including:

- 1. Illumination
- 2. Short Circuit
- 3. Voltage Drop
- 4. Panel size
- 5. Feeder size
- 6. Total load
- 7. Physical space requirements

B. Construction Submittals

- 1. NMSU Project Representative has the right to request any submittal for review, but it is the sole responsibility of the Design Professional to approve or reject that submittal. Do not mark any item “Approved As Noted – Pending NMSU Review” (or similar). Discuss any questions

or concerns with NMSU Project Representative prior to returning the document to the contractor.

2. Require all submittals in PDF format so that they may be shared electronically.
3. Provide a schedule to NMSU Project Representative containing submittals transmitted for review. Include NMSU Project Representative on any review comments. This review shall be simultaneous to that of the Design Professional.
4. .Standard of Quality/Quality Assurance (reserved)

.40 COORDINATION (reserved)

26 01 00 OPERATION AND MAINTENANCE OF ELECTRICAL SYSTEMS

1.1 GENERAL

- A. It is the goal of NMSU to design systems that are safe, robust, and easy to maintain. At NMSU, all major electrical equipment is inspected, tested, and maintained per NETA 2010 Maintenance and testing Specifications.

26 01 50 OPERATION AND MAINTENANCE OF LIGHTING

- A. . All inside lighting fixtures must be placed so re-lamping can be accomplished with minimum effort and hazard, with consideration for height, obstructions, working surfaces, and use of equipment.

26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

1.1 ELECTRICAL ACCEPTANCE TESTING

The Design Professional shall consider utilizing the information below to create a separate “Electrical Acceptance Testing” specification. It is acceptable to include testing requirements within other specification sections. Coordinate with NMSU Project Representative for independent testing of those special sections that require additional testing.

- A. Testing shall be performed on electrical equipment and systems to assure that equipment and systems are operational and within applicable standards and manufacturer’s tolerances. Testing should verify that equipment and systems are installed in accordance with design specifications. All testing shall occur at the work site.
- B. Testing shall be performed by an independent organization that is professionally independent of the manufacturers, suppliers, and installers of the equipment or systems being evaluated. The name of the proposed testing

organization shall be submitted to NMSU Project Representative for approval.

- C. Qualified technicians who are trained and regularly employed for testing services shall do all testing. Submit qualifications of all testing technicians.
- D. The testing organization shall conform to the general guidelines of section 5 of the latest NETA Acceptance Testing Specifications, in their entirety.
- E. Provide completed reports in electronic PDF format to NMSU Project Representative.
- F. Notify NMSU Project Representative at least seven (7) days in advance of any testing. A NMSU Project Representative shall witness testing.
- G. Inspection and testing of all applicable electrical equipment listed below shall be done in accordance with the latest version of NETA ATS. This will include all tests marked optional unless waived in writing by NMSU Project Representative. The following list represents equipment that is subject to testing. Coordinate with the NMSU Project Representative and Engineer of record for equipment installed on the project.
 - 1. Switchgear and Switchboard Assemblies
 - 2. Transformers
 - 3. Cables: Low and Medium Voltage
 - 4. Air Switches
 - 5. Oil Switches: Medium Voltage
 - 6. Vacuum Switches: Medium Voltage
 - 7. Low Voltage Circuit Breakers:
 - a. Insulated Case/Molded Case (100 amp frame and larger)
 - b. Power
 - 8. Medium Voltage Circuit Breakers:
 - 9. Circuit Switches
 - 10. Network Protectors
 - 11. Protective Relays
 - 12. Instrument Transformers
 - 13. Metering Equipment
 - 14. Grounding Systems
 - 15. Ground Fault Protection Systems
 - 16. Motors
 - 17. Generators
 - 18. Motor Starters
 - 19. Motor Control Centers
 - 20. Adjustable Speed Drive Systems
 - 21. Direct Current Systems
 - 22. Surge Arresters
 - 23. Capacitors and Capacitor Control Devices

- 24. Outdoor Bus Structures
- 25. Emergency Power Systems:
 - a. Engine Generator
 - b. Uninterruptible Power Systems
 - c. Automatic Transfer Switches
- 26. Automatic Circuit Reclosers and Line Sectionalizers
- 27. Fiber Optic Cables

1.2 System Function Tests

- A. Perform system function tests upon completion of equipment tests as defined in [26 05 10.1](#). It is the purpose of the system function tests to prove the correct interaction of all sensing, process, and action devices.
- B. Verify the correct operation of all safety devices for fail-safe functions in addition to design function.
- C. Verify the correct operation of all sensing devices, alarms, and indicating devices.

1.3 Fire Alarm Testing

- A. Shall be overseen by NMSU Fire Department.

26 05 13 MEDIUM-VOLTAGE CABLES

1.1 Primary Cables

Okonite Okoguard URO-J or preapproved equivalent jacketed.

- A. The 25-kV and 15-kV main conductor shall be aluminum with a 1/3 copper neutral and an encapsulating jacket.
- B. For 8-kV and 5-kV cable the main conductor can be copper or aluminum with a ribbon shield that is copper or aluminum.

1.2 Rubber Goods

All rubber goods shall be Elastimold or preapproved equivalent.

1.3 Design Specifications

Contact NMSU Project Representative for detailed instructions for medium voltage system components.

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1.1 Cabling

- A. Minimum wire size shall be #12 AWG copper or equivalent with approval by NMSU Project Representative.
- B. Provide separate neutral conductor for every interior branch circuit.
- C. Service Entrance, Feeders, and Branch Circuits: Single conductors in raceway, minimum 75C rated.
- D. MC Cable is not acceptable. This requirement may be waived on student dormitories and other projects deemed appropriate, contact NMSU Project Representative for details.
- E. All exterior wiring connections, and those made at or below grade shall be weatherproof with UL listed weatherproof connectors.

1.2 Conductor Type

- A. Distribution feeder conductors in sizes 250 kcmil to 1000 kcmil may be copper or aluminum alloy.
- B. Aluminum alloy conductors shall be compact stranded conductors of AA-8000 series alloy. AA-8000 series alloy conductor must be Alcan Cable STABILOY® or approved equal. Compliance with the elongation requirement per Table 10.1 of UL Standard 1581 for stranded AA-8000 series aluminum alloy conductors shall be determined on wires taken from the conductor after stranding by manufacturer.

1.3 Insulation

- A. For use in raceways: Type THHN-2.
- B. For use in Cable Trays: Sizes #1/0 AWG and larger Type THHN-2.
- C. Type THHN-2 conductors shall be Listed by Underwriters Laboratories (UL) and suitable for operation at 600 volts or less at a maximum operating temperature of 90 C in wet or dry locations.

1.4 Aluminum Wire Connections

- A. Contractor shall use manufactures installation specification for all connections.

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.1 GENERAL

- A. Grounding and Bonding for electrical systems will conform with the current versions of the NEC and New Mexico Electrical Code.

26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS (RESERVED)

26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.1 GENERAL

- A. Minimum size **home-run** conduit shall be 3/4 inch.
- B. Lighting whips no longer than 72 inches
- C. May be 1/2 inch flexible metallic conduits,
- D. Aluminum and plastic conduit is not acceptable in interior applications. The use of schedule 40 and schedule 80 PVC conduit within corrosive environments is acceptable will conform with the current versions of the NEC and New Mexico Electrical Code.
- E. EMT conduit and intermediate grade, rigid steel, are acceptable for interior applications. Where EMT is used, steel compression fittings are required. .
- F. Install No. 12 non-ferrous or 200 lb. test nylon fish line in conduits where permanent wiring is not installed shall be used in interior applications.
- G. Where installed in fire-rated partitions, apply firestop putty pads or similar fire rated products on or around outlet boxes as required to maintain the fire rating of the partition.
- H. Junction box installations will comply with all current applicable codes. Junction box installations in fire rated walls will comply with all current applicable codes.
- I. Outlet boxes shall be separated by at least one stud wherever possible. There must be a minimum of a 1” horizontal separation space between boxes of adjacent rooms.
- J. Surface mount raceway, when approved by NMSU Project Representative, shall typically be metallic with dual channels. Specify appropriate metallic raceway when required to resist certain chemical environments.

26 05 36 CABLE TRAYS FOR ELECTRICAL SYSTEMS

1.1 Cable Trays

- A. Acceptable for communication cable. Refer to NMSU ICT for specifications. Contact NMSU Project Representative for application and location
- B. Install in locations to ensure ease of cable installation and accessibility.

26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

1.1 Underground Ducts

- A. Underground primary cables will be installed in 4-inch PVC conduit encased in 3000 PSI red concrete. Conduit will be NEMA TC-6 Type EB or Schedule 40. Elbows shall be long radius Schedule 40.
- B. Underground secondary cables greater than 1000v will be installed in 4-inch PVC conduit encased in 3000 PSI red concrete. Conduit will be NEMA TC-6 Type EB or Schedule 40. Elbows shall be long radius Schedule 40.
- C. Add the following requirements to any duct bank detail.
 - 1. Avoid over-excavation of the duct bank trench. Duct bank walls will be formed within 5 feet of a manhole.
 - 2. Inspection and sign-off by NMSU Project representative is required prior to and after concrete encasement.
 - 3. All conduit ends will be sealed with a UL listed sealing compound.
- D. Contact NMSU Project Representative for typical AutoCAD details.
- E. All utility trenches will be GPS located prior to the trench backfill.

1.2 Switch and Transformer Vault

- A. All Medium Voltage equipment will rest on an appropriately sized concrete vault with poured-in-place footing. Minimum vault size will be 8' X 8' outside dimensions. Electric Vaults will be precast or poured in place. Use of pulling irons and cable supports will be coordinated with the NMSU Project Representative. Coordinate vault size and lid configuration with NMSU Project Representative. .
- B. Bell ends will be used where conduits penetrate vaults.
- C. Grounding:
 - 1. All electrical systems shall be suitably grounded, including all non-

current carrying metallic components of all equipment and metallic conducts. Grounding shall be accomplished as required by the National Electric Code.

2. Transformer foundation shall have a minimum 4/0 AWG bare copper ground ring with at least two (2) 96” ground rods. Irreversible compression fitting for rods and ring. Ring shall be a minimum of 24” from the edge of the foundation, buried between 18” and 24” deep. Rods shall be installed at opposite corners or at a distance of more than rod length apart. Extend cabling a minimum of 48” above grade for connection to transformer. Do not connect this ground ring to the building service.

D. Supports in Electric Vaults:

1. The Contractor will furnish and install supports in new and existing vaults where cables are to be installed. Nonmetallic support systems will be used and approved by the NMSU Project Representative.
2. All cables shall be properly dressed around the walls of the vaults providing adequate slack for future rearrangement and splicing. Existing ducts must not be blocked by cables.

E. Work within manholes and NMSU Tunnel system will comply with the NMSU [Confined Space Entry process and procedures](#). Due care shall be taken not to damage existing cables.

F. Contact NMSU Project Representative for typical AutoCAD details.

26 05 48 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

1.1 GENERAL

Refer to section 1613 of the latest IBC (International Building Code) to confirm any requirement for seismic restraint. Discuss requirements with NMSU Project Representative prior to proceeding with design.

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.1 GENERAL

- A. All nameplates will be fastened by rustproof screws.
- B. Panel directories will denote their source of power.
- C. Utilize NMSU Facilities and Services naming scheme for mechanical equipment, exterior lighting fixtures, etc.

- D. Refer to 26 27 26 [Wiring Devices](#) for Class 1 Critical Research labeling.
- E. The contractor will use an indelible marker to legibly inscribe the panel information that matches the panel schedule circuit number on all ceiling junction box covers and a durable tag on the cover plate of devices.
- F. Color for 208/120V Circuits:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Phase C: Blue.
- G. Color for 480/277V Circuits:
 - 1. Phase A: Brown.
 - 2. Phase B: Orange.
 - 3. Phase C: Yellow.
- H. Provide emergency power warning sign per NEC 700, as required.
- I. Label all electrical equipment.
 - 1. Distribution Equipment Designations
 - a. Distribution Equipment:
 - MDP Main Distribution Panelboard
 - EDP Emergency Distribution Panel (for distribution from generator)
 - SBDP Standby Distribution Panel
 - b. Panelboards:

<u>Branch</u>	
E	Life Safety (Code Required Emergency)
–	Normal

<u>Voltage</u>	
H	480Y/277V
L	208Y/120V

<u>Type</u>	
B	Lab (include lab room number)
D	Distribution Panel
E	Life Safety (Code Required Emergency)
L	Lighting
M	Mechanical

R Receptacle

Building Floor

0 Basements
 1 First
 2 Second...
 P Penthouse

Building Area (as required)

A, B, C...
 Or
 Contact NMSU Project Representative

Panel Sequence (as required)

A, b, c...
Or
 1, 2, 3...
 Or
 Contact NMSU Project Representative

26 05 73 Engineering Power Studies

1.1 GENERAL

- A. Short circuit Studies, Protective Device Evaluation Studies, Protective Device Coordination Studies and Flash Protection Studies will be performed by an independent firm currently involved in high and low voltage power system evaluation. The study will be performed, stamped and signed by a State of New Mexico registered professional engineer.
- B. The studies will be submitted to NMSU Project Representative prior to receiving final approval of the distribution equipment shop drawings and prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from NMSU Project Representative may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
- C. The studies will include all portions of the electrical distribution system from the designated incoming primary source or sources, the emergency and standby power source or sources, down to and including all panels and distribution equipment in the distribution system, and as required to comply with NFPA 70E. Normal system connections and those which result in maximum fault and/or arc flash conditions will be adequately covered in the study.
- D. The firm performing the study will demonstrate capability and experience to provide assistance during start up, as required.

- E. The power system studies are required to confirm the adequacy of the ratings of all electrical system components and proper coordination settings of all circuit breakers. These studies will not be used as a basis to compromise the electrical system and do not imply that short circuit ratings of distribution equipment and devices are lower than those indicated on the drawings or specified herein.
- F. The power distribution equipment manufacturer will carry in their bid to the Electrical Subcontractor, a sufficient allowance to provide modifications to the equipment, if necessary, based on the results of the studies identified herein.
- G. Perform all studies using ETAP Systems Analysis software, or approved equal by one of the following.

1.2 Coordination Study

- A. Perform coordination study to support the selection of instrument transformer ratios, protective relay characteristics and settings, fuse ratings, low-voltage circuit breaker ratings, characteristics, and settings.
- B. The study shall demonstrate that the protective devices as selected and set will ensure that the minimum unsalted load is interrupted when protective devices isolate a fault or overload anywhere in the system while satisfactory protection is provided for equipment against overloads, and short circuits are interrupted as rapidly as possible.
- C. Provide technical characteristics, manuals, time characteristic curves, etc. for each protective device along with the calculations used in preparing the study to NMSU Project Representative. Report shall be in paper as well as editable electronic format. Electronic copy shall be compatible with E-TAP Systems Analysis software.

1.3 Fault Current Studies

- A. The short-circuit current available on the primary feeder will be given to the Professional by NMSU Project Representative.
- B. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 1. Switchgear and switchboard bus.
 2. Medium-voltage controller.
 3. Motor-control center.
 4. Distribution panelboard.
 5. Branch circuit panelboard.

6. Other equipment as required.

1.4 NFPA 70E (Arc Flash Analysis) Study

- A. Calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
- B. The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
- C. Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
- D. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- E. The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584-2002, the IEEE *Guide for Performing Arc-Flash Calculations*.
- F. The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.
- G. The Arc-Flash Hazard Analysis shall include the proper settings for arc flash reduction maintenance switch(es), if specified on the project. Provide settings to avoid nuisance tripping.
- H. The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least five actual Arc-Flash Hazard Analyses it has performed in the past year.
- I. The proposed vendor shall demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
- J. The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2002 section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.
- K. Engineer shall specify or provide study on all major electrical distribution equipment and downstream distribution and utilization equipment. This shall include, but not be limited to:
 - 1. Substation(s), switchgear, and switchboards
 - 2. Distribution panelboards
 - 3. Lighting and appliance panelboards

4. Motor control centers
5. Disconnect switches
6. Controller equipment such as variable frequency/adjustable speed drives
7. Fuses and circuit breakers
8. Rotating equipment
9. Batteries
10. Generator(s)
11. Automatic transfer switches
12. Feeders

L. Provide proper labeling per NFPA 70E on all noted equipment. Coordinate study and labeling requirements with NMSU Project Representative. Label should be based on NPFA 70E requirements.

26 09 00 INSTRUMENTATION AND CONTROL FOR ELECTRICAL SYSTEMS

26 09 23 LIGHTING CONTROL DEVICES

1.1 GENERAL

Intent – NMSU designs shall strive for simple and effective methods of lighting control that is robust and easy to maintain. Lighting control panels where applicable, shall be capable of communicating via modbus, or bacnet over Ethernet . Override switch(es) shall be installed by area entrance(s).

1.2 LIGHTING CONTROLS:

- A. Interior building corridor, office, storage, individual restroom, and similar spaces shall be controlled via occupancy sensors (wallbox, wall mount, or ceiling mount Dual-technology is typically preferred, but consider whether the use of one technology over another is more appropriate. When ceiling sensors are used, other than in corridors, provide switch(es) on the load side to allow some user control. Discuss control strategy with NMSU Project Representative at schematic design phase.
- B. Interior building lighting of common spaces and certain “Egress” lights can be controlled via occupancy sensors and/or adjustable schedule. Provide timed override stations for certain spaces that may be occupied after normal business hours. Contact NMSU Project Representative for further information.
- C. Exterior building mount “Egress” lights shall be controlled through a digital astronomical clock.. No mechanical time clocks or photocells are allowed.
- D. Exterior “Site” (walkway, roadway, and parking) lights shall be controlled through a digital astronomical clock, Discuss options with NMSU Project Representative.

26 09 26 LIGHTING CONTROL PANELBOARDS

1.1 Introduction

The work covered in this section is subject to all the requirements in the General Conditions of the Specifications.

The contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

1.2 Description of Work

A. The extent of the lighting control system work is indicated by the drawings and by the requirements of this section. It is defined to include, but not by way of limitation:

1. Control electronics for switching and monitoring the status of the system
2. Associated low voltage switches, occupancy sensors and external time clocks
3. Any interface and communications hardware

B. System installation includes the following:

1. Wiring of main and branch circuit conductors
2. Installation of external control devices and wiring to the main controller
3. Installation of communications conductors and associated hardware

1.3 Quality Assurance

A. Manufacturers: Firms engaged in the manufacture of lighting control equipment and ancillary equipment, of the types indicated, whose products have been in satisfactory use in similar service for not less than five years.

B. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

C. NEC Compliance: Comply with applicable portions of the current NEC.

D. UL Compliance: Comply with current applicable UL standards,

E. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15, Subpart J for Class A applications.

F. IEC 1000: Electronic components shall meet or exceed levels specified below:

- | | |
|---|-----------|
| 1. ESD Immunity
Level 4 | IEC 1000, |
| 2. RF Susceptibility
Level 3 | IEC 1000, |
| 3. Electrical Fast Transient Susceptibility
Level 3 | IEC 1000, |
| 4. Electrical Surge Susceptibility—power line
Level 4 | IEC 1000, |
| 5. Electrical Surge Susceptibility—interconnection lines
Level 3 | IEC 1000, |

G. ISO Compliance: Must meet current accepted ISO guidelines.

1.4 Warranty

Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for at least one year from substantial completion.

1.5 Equipment

A. Standards for use are as follows:

1. Mechanical, Electrical Telecom Rooms Storage Areas, Closets; Watt Stopper TS-400- 24 Inteliswitch TS Digital Time Switch or equivalent.
2. Classrooms, Conference Room Offices and Break areas: Hubbell Wireless Lighting Controls wiHUBB or equivalent.
3. Restroom and hallways: Leviton OSC20-U0W Ultrasonic Ceiling Mount Occupancy Sensor or equivalent.
4. Janitors Closets Small rooms some offices: Leviton ODS0D-IDI Passive infrared Wall Switch or equivalent

1.6 BACnet Conformance (Option):

1. Reference BACnet Standard, ANSI/ASHRAE 135
2. Each panel controller shall, at a minimum, support serial BACnet MS/TP and Ethernet BACnet/IP communications.

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3. Each panel controller shall be able to communicate directly via BACnet RS-485 serial networks and Ethernet 10Base-T networks as a native BACnet device.
 4. Each panel controller shall comply with Annex J of Standard 135 for IP connections.
 5. Each panel controller shall function as a BACnet Application Specific Controller in accordance with Annex L of Standard 135, and shall support the following BACnet Interoperability Building Blocks:
 - a. Data Sharing - Read Property - B
 - b. Data Sharing - Read Property Multiple - B
 - c. Data Sharing - Write Property - B
 - d. Data Sharing - Write Property Multiple - B
 - e. Device Management - Dynamic Device Binding - B
 - f. Device Management - Dynamic Object Binding - B
 - g. Device Management - Device Communication Control - B
 - h. Device Management - Time Synchronization - B
 - i. Device Management - UTC Time Synchronization - B
 - j. Device Management - Reinitialize Device – B
 6. Standard BACnet object types supported shall, as a minimum, include Analog Value, Binary Value, Multi-State Value and Multi-State Output.

26 10 00 MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION

1.1 GENERAL

- A. NMSU Facilities and Services Electric Shop shall be informed of all concrete pours as they pertain to the NMSU Medium Voltage System. A visual inspection of all vault and pull box ground terminations shall be completed and approved by NMSU Electric Shop before lid is installed.
- B. All medium voltage apparatus will sit on an minimum 8'X8' vault or pad. If a vault is used then the vault lid will have "A" type anchors embedded in the concrete lid. The vault can be poured in place or be precast. MV apparatus shall not overhang the lid unless preapproved in writing by the NMSU Project Representative.
- C. Pull Boxes and Vaults will have a one piece lid. Apparatus installations will have a two piece lid with a minimum access lid size of 30" width. The vault lid will not overhang the vault without prior written approval from the NMSU Project Representative.
- D. Cable access to apparatus will be via block out in the vault lid. Block outs will be as large as possible to accommodate cable movement and installation of cable on apparatus.
- E. LECO precast 10'X10' and 8'x8' vaults for three phase applications and 44"X88" vaults for single phase applications are preapproved.
- F. The maximum distance between vaults and pull boxes will not exceed 500'.
- G. All vault applications will be set on a 12" deep by 18" wide poured in place footing with a 6" depth of ¾" gravel in the bottom when measured from the top of the footing. 2"x4" redwood timbers on 18" centers will be installed on top of the footing inside the vault.
- H. All ground connections will be made using irreversible compression crimp.
- I. Two ¾" X 10' copper clad ground rods shall be installed in opposite corners of the vault. A continuous piece of 4/0 AWG ground wire shall run the interior circumference of the vault and terminate on the ground rods. A 4/0 AWG ground wire shall also be attached to the rebar in the footing and terminate on the continuous ground wire. Apparatus mounted to the vault shall also be grounded to the continuous ground wire via a continuous piece of 4/0 AWG ground wire.
- J. Ductbank conduits shall enter vault under the lift lid where possible and not under the apparatus lid. All conduits entering the vault shall have a bell end installed and sealed with a UL listed sealing compound.
- K. Inspection and sign-off by NMSU Project representative is required prior to

and after concrete encasement

- L. The bend in the conduits entering the vault will be completely encased in 3000 PSI red concrete.
- M. All ductbank conduits will be encased in 3000 PSI red concrete with 3" of concrete on all sides of the conduits. Under roadway ductbank conduits shall be 48" to the top of the conduit. All other ductbank conduits will be 42" to the top of the conduit.
- N. All ductbanks will utilize a minimum of two 4" schedule 40 PVC conduits supported by 3" base spacer sand separated by 3" conduit spacers. Conduits will be completely covered on all sides by a minimum of 3" of 3000 PSI concrete. A metallic caution tape will be installed 18" below finished grade indicating "ELECTRICAL" conduits buried below.
- O. A 1250# mule tape will be installed in all spare conduits in the ductbank conduits.
- P. All ductbank runs will be GPSed by the contractor using control point provided by NMSU Project Representative. This information will be sent to the NMSU Project Representative before final payment can be made.
- Q. All excavated and cut areas as they relate to the installation of the conduit(s) will be returned to preconstruction condition.
- R. All equipment will be secured using approved fasteners as shown on the equipment cutsheets and or factory supplied drawings.
- S. Switches and transformers will be installed as close together as practical. Transformers that are close to the protection switch may sit on concrete pads at the discretion of the NMSU Project Representative.
- T. On elbows, switch modules, splices etc., will have a minimum of a 6' copper conductor whip for grounding to the 4/0 AWG ground wire. This additional wire can be irreversibly crimped to the grounding tail to facilitate the required 6' length.
- U. An approximate 30' loop of cable per phase will be coiled in the bottom of all vaults to facilitate termination failure.
- V. Multipoint junction modules will be installed in all vaults. Vaults with MV apparatus do not require multipoint junction modules if and only if the cables terminate on residing apparatus.
- W. For both 5-kV and 25-kV installations, the cable will be Okonite or approved equal, 100% EPR jacketed cable with 1/3 concentric copper neutral and moisture blocked aluminum conductor for underground distribution.

- X. All cable will be easily identified and marked by phase; black, red, blue for 25-kV cable and brown, orange, red, for 5-kV cable. Cable will be identified by beginning and ending point, via apparatus number, vault number, box number etc.
- Y. All rubber goods such as elbows, terminators, splices, junction modules, etc., will be preapproved by NMSU Project Representative.

26 11 00 SUBSTATIONS

26 11 16 SECONDARY UNIT SUBSTATIONS

1.1 GENERAL

- A. Indoor unit substations may be required under certain designs. Where used, these will be three-phase units equipped with a loadbreak solid dielectric switchgear, with electronic interrupter controls.
- B. High/Low voltage transformers will utilize taps, two at 2-1/2% each above and two at 2-1/2% each below normal will be provided.
- C. Indoor transformer rooms will be adequately ventilated with powered ventilators, dampers, and a suitable control system.
- D. Exterior MV/LV transformers will comply with the latest federal standards and utilize environmentally friendly insulating oils.
- E. Contact NMSU Project Representative for details specific to the transformer and its application.

26 11 17 MEDIUM VOLTAGE SWITCHES

1.1 GENERAL

- A. Medium voltage switches will be solid dielectric switchgear. All ways (pins) will be equipped with loadbreaks and fault interrupters/overcurrent protection. Interrupters will be computer programmable. A spare protected way (pin) will be included in the switch.
- B. Each switch control will operate three, single phase vacuum interrupting mechanisms and will be field set via software for single-phase or three-phase trip. . The control mechanism will include multiple TCC curve capability, ground fault trip, inrush restraint, selectable minimum response time, readout of real-time current values and USB or latest interface connection.
- C. Switch will utilize padmount enclosures, front/rear access with bushings mounted in the front and a side mounted handle for hotstick operation. The

switchgear will be capable of utilizing motor actuators for remote operation without extensive alterations. Switches will be painted desert tan and have hinged lid and grounding connections.

- D. Contact NMSU Project Representative for details specific to the switch and its application.

26 12 00 MEDIUM-VOLTAGE TRANSFORMERS

1.1 Distribution Transformers

- A. Discuss medium voltage pad-mount transformer project requirements with NMSU Project Representative.
- B. Indoor oil-filled transformer(s), will be FM approved and utilize environmentally friendly insulating oil.
- C. Where fuses are used, a complete set of spare fuses will be provided.
- D. Transformers that are loop feed will have an integral switch that can accommodate the following positions; Off, A only, A&B, and B only
- E. Transformers will be delta/wye for service loads and delta/delta for voltage changes on the main distribution system.
- F. Windings will be aluminum windings.
- G. Dry Type distribution type transformers will not be utilized in any application.

1.2 Grounding

- A. All electrical systems shall be suitably grounded, including all non-current carrying metallic components of all equipment and metallic conducts. Grounding shall be accomplished as required by the National Electric Code.

26 20 00 LOW-VOLTAGE ELECTRICAL DISTRIBUTION

1.1 GENERAL

- A. Services (480V and below)
 - 1. Equipment will be fully rated, series rated is not acceptable.
 - 2. Provide 30"x42", laminated copy of the one-line diagram(s) adjacent to the service entrance equipment. Mount in aluminum frame under plexi-glass.

3. Contact NMSU Project Representative for a list of acceptable equipment manufacturers.
4. All busing is to be copper. Specify that all lugs are to be copper or dual rated, AL7CU or AL9CU, and listed by UL for use with aluminum or copper conductors and sized to accept aluminum conductors of the ampacity specified.
5. Perform and submit voltage drop and short circuit studies. Voltage drop study shall size feeders utilizing a load equal to 80% of the overcurrent device rating. Engineer will size feeders for a maximum 3% voltage drop. Engineer will also provide information on each Panelboard advising the contractor as to the maximum length of a #12 AWG and #10 AWG branch circuit feeding a 12 A load to maintain no more than an additional 5% voltage drop. Short circuit study will utilize the feeder sizes as determined by the voltage drop study.
6. Coordinate the requirement for panic hardware on door(s) exiting the main electrical room with the architect. When required, provide true panic bar setup to allow egress without use of hands, in case of electrical burns.
7. Indicating lamps on any equipment shall be LED.
8. Electronic trip units with display must have integral power supply. Main/tie/main gear will have dual power supplies with interconnection in tie section. Power supply must be multi-tap, capable of running on 120/240 VAC, and 48/24 VDC.
9. All circuit breakers of frame sizes from 100 amperes up to 400 amperes will incorporate adjustable magnetic trip. Breakers 400 amperes and larger will incorporate electronic trip units with functions as determined by the coordination study and as required by NEC. Breaker will have cause of trip indicator targets. Trip units that utilize battery backup will have field replaceable batteries. Provide 20% spare batteries as well as full function secondary injection portable test set.

B. Service Entrance Equipment

1. Ground fault protection will be provide where required by the National Electric Code.
2. Designs for NMSU will provide the lowest possible arc flash incident energy.
3. Refer to [26 27 13 Electricity Metering](#) for requirements.
4. Refer to [26 35 33 Power Factor Correction Equipment](#) for requirements.

5. Refer to [26 43 13 Surge Protective Devices for Low-Voltage Electrical Power Circuits](#) for SPD requirements.

26 22 00 LOW-VOLTAGE TRANSFORMERS

1.1 GENERAL

- A. Provide high efficiency dry type transformer(s) meeting US Department of Energy proposed Candidate Standard Level (CSL) 3 efficiency, with extremely low no load losses.

26 23 00 LOW-VOLTAGE SWITCHGEAR

1.1 GENERAL

- A. Provide the following for any electrical equipment with draw-out breakers:
 1. Overhead-circuit-breaker lifting device, track mounted, at top front of the gear.
 2. Floor mount rolling hydraulic foot-pump platform lift as provided by switchgear manufacturer or Beech Engineering (Division of Miller Products Inc.) Model CH-2470, or approved equal by Genie, Vestil, or Wesco. Rated load of 400lbs., minimum lift height of 68", and platform measuring a minimum of 20"X20".
 3. Allow 20% spare and another 10% fully provisioned space capacity for future breakers. Critical operations, shops and research facilities may require 50 percent spare capacity, consult with NMSU Project Representative.
- B. Provide hinged doors, front and rear. Rear doors shall have hasp for padlock. Label rear doors to match the front.

26 24 00 SWITCHBOARDS AND PANELBOARDS

26 24 13 SWITCHBOARDS

1.1 General

- A. Provide hinged doors, front and, as applicable, rear. Rear doors will have hasp for padlock. Label rear doors to match the front.
- B. Provide vertical barrier between adjacent upright sections to prevent arc event from traveling through the rear of the lineup.
- C. Allow 20% spare and another 10% fully provisioned space capacity for future

breakers. Critical operations, shops and research facilities may require 50 percent spare capacity, consult with NMSU Project Representative.

26 24 16 PANELBOARDS

1.1 General

- A. Provide “door-in-door” hinged front cover.
- B. Panels shall have complete bus and mounting hardware requiring only the installation of additional breakers for future expansion.
- C. Allow 20% spare and another 10% fully provisioned space capacity for future breakers. Critical operations, shops and research facilities may require 50 percent spare capacity, consult with NMSU Project Representative.
- D. Distribution Panels
 - 1. Consider second level of SPD, if panel feeds sensitive or critical loads.
- E. Branch-Circuit Panels
 - 1. Group installed panelboards will have separate trim.
 - 2. All circuit breakers in utilization panelboards will be of the bolt-on type.
 - 3. Specify that the electrical contractor will coordinate final room name and numbering with NMSU Project Representative prior to submitting panel schedules for approval. Circuits feeding exterior lighting will utilize the 3-letter labeling scheme as directed by NMSU Project Representative .
 - 4. Panelboard Installation:
 - a. Panels serving loads in only one room may be located in that room.
 - b. Panels serving more than one room will be located in an electrical closet, corridor, or other accessible space.
 - c. Do not install panelboards in janitor closets, storage rooms, or dedicated telecom rooms.
 - d. Where flush panelboards are used, install a 3/4-inch conduit for every three spare poles to a point above the suspended ceiling.
 - e. Specify green ground wire with all circuits.

F. Controlled Breaker Panels:

1. Refer to [Lighting Control Devices](#) in section 20 09 00 and to the [BAS Specification](#) for luminaire control requirements.

G. Lab Panels – limit available short-circuit current to under 10,000 AIC.
Discuss current-limiting solution with NMSU Project Representative. Provide main breaker, door with lock, and tamperproof screws.

H. All panels shall have a panel schedule that is complete and correct at time of acceptance.

26 24 19 MOTOR-CONTROL CENTERS

1.1 General

A. Motor Control Centers

1. Structures will be totally enclosed, dead front, free standing. Provide guide rails for control units, accessible wireways and terminal blocks for control wiring. All equipment will be in compliance with latest edition of NFPA 70E.
2. Each starter will have two normally open and two normally closed auxiliary contacts wired to the terminal blocks, hand, off, auto switch, green run light, red off light. All indicating lamps will be LED.
3. All control voltage will be 120 volts.
4. The motor control center will be sized for a minimum 25 percent spare capacity, minimum 1 bucket space per upright. Size spaces to accommodate, at minimum, one (1) each of the largest starters provided. It will be complete with buss bar, rails, wireways and other appurtenances so that other than new starters, no additional hardware is required for future expansion.
5. All internal control wiring to terminate at screwed terminal strips, properly identified for connecting field control wiring.

26 25 00 ENCLOSED BUS ASSEMBLIES

1.1 General

- A. Contact NMSU Project Representative for approval.

26 26 00 POWER DISTRIBUTION UNITS

1.1 General

- A. Provide units with electrical metering, networked via BACNet or Modbus that can be accessed via a web browser.

26 27 00 LOW-VOLTAGE DISTRIBUTION EQUIPMENT

26 27 13 ELECTRICITY METERING

1.1 General

Building electrical metering equipment will be provided by NMSU Project Representative; this includes meters, submeters, I/O cards, and Ethernet cards or gateways and protection devices.

26 27 26 WIRING DEVICES

1.1 General

A. All Cover Plates

- 1. Utilize stainless steel cover plates for all devices and locations.

B. Receptacles

- 1. Receptacles will be rated 20A, specification grade. Install with ground pin up or left.
- 2. All requirements for special receptacles will be discussed with NMSU Project Representative.
- 3. Receptacles will be provided at least every 50 feet, in all corridor areas, for operation of floor care equipment.
- 4. Class 1 Critical Research – provide dedicated twist-lock receptacle on “Standby” (NEC 702 optional standby systems) system power. Provide equipment with a twist-lock cord and cap assembly including an engraved brass tag (consult with NMSU Project Representative for labeling). Engrave outlet cover to read “Class 1 Emergency Power” and the panel/circuit feeding the load. Any load with this designation must be reviewed and approved by NMSU Project Representative.
- 5. Consult with NMSU Project Representative for media related requirements.

C. Switches

1. Local wall switches will be heavy duty, specification grade, quiet operating rocker or toggle type, 20A, 120/277V.
2. Require labeling of switch cover plate for three (3) or more devices ganged together.

D. Device Color Coding:

1. Wiring Device Connected to Emergency Power System: Red.
2. SPD Receptacle: Blue.
3. Isolated-Ground Receptacle: Orange
4. Other Type: as approved by NMSU Project Representative.

E. Handicap Access Devices and Locations

1. One handicapped door operator with requisite power outlet will be provided at a minimum of one (1) exterior door
2. Provide handicap door operator activation devices and controllers
3. NMSU Project Representative will determine if Bollards are required to hold door activation device.

26 28 00 LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

26 28 23 ENCLOSED SWITCHES

Consult with NMSU Project Representative for compatibility requirements.

26 28 26 ENCLOSED CIRCUIT BREAKERS

Consult with NMSU Project Representative for compatibility requirements.

26 29 00 LOW-VOLTAGE CONTROLLERS

26 29 13 VARIABLE-FREQUENCY MOTOR CONTROLLERS

Refer to [NMSU Variable-Frequency Drive](#) specification. Only VFDs with less than 3% Total Harmonic Distortion (THD) are acceptable drive.

26 30 00 FACILITY ELECTRICAL POWER GENERATING AND STORING EQUIPMENT

1.1 Essential (Emergency and Standby) Power Systems

- A. Emergency power source at NMSU Main Campus will be the essential bus. This applies to research buildings and utility systems. Coordinate availability with NMSU Project Representative.
- B. Where the essential bus is not available an engine driven generator will be provided. Emergency system distribution voltage should be 480Y/277V or 208Y/120V for three phase installations (greater than 50 KVA) and 240/120V for single phase installations (less than 50 KVA). For further requirements, refer to [26.32.13 Engine Generators](#).
- C. Wiring from each branch of the essential power systems will be kept separate from each other and the normal power system.

1.2 Life Safety Power

- A. The Life Safety (NEC 700, code required emergency systems) power source at NMSU Main Campus will be the campus “emergency” cable system (4160Y/2400V) wherever possible. Coordinate availability with NMSU Project Representative.
- B. When provided by NMSU “emergency” cable, installation will include:
 - 1. Primary fused disconnect switch with current limiting fuses and lighting arrester
 - 2. Dry type, high-efficiency transformer
 - 3. Secondary overcurrent protection
 - 4. [Transfer switch](#)
 - 5. Provide provisions for power meter (meter provided by NMSU). Provisions will match those as noted in [Electricity Metering](#) section.
- C. Life Safety service Loads will include, but not be limited to:
 - 1. Egress lighting
 - 2. Exit signage
 - 3. Fire alarm system
 - 4. Sprinkler equipment
 - 5. ICT equipment

6. Building Automation System infrastructure equipment

1.3 Critical Power

- A. Installation only to occur when approved by NMSU Project Representative. The Critical Branch (NEC 701, legally required standby systems) power source at NMSU Main Campus will utilize the campus essential bus(4160Y/2400V), wherever possible. Coordinate availability with NMSU Project Representative.
- B. When provided from the essential bus, installation will include same components as the [Life Safety Power system](#).
- C. Critical service Loads will include, but not be limited to:
 - 1. Elevator, but only when required by AHJ
 - 2. Animal rooms
 - 3. Other loads as required by AHJ

1.4 Standby Power

- A. The Standby Branch (NEC 702, non-required standby systems) power source at NMSU Main Campus will utilize the campus essential bus (4160Y/2400V) wherever possible. Coordinate availability with NMSU Project Representative .
- B. When provided from the essential bus, installation will include same components as the [Life Safety Power system](#).
- C. Standby service loads will include, but not be limited to:
 - 1. Class 1 (irreplaceable) research loads will be determined by each College. Utilize dedicated breaker and single twist-lock receptacle per “Devices” section. Coordinate these loads with the NMSU Project Representative so that they can be numbered and tracked.

26 30 10 EMERGENCY POWER SYSTEMS

Building emergency power will be supplied by emergency generator where required or when not required by a dedicated Emergency Inverter System.

- A. Fire alarms and building security, fire protection and communications equipment should be tied into the dedicated Emergency Inverter System; this does not eliminate the need for batteries. Inverter system batteries will be tested to indicate amp hour availability.

- B. Wiring for emergency systems will be in separate conduits. Specify that all emergency system junction boxes and covers will be painted red.

26 32 00 PACKAGED GENERATOR ASSEMBLIES

26 32 13 ENGINE GENERATORS

1.1 General

- A. When use of a generator is approved by NMSU Project Representative, coordinate manufacturer, silencer type, fuel type, amount of fuel storage, and other options.
- B. Equipment will not be installed on building roof or other locations that are difficult for service and replacement.
- C. Consider paralleling equipment to allow for testing under load and demand side reduction.
- D. Equipment will be equipped with electronics capable of interfacing with an energy management system via BACnet communication protocol. Check with NMSU Project Representative for communication substitutions.
- E. Specify a 2 year full coverage warranty.
- F. Coordinate monitoring requirements with the [BAS Specification](#).
- G. Emissions for internal combustion engines rated at greater than 100 brake horsepower – NMSU Main Campus has a Title V Air Quality Permit, which sets limits on the total annual emissions, and requires documentation and testing of all fuel-burning equipment.

26 35 00 POWER FILTERS AND CONDITIONERS

26 35 53 POWER FACTOR CORRECTION EQUIPMENT

1.1 General

- A. Building power factor shall be, at minimum, 0.95 lagging. Provide central dynamic PF correction at each normal power service entrance as a deduct alternate (estimate the amount of capacitance required and dedicate floor space in the main electrical room).
- B. For main-tie-main systems, provide separate dynamic PF correction at each end, each not less than 0.95 lagging when feeding each side of the gear separately. Specify a second set of CT's, one (1) on each side of the tie breaker, connected in parallel with the CT on its side of the main. Each "tie"

CT must be wired in reverse polarity to the main so that the system works properly with the tie closed.

- C. Final capacitor selection shall occur within 6 months after building occupancy and will be based upon actual field measurements at that time.
- D. Coordinate sizing with NMSU Project Representative.

26 36 00 TRANSFER SWITCHES

1.1 General

- A. Transfer switch will have the capability to monitor via communications interface to the central energy management system. Request communications protocol through NMSU Project Representative. Transfer switch will include capabilities for monitoring “normal source acceptable”, “emergency source acceptable” and “switch status”. [BAS Specification](#)
- B. Typically, provide solid neutral connection and open transition without delay. Discuss the following options with NMSU Project Representative:
 - 1. Overlapping neutrals on systems with ground fault protection
 - 2. Closed transition (for generator systems only)
 - 3. Paralleling
 - 4. Delayed transition
 - 5. Bypass Isolation (for buildings requiring maintenance without interruption)

26 40 00 ELECTRICAL AND CATHODIC PROTECTION

26 41 00 FACILITY LIGHTNING PROTECTION

1.1 General

- A. Consult with NMSU Project Representative to determine if a lightning protection system is required.
- B. System components will be copper.
- C. System installation will be concealed within the building structure.
- D. Design per NFPA 780 and require a U.L. Master Label.

26 43 00 SURGE PROTECTIVE DEVICES

26 43 13 SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

1.1 General

Service Entrance – Provide SPD at each building service. Unit should typically be 240 kA per phase, 120 kA per mode (including all phases and phase to ground), but confirm actual rating with NMSU Project Representative. Unit to have disconnect and field replaceable MOV’s. Integral mounting within the service entrance equipment is preferable, but surface mounting is acceptable as approved by NMSU Project Representative (keep the leads to the bus 60 inches or less). Unit will comply with most recent edition of UL 1449 and UL 1283.

26 50 00 LIGHTING

26 51 00 INTERIOR LIGHTING

1.1 Lighting Design

- A. Maximize the use of best combination of efficiency and lumens. Utilize different lamp styles and wattages to promote extended life and low cost of operations.. www.ceel.org
- B. The professional shall submit two (2) digital copies of computer generated point-by- point calculations of most interior spaces to NMSU Project Representative for review. The use of certain “typical” rooms shall be acceptable except when the amount of fenestration or the room orientation changes. Show calculations for each space without daylight contribution as well as with daylight contribution and lighting controls. Point levels shall be legible shown on a scale drawing. All pertinent calculation parameters shall be indicated and highlighted where non-IES compliant. NMSU Project Representative will provide direction and variance where deemed adequate. Utilize AGI-32 full calculation mode or similar program or as approved by NMSU Project Representative.
- C. The current edition of Illuminating Engineers Society Lighting Handbook shall be used as a standard for lighting levels. For television studios and classrooms used for TV production, consult NMSU Project Representative for guidelines.

Space Type	Lighting Level Range (fc)
Classroom	30-50
Science Lab	50-70
Library	30-50
Office	30-50
Computer Lab	3-30
Corridor/Common Space	10-20



Gym (recreational)	30-50
Gym (competition)	50-100
Gym (NCAA broadcasting)	100-150
Cafeteria	10-20
Kitchen	30-50
Pool	5-50
Parking Garage	10-20
Restroom	5-15
Mechanical Room	20-50

- D. All fixtures will be LED.
- E. Provide two (2) digital copies of a light fixture cutsheet booklet with any submittal showing lighting layouts. Booklet shall be in color and include the light fixture schedule as well as proposed lighting controls.
- F. Specify the proper disposal of high mercury content lamps and PCB ballasts with NMSU EH&S. Coordinate electrical hazard waste disposal on all renovation work with NMSU EH&S.
- G. Emergency egress lighting will be connected to the continuous lighting circuit or will have individual battery packs. NMSU Project representative will determine if the continuous lighting circuit is available. This includes buildings that have emergency generators, as these fixtures provide adequate lighting in case of power failure. Lighting will utilize LED in these instances.
- H. Custom designed/manufactured luminaires will not be used in new or existing construction unless the complete unit is UL listed.
- I. LED drop-in troffers will have opposite corners securely supported from and directly attached to building structure so as to comply with luminaire mounting requirements in NEC 410 independent of any support provided from the suspended ceiling grid. All fixtures recessed or other will be directly attached to the building structure using reusable bolt/screw type hardware.

1.2 Lamps

- A. LED fixtures will qualify under ENERGY STAR or Design Lights Consortium (DLC).
- B. LED lamps will typically incorporate a 3500 degree Kelvin temperature and a minimum CRI of 80 or higher. Only lamps that are approved and listed by CEE (Consortium for Energy Efficiency) will be utilized in fixture installations.
- C. The use of incandescent lamps is not allowed in any installation.

- D. Contractor will obtain all similar lamp types through one source from a single manufacturer.
- E. Lamp Orientation: All lamps will be specifically rated for the burn position in which they are used. Universal burn lamps are only acceptable in luminaires that will require aiming that will result in a lamp orientation that is neither vertical nor horizontal.
- F. Use LED fixtures that can be dimmed via digital controllers.
 - 1. Frequent switching applications.

.3 Luminaires

- A. All fixtures will be LED.

.4 Installation

- A. 2x2 luminaires will be installed such that diffusers are aligned in the same relative orientation from one fixture to the next.
- B. The current edition of Illuminating Engineers Society Lighting Handbook shall be used as a standard for lighting levels. For television studios and classrooms used for TV production, consult NMSU Project Representative for guidelines.

26 52 00 EMERGENCY AND EGRESS LIGHTING

- A. Emergency egress lighting will be connected to the continuous lighting circuit or will have individual battery packs. NMSU Project representative will determine if the continuous lighting circuit is available. This includes buildings that have emergency generators, as these fixtures provide adequate lighting in case of power failure. Lighting will utilize LED in these instances.
- B. Will be integrated into the overall lighting scheme without requiring separate fixtures.
- C. Exit lights shall utilize LED lamping.
- D. Self-powered exit signs should be provided with sealed maintenance free batteries.
- E. Identified Egress Paths (i.e. hallways, stairwells and assembly areas) must meet both currently adopted code requirements for minimum illumination levels when normal power is not available to allow easy and safe egress for the area involved.
- F. Switches for emergency lighting circuits shall not be accessible to the public.

26 55 36 EMERGENCY LIGHTING

1.1 General

- A. Each building shall be equipped with an egress lighting system as required by the State of New Mexico or other applicable code(s).
- B. Provide emergency lighting along the path of egress, including the exterior of a building and ending at a public way (or as approved by NMSU Project Representative).
- C. All egress lighting (which includes stairwell lights, exit lights, selected corridor lights), fire extinguisher identification lights, and elevator cab lights will operate twenty-four (24) hours a day and will be connected to the Life Safety panel. There may be some deviation from this depending on the type emergency lighting installed and the amount of daylight available in any given space.
- D. Battery backup type emergency lighting shall be utilized in all new construction for emergency egress lighting installations. Fixtures will utilize LED.
- E. Stairwells, lobbies, hallways and entrances will have ample lighting to allow for night cleaning.

26 53 37 EXIT SIGNS

1.1 General

- A. Exit lights will be red LED and have stencil face with red letters. Flush mount types are desirable because they are more vandal-proof. Consider vandal-resistant models for residence hall design.
- B. Exit lights should utilize battery backup in emergency conditions.
- C. Self-contained exit signs powered by a radioactive source (tritium or similar) are not acceptable.
- D. Exit signs will be installed at all exits of a building.

26 58 00 EXTERIOR LIGHTING

1.1 General

- A. Roadway and Open Parking Area Lighting

1. Light Source: Light sources for roadway and open parking area lighting will be of the LED.
2. Luminaire: Luminaire shall utilize a cut-off optical assembly and an IES distribution as required to maintain recommended lighting and uniformity levels. Luminaires will conform to a “cobrahead” design with voltage requirements as directed by NMSU Project Representative.
3. Pole: Poles will be sized to the area that is to be lit. Poles shall be Ameron Valley Red with anti-graffiti coating. The pole arm shall be painted light gray. The contract Professional will coordinate final height of poles with local ordinance stipulations and other University requirements. Preapproved poles are Ameron spun concrete. Poles utilized in areas other than parking lots will be direct burial type. Use of poles lower than 8 ft above finished grade is discouraged and must be approved by NMSU Project Representative.
4. Concrete Base: Parking Lot lighting poles will utilize a concrete base with rebar reinforcement and embedded anchor bolts, and will be designed to support the pole and luminaire assembly utilizing local wind load parameters and assembly effective projected area (EPA). Bases will protrude 30” above grade where damage from vehicles is possible. Above grade concrete will be finished smooth.
5. Contact NMSU Project Representative for typical design detail drawing.
6. Illumination Levels:
 - a. Roadway and open parking area illumination levels will comply with the following. Areas not covered herein will comply with the latest IES recommendations. Roadway illumination levels outside of core campus will be reviewed with NMSU Project Representative. Lower average levels may be acceptable.

ROADWAYS		
	Avg Maintained FC (Min)	Avg/Min Ratio
Roadway Illumination @ Grade	1.50	3 : 1

BUS PULL-OFF AREAS		
	Avg Maintained FC (Min)	Avg/Min Ratio
* Bus Pull-Off Area Illumination @ Grade	2.50	3 : 1

* Bus pull-off area shall include the area of roadway traversing the length of the bus pull-off and all roadway pedestrian crosswalks within the area of the pull-off.

EXTERIOR OPEN PARKING FACILITIES				
	General Parking & Pedestrian Areas		Vehicle Use Only	
Activity	Min FC @	Avg/Min	Avg FC	Avg/Min Ratio

Level	Grade	Ratio	@ Grade	
High	0.9	4 : 1	2.0	3 : 1
Medium	0.6	4 : 1	1.0	3 : 1

7. Calculations – The professional will submit two (2) copies of computer generated point-by-point calculations to NMSU Project Representative for review. Point levels will be legible and plan to scale. All pertinent calculation parameters will be indicated and highlighted where non-compliant. NMSU Project Representative will provide direction and variance where deemed adequate.

B. Walkway Lighting:

1. Light Source: All fixtures will be LED. Source will provide a minimum color rendition index (CRI) of 92 and a Kelvin temperature of 5000. Where sidewalks are adjacent to roadways, the roadway light source will be deemed acceptable where the minimum lighting levels are satisfied. Otherwise, the contract professional will review alternatives with NMSU Project Representative.

2. Illumination Levels:

- a. Walkway area illumination levels will comply with the following. Areas

not covered herein will comply with the latest IES recommendations. Walkway calculation areas (distant from roadways) will include a 6 ft area bordering the walk on each side, illuminated to a level of one-third the levels suggested for walkways for additional pedestrian safety. Walkways leading to a building entrance will be designed for the specified walkway illumination levels, and not the levels set forth by IES Building Entrance requirements.

Walkway Classification	Avg Maintained FC @ Grade (Min)	Avg Vertical FC @ 6Ft Above Grade	Avg/Min Ratio
Roadside Walkways	1	1.5	4 : 1
Walkways Distant from Roadways	0	0.5	4 : 1

4. Calculations:

- a. The contract professional will submit two (2) copies of computer generated point-by-point calculations to NMSU Project Representative for review. Point levels will be legible and plan to scale. All pertinent calculation parameters will be indicated and highlighted where non-compliant. NMSU Project Representative will provide direction and variance where deemed adequate.
- b. Coordinate the method of calculating the vertical footcandle requirement for Walkways with NMSU Project Representative.

5. Façade Lighting – Do not light the building façade unless otherwise approved by NMSU Project Representative.

1.2 “Site” (Walkway, Roadway, and Parking) Lighting Circuitry

- A. All underground circuitry will be installed in 2” PVC schedule 40 conduit with burial depth of 24” below finish grade, or as directed by NMSU Project Representative.
- B. Where multiple phases of power are utilized for circuit, luminaires will be connected to alternate phases (to neutral) throughout run.
- C. A direct buried handhole will be installed adjacent to the base of each concrete pole base. Handholes installed in finish grade areas will be, minimum 12” x 14” tier 22 concrete composite box, with open bases. Provide heavy-duty

bolted covers where subject to vehicular activity.

- D. Provide in-line waterproof fuseholders with appropriate fuse for each luminaire, installed in handhole serving the pole. Fuse holders will be similar to Bussman HE Style or equivalent.
- E. Provide 5/8" x 8' copper clad ground rod for each pole, installed inside direct buried handhole. Rod will be connected / bonded to equipment ground and pole grounding lug, where applicable.
- F. All wiring connections made at or below grade will be waterproof with UL listed waterproof geltap type connectors .
- G. Run separate circuit(s) to each type of lighting (roadway, parking, and walkway). Refer to " Lighting Control Devices " in Section 26 09 00.
- H. Contact NMSU Project Representative for typical AutoCAD details.



26 60 00 COMMUNICATIONS WITH RESPECT TO THE ELECTRICAL CONTRACTOR

1.1 General

- A. All new communication installations shall follow the TIA/EIA Telecommunications Building Wiring Standards: TIA/EIA – 568 Commercial Building Telecommunications Cabling Standard Part 1 & 2; TIA 569 Commercial Building Telecommunications Pathways and Spaces; TIA 758 Consumer-Owned Outside Plant Telecommunications Infrastructure Standard. The NMSU Guidelines are meant to reinforce the industry standards and in some cases apply even stricter standards. If any discrepancy with TIA/EIA specifications is found the more stringent specification shall apply.
- B. The NMSU Information and Communication Technologies (ICT) office is responsible for telecommunications wiring specifications. Installation subcontractors must be prequalified by the ICT office. NMSU ICT has the right to reject any subcontractor who is not prequalified prior to bidding.
- C. A Category 6 wiring installations requires that telecommunication equipment connected to the outlet not exceed 100 meters in cable length distance from the electronics located in the telecomm room. Therefore telecommunications pathways shall not exceed 90 meters from telecomm room to the outlet.
- D. All cable trays, conduits, J-hooks, cable rings and outlet boxes must be installed before telecommunications wiring installations begins. Pull strings must be included in all conduits.
- E. The environment of telecomm rooms shall be equivalent to that of an office which is heated and cooled by the building HVAC system. Maximum heat gain per room shall be 52850 BTU/hr. Telecomm rooms shall be sized according to ETA/TIA – 569; typically 100 square feet with no walls measuring less than 6 feet in length. The room shall have finished floors and walls.
- F. A minimum of two 4'X8' sheets of ¾" AC grade plywood (fire treated on all sides and unpainted) shall be mounted to the wall in every telecomm room. Conduits shall terminate either directly above or directly below the plywood backboard to minimize routing of riser cables and station cables around BET or IDF. It is the responsibility of the electrical contractor to install this backboard in all telecomm rooms when electrical work is being performed. A minimum #6 AWG ground shall be utilized to ground all communications equipment including cable trays and Building Service Entrance Ground Busbar.
- G. The minimum ceiling height in the room shall be 8 ft without obstructions. The height between the finished floor and the lowest point in the ceiling shall be a minimum of 10 ft to accommodate taller frames and overhead pathways.

- H. Doors shall be a minimum of 36 inches wide and 80 inches high without doorsill, hinged to open outward (code permitting) or side-to-side or be removable. The door shall be fitted with a lock.
- I. Suspended ceiling shall not be provided within the telecomm room. In such cases where fire-proofing may be sprayed onto the exposed ceiling, the fire-proofing shall be treated to mitigate airborne dust.
- J. Lighting shall be a minimum of 500 lx (50 foot candles) measured 3 feet above the finished floor in the middle of the aisles between cabinets and racks. Lighting shall be controlled by one or more switches and shall not be powered by the same electrical distribution panel as the telecommunications equipment in the telecom room. Dimmer switches shall not be used.
- K. Furniture with integrated cable management shall be coordinated with the telecommunications design in order to mate-up with outlet box locations, so that telecommunications station cabling may enter the furniture without being exposed.

END OF DIVISION 26



DIVISION 27 – COMMUNICATIONS

See Volume #3 and <https://telecomm.nmsu.edu/communications-cabling-design-documents/>

END OF DIVISION 27

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

See <https://telecomm.nmsu.edu/communications-cabling-design-documents/>

28 23 00 VIDEO SURVEILLANCE

- A. Exterior security cameras shall be shown if required.
- B. Must comply with NMSU Security Camera policy.

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Video Recording Server
- B. Cameras and Accessories
- C. Cabling

1.2 REFERENCES

- A. NFPA 70 – National Electrical Code.
- B. Electronic Industries Association (EIA) Video Surveillance Equipment Standards.
- C. Open Internet Video Interface Forum (ONVIV) Standards.
- D. Institute of Electrical and Electronics Engineers, Inc. Standards.
- E. NMSU Design Guidelines.
- F. NMSU ARP 16.03 – Regulation of Security Cameras on University Premises.

1.3 SYSTEM DESCRIPTION

- A. This section describes the furnishing, installation and commissioning of a partial or complete IP-based security camera system.
- B. Camera selections will be approved by the NMSU Police Chief (or designee) and the ICT Network Engineer prior to installation.
- C. Product Data Submittal: Provide manufacturer’s technical product specification sheet for each individual component. Submitted data will show the following:
 - 1. Compliance with each requirement of these documents.

2. All component options and accessories specific to the project.
 3. Power Over Ethernet (POE) power consumption in Watts per camera.
 4. Cabling to be used will be Cat 6 or Cat 6A, reference NMSU Division 27.
 5. Number of IP addresses that will be required from NMSU ICT department.
- D. Contractor to provide drawings showing camera locations and field of view for each camera.
- E. NMSU Personnel requesting security cameras must have NMSU Security Camera Proposal and Justification Form completed (link at NMSU ARP 16.03).

PART 2 – PRODUCTS

1.1 VIDEO MANAGEMENT SYSTEM (VMS)

- A. The VMS to be used is Panasonic Video Insight software. All cameras provided by the contractor will be compatible with the Panasonic Video Insight software.
- B. Only Axis or Panasonic IP network cameras will be allowed on NMSU VMS platforms.
- C. Cameras will be provided by contractor.
- D. Contractors will be responsible for completing product warranty registration(s).
- E. Cameras will fully support IPv4 and static IP addressing.
- F. Cameras will have adjustable frame rates.
- G. Cameras will be able to transmit in H.264.
- H. All cameras will be vandal resistant.
- I. All cameras will be capable of day and nighttime recording. Infrared illuminators may be required to ensure image quality.
- J. Indoor cameras will be powered by POE or POE+ network switches. (No power injectors).

- K. Outdoor cameras should be powered by POE or POE+ switches. Approval to use power injectors for “special” cameras must be approved by NMSU Police Chief and ICT Network Engineer.
- L. Outdoor cameras will be certified to operate between -30°C to +50°C (-22°F - +122°F).
- M. Cameras will be able to support time stamping.
- N. Cameras that support audio recording will be able to have this feature disabled through its web interface.
- O. Cameras will support motion detection and be adjustable using its web interface.
- P. Cameras will be of manufacturer’s official product line designed for commercial/industrial 24x7x365 use.
- Q. All camera locations will be shown in construction drawings.

PART 3 – EXECUTION

1.1 INSTALLATION LOCATIONS

- A. Security cameras will be installed in the following locations:
 - 1. Entrances to buildings.
 - 2. Loading dock and receiving areas.
 - 3. Exterior points that have views of the building curtilage.
 - 4. Areas that have safes or currency handling.
 - 5. Areas containing large amounts of hazardous materials.
 - 6. Areas with valuable items (i.e. artwork, service vehicles).
 - 7. Firearm storage areas

1.2 CABLING

- A. Provide all cabling as required to install security cameras.
- B. All cabling installed will be performed in accordance with NMSU Division 27.

1.3 ALL RACEWAYS AND CABLING WILL BE INSTALLED IN ACCORDANCE TO THE FOLLOWING:

- A. NFPA 70-National Electrical Code.
- B. A minimum ¾" conduit is required.
- C. All raceway will use approved connections at each end and be properly connected to an approved box or fitting.
- D. All security camera hardware raceway and cabling will be concealed and installed in a workman-like manner.

1.4 NETWORK CONNECTION

- A. Contractor must supply camera locations, MAC address and login credentials for each camera to NMSU ICT.
- B. ICT will supply camera name and IP address for each camera to contractor.
- C. Contractor will program camera with correct IP address and name.
- D. ICT will provide POE switch port and add camera to the VMS.

1.5 TESTING

- A. Check camera field of view, coordinate camera field of view with contractor.
- B. Check video quality and make adjustments as needed.

28 31 00 FIRE DETECTION AND ALARM

- A. Systems must comply with NMSU Fire Department Fire Alarm Systems General Notes. Contact NMSU Project Representative for General Notes.
- B. Fire alarm systems will be of the “addressable” type. They will be complete with all necessary hardware, software, and memory specifically tailored for the installation. It will be possible to permanently modify the software on site by using an appropriate external device. . The system will consist of, but not be limited to, the following:
 - 1. Fire Alarm Control Panel
 - 2. Remote Annunciation
 - 3. Addressable manual fire alarm stations
 - 4. Addressable area smoke detectors, with sensitivity/maintenance alert

5. Beam detectors
 6. Addressable duct smoke detectors, with sensitivity/maintain alert
 7. Addressable heat detectors
 8. Sprinkler waterflow alarm switches
 9. Audible notification appliances
 10. Visual notification appliances
 11. Air handling systems shutdown control
 12. Smoke exhaust systems startup control
 13. Magnetic door holder release
 14. Sprinkler supervisory switches and tamper switch supervision
 15. Fire pump supervision
 16. Elevator recall
 17. Elevator lobby Smoke control systems.
 18. Utility shunts
 19. Clean Agent Systems
 20. Kitchen Hoods suppression systems
- C. Fire alarm shop drawings shall be reviewed and approved by the design engineer, and NMSU Project Representative.
- D. The contractor will coordinate with NMSU Project Representative prior to start of work on any new or existing fire alarm system.
- E. Contractor will advise the NMSU Project Representative that a fire alarm system may be out of service. Contractor must give the NMSU Project Representative 21 day notice as per FS Outage and Impairment policy.
- F. The architect must consider the location of future furnishing and NFPA 72- National Fire Alarm and Signaling Code when locating fire alarm/notification devices. Consideration must be given to furnishings obstructing the devices.

- G. Ensure full point address testing between building system and NMSU system is included in the specifications and performed prior to acceptance. All fire protection systems will receive a 100% device/operational test, performed by the installing contractor and witnessed by an NMSU Project Representative. The test will include activation of each pull station, smoke detector, flow/tamper switch, alarm notification device and connection through the fire alarm panel to NMSU dispatch.
- H. The system contractor will coordinate work with all related trades to comply with NFPA 70 – National Electric code and NFPA 72- National Fire Alarm and Signaling Code.
- I. **Warranty.** Manufacturer shall guarantee the system equipment for a period of one(1) year from the date of final acceptance of the system. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of acceptance of the system. Upon completion of the installation of fire alarm system equipment, the electrical contractor shall provide to the architect a signed written statement substantially in form as follows: “The undersigned, having engaged as the Electrical Contractor on the (name of project) confirms that the fire alarm system equipment was installed in accordance with the wiring diagrams, instructions and directions provided to us by the manufacturer.”
- J. All notifying appliance circuits (NAC) and signaling line circuits (SLC) will be complete as shown on drawings. Initial device loading will not exceed 80% of loop capacity for future expansion.
- K. Fume hood air flow sensors will not be tied to the fire alarm panel without approval from the Authority Having Jurisdiction (AHJ).
- L. Manufacturers. FireLite, Silent Knight, Notifier, EST, Simplex, Pyrotronics, or approved substitute. . If a proprietary system is deemed appropriate by the Authority Having Jurisdiction (AHJ), the Contractor would need to support in-house training and certification of NMSU personnel on the system.

28 31 13 FIRE DETECTION AND ALARM CONTROL, GUI AND LOGIC SYSTEMS

- A. Main fire alarm panel location will be indicated and approved by AHJ.
- B. All FA systems will be the addressable type. Each device will report in as a separate address. The contractor will be responsible for programming the address according to the needs of NMSU Alarms.
- C. This theory of operation is provided for the designers information:
 - 1. Actuation of any manual fire alarm station or automatic detector will sound

all audio/visual alarms and trip the master fire alarm panel.

2. Actuation of automatic detectors in the elevator lobbies, shaft, or equipment room will sound all audio/visual alarms, trip the master fire alarm panel, and activate the elevator emergency systems as per International Fire Code .
3. Activation of a HVAC unit smoke detector will sound all audio/visual alarms, trip the master fire alarm panel and shut down the HVAC unit through the temperature control system.
4. Actuation of a sprinkler flow switch will sound all audio/visual alarms and trip the master fire alarm panel.
5. Closure of any sprinkler system valve or the PIV valve will report as a supervisory signal.
6. Closure of HVAC “dampers” will report as a supervisory signal.

28 31 23 FIRE DETECTION AND ALARM ANNUNCIATION PANELS AND FIRE STATIONS

- A. Remote annunciator(s) will be shown and approved by AHJ.
- B. The manufacturer must have received prior approval of their fire alarm system before their system will be considered for use. Prior approval submittal will include system operation description, equipment cut sheets, typical wiring diagrams and code analysis.
- C. Applicable Codes and Standards. All equipment will be UL listed for its intended use. Installation of equipment and operation of, will comply with NFPA 72, the National Electric Code, all other local codes and authorities having jurisdiction.
- D. Circuit Identification Nameplates. All circuit breakers related to the fire alarm system will have a red marking, be identified as “Fire Alarm Circuit Control”.
- E. Include in the technical requirements that an allowance of \$10,000 (or a quantity of 20% of those shown on drawings) for additional contractor furnished fire alarm signals beyond those required by the documents or approved shop drawings. The installation will occur after initial testing and in areas where signals cannot be heard properly. The system’s capacity and battery system will be sized to accommodate the extra (20%) devices.
- F. Specify spare parts for the system. The spare parts will directly interchange with the corresponding components as furnished in the installed systems. Spare parts and accessories will be suitably packaged and identified by nameplate, stamping or tagging. Provide the following spare parts and

accessories.

1. 1 spare pull station
2. 1 spare horn/strobe
3. 1 spare “module”
4. 1 spare of each type of smoke detector installed (ion, photo) and heat detector.

G. The contractor will furnish a list of all other spare parts and accessories which the manufacturer recommends to be stocked for maintenance of the system.

28 31 33 FIRE DETECTION AND ALARM INTERFACES

28 31 33 13 FIRE DETECTION AND ALARM INTERFACES TO REMOTE MONITORING

- A. Central Station Dialer. Furnish and install digital alarm dialer, which is compatible with the NMSU central station alarm reporting system, (Contact ID format).
- B. Tests:
 1. All systems must be installed and tested per NFPA 72.
 2. The entire fire alarm system shall be tested and adjusted under the supervision of a factory-trained representative of the manufacturer. Any defects will be corrected at once and the test re-conducted.
 3. After the completion of the installation and supplier’s testing, the entire system, devices, wiring, and equipment will be completely tested in the presence of the architect’s representative, the NMSU Fire Department, and the facility owner. If the system fails to pass this inspection, the contractor will be liable for all additional re-inspection and re-testing expenses. NMSU Fire Department must approve the entire Fire Alarm System before it will be accepted.

28 31 46 SMOKE DETECTION SENSORS

- A. The minimum detection and protection requirements for storage, custodial and trash rooms will be identified by AHJ .
- B. Provide a dedicated electric supply to duct detectors separate from the air unit power. This will eliminate setting off the fire alarm if the fan is shut down for repair.

28 31 43 FIRE DETECTION SENSORS

Smoke/fire duct detectors will be shown and coordinated with mechanical and not double specified (i.e., by both MECH and ELECT).

28 31 53 FIRE ALARM INITIATING DEVICES

AHJ will require typically requires EXIT light and fire alarm pull station at all exterior doors.

28 31 63 FIRE ALARM HORNS AND STROBES

- A. Requirement to conform to NFPA 72.
- B. The AHJ holds “overview” interpretation of the code. It does not include descriptions concerning technical settings and sound engineering.
- C. As a general rule, install strobe devices in restrooms and horn/strobe devices in all other "occupied" locations per AHJ. The basic requirement is to install a horn/strobe in every occupied room, regardless of the noise level. NOTE: This applies to Main Campus only. Branch campuses must coordinate with State Fire Marshal's office.
- D. Visual Fire Alarm Strobe Lights. Under the Americans with Disabilities Act, most workplaces and places serving the public, including theaters, restaurants, and recreation areas, are required to have fire alarms which flash as well as ring so that people who cannot hear or cannot hear well will know that there is an emergency. To reduce the likelihood of the strobe light triggering a seizure, the Epilepsy Foundation’s professional advisory board recommends that the flash rate be kept to under 2 Hertz with breaks every so often between flashes; and flashing lights should be placed at a distance from each other and set to flash together at the same time to avoid an increase in the number of individual flashes.
- E. Section A-6-3.1 of NFPA 72 provides average sound levels to be used for design guidelines in an assortment of occupancy types. This section is clear - listed values should not be used in lieu of actual level measurements.
- F. Ambient tests should be conducted over a 24 hour period to determine the sound level within each space as a baseline requirement. In this case we assume the tests are conducted during normally occupied periods. (Technical Report notations are not included in this description.)
- G. Average sound values are clearly defined in the National Fire Alarm Code Handbook.

-
- H. Use of the “at least 15 dB above the average ambient sound level” value is the standard.
 - I. Sound levels are measured 5 feet above the floor in the occupiable area. The testing device shall be located approximately centered in the room at the defined height. The room center will be located as appropriate with consideration of varying size, configuration, and audible devices location (if any) of each space.
 - J. Audible appliance ratings and sound measuring devices are influenced by acoustical properties within, and surrounding, the space. Space use and ambient noise levels created in each space varies widely. Due to the difficulty in quantifying actual “in use and occupied” conditions at this stage of each project, testing both ambient and audible levels within a space, under its existing conditions at the time of the test, with the door closed, is our reasonable compromise to the myriad of defined, and undefined, test conditions described by NFPA 72.
 - K. AHJ will be present (or their designee) during the decibel level checkout to verify results.
 - L. Designer to provide sound pressure test results.
 - M. List the standard measured in the report (and/or on the As built Drawings.)
 - N. Contractor to identify deficiencies (and make corrections) prior to requesting NMSU to provide final acceptance.
 - O. AHJ to review design before the plans are released for construction quotes/bids.

END OF DIVISION 28



DIVISION 31 – EARTHWORK

31 01 00 MAINTENANCE OF EARTHWORK

- A. Protect excavation from surface water intrusion and run off. Follow LEED requirements for LEED certified projects, and to the extent possible on non-LEED certified projects.
- B. Maintain all appurtenances required for proper site protection in accordance with SWPPP standards.
- C. All excavation and backfill operations to be in accordance OSHA standards.

31 05 00 COMMON WORK RESULTS FOR EARTHWORK

- A. Over excavation, placement of engineered fill, compaction, and slope protection will be clearly specified by the engineer of record

END OF DIVISION 31

DIVISION 32 – EXTERIOR IMPROVEMENTS

SAFETY CONSIDERATIONS

- A. Comply with all current code addition requirements.
- B. All outside steps must be adequately lighted. Treads and landings should have positive drainage away from the building.
- C. Suitable railings and guards shall be provided at all places such as stairwells, outside steps, bridges, loading ramps, etc. where persons are exposed to the possibility of falls from one level to another.
- D. Runways and ramps should be installed in all buildings where bulk supplies are handled. Ramps should have a surface providing traction.
- E. Engineer of record will insure adherence to current ADA standards for pedestrian access.

32 10 00 BASES, BALLASTS AND PAVING

- A. Indicate that concrete paving, sidewalks and brick pavers shall be replaced in full panel sizes with colors and patterns to match what was removed and/or existing. Remove existing concrete to the nearest joint, score, or edge. Straight saw-cut edges are required. Random cuts or patches are not allowed. Score joints shall be at no more than six (6') foot intervals or match existing. Expansion joints shall be at no more than twenty (20') foot intervals.
- B. Sidewalks less than 6' wide, or work within a walkway 4' wide to 6' wide – Provide and install 6" X 6" - W2.9 X W2.9 wire mesh centered on slab. Slabs shall be of four (4") inch thick 4000 psi concrete.
- C. Sidewalks 6' wide or greater, or work within a walkway 6' wide or greater – Provide and install #3 Rebar at 12" on center each way centered on slab. Provide and install #3 rebar along edges of slab, provide 2" cover. Slabs shall be of 6" thick 4000 psi concrete.
- D. Eight inch wide concrete or brick mow strip to be provided adjacent to every building between turf and mulched areas or buildings. Only with written permission from the FS Vice-President may mow strips be eliminated.
- E. Slopes should be designed no greater than 3:1. If grade changes must be more severe, then terraces or retaining walls are required.
- F. Land should be contoured to direct rainwater runoff through the site to give vegetation an additional water supply, rather than sending runoff to paved

areas.

- G. Clearly define new and existing landscape irrigation system relocation. If existing valves, mains or laterals are to be relocated, delineate that work on the plans.

32 11 13 SUBGRADE MODIFICATIONS

Subgrade under sidewalks shall be scarified to a depth of eight (8”) inches and recompact to minimum of 90% maximum density as determined by ASTM D 1557. Any soft or ‘spongy’ areas shall be removed and replaced with structural fill as described herein.

32 80 00 IRRIGATION

- A. Coordinate all irrigation systems through NMSU Project Representative.
- B. Contractor will be responsible for protecting existing irrigation systems and restore immediately if damaged. Hand watering is required if irrigation is unavailable for any reason. Coordinate requirements with NMSU Project Representative prior to start of work. Coordinate all repairs with NMSU Project Representative to allow staff to check for contaminated lines, valves and sprinklers.
- C. Indicate that new irrigation and/or sleeves shall be installed beneath sidewalk prior to concrete placement. Coordinate sleeve installation with NMSU Project Representative.
- D. All irrigation main lines will be marked with a trace wire upon installation.
- E. As-built drawings for any newly installed irrigation or existing irrigation lines found or installed during construction should indicate precise measurements to assist with future locates.

32 93 00 PLANTS

- A. The landscape plan for the project shall be integrated with the surrounding landscape design and it shall include trees.
- B. Trees to remain shall have a water basin around them, one foot in diameter for each inch DBH (diameter at breast height). Trees shall be further protected by a fence at the dripline. No material storage, waste disposal, or vehicle parking will be allowed within the fence area.
- C. Any utilities to be installed under the dripline of a tree shall be place by tunneling under the roots rather than trenching through the roots.
- D. Trees identified to remain shall not have any soil added or removed within

the dripline. They shall be protected from grade changes with retaining walls, berms, swales, or similar structures.

1. Design Architect shall inspect and document trees to be preserved and gain concurrence, in writing with the NMSU Project Representative on the plan prior to the start of construction.
 2. Contractor will be responsible for all restoration and preservation of all plant materials. Damaged or loss of any plant material will be the responsibility of contractor to replace.
- E. New or reconstructed parking lots should have in-lot planters with a minimum area of 200 ft² (i.e. a 3' x 3' diamond at the intersection of parking spaces is not acceptable).

END OF DIVISION 32



DIVISION 33 – UTILITIES

See Volume #4

Appendix-A

All electronic drawing files shall be provided on a specific electronic storage media with label printed directly on the face of the media when applicable. The contractor shall ensure that all digital files and data are compatible with the University’s CAD system (.dwg) and adhere to other standards and requirements specified herein.

All electronic drawing files shall be provided on electronic storage media (USB Flash Drive) with label printed directly on the face of the media.

- Media shall be labeled with the following minimum information:
 - Company Name
 - Contract Information
 - Both NMSU Project name and number on title sheet
 - Summary of Media contents
 - Date created

Files shall be arranged in two separate folders (Figure 1). In each folder, a separate folder shall be created for each discipline (Arch, Civil, MEP, etc. (see Figure 2)).

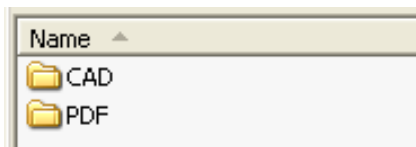


Figure 1.

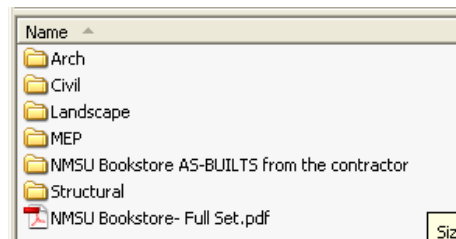


Figure 2.

CAD-Separate CAD files for each sheet of the set, name shall begin with the NMSU building number, followed by sheet number and sheet name. (Example, Figure 3.) All CAD files shall contain all X-Ref, embedded images .ctb files, blocks, fonts and any other related data.

Appendix-A cont.

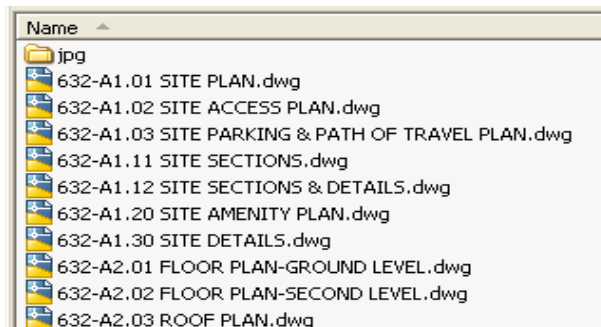


Figure 3.

PDF-Separate PDF Files for each sheet of the set to match the structure of the CAD folder above (300 DPI). All PDF files shall be produced in the proper scale/paper size, (Example, Figure 4).

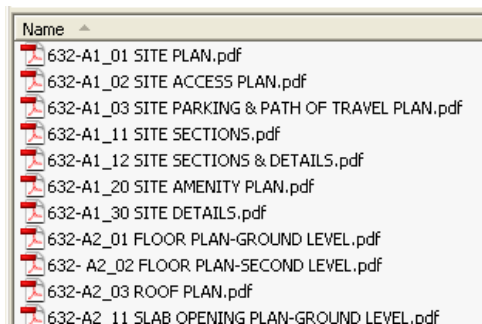


Figure 4.

Filing of As-Builts

The Project Manager shall transfer all as-built drawings to The Office of Space Planning for permanent storage via transmittal after approval of the final set. A PDF copy of all final as-builts shall be placed on the Delta-T drive for future reference.

Appendix-B

Color 1 Typical Use

- Notes
- Text
- Leaders
- Existing walls/structures

Color 2 Typical Use

- Bold Text
- Dimension Text
- Darker line – in between color 1 & 3

Color 3 Typical use

- New walls/construction
- Large Bold Text

Color 4 Typical Use

- Revision Cloud
- Section Callouts

Color 6 Typical Use

- Dimensions

Color 8 & 9 Typical Use

- Hatch

<u>Name</u>	<u>Color</u>	<u>Line Type</u>	<u>Lineweight</u>	<u>Object Color</u>
Color 1	Red	Continuous	0.2500mm	No
Color 2	Yellow	Continuous	0.3500mm	No
Color 3	Green	Continuous	0.500mm	No
Color 4	Cyan	Continuous	0.700mm	No
Color 5	Blue	Continuous	0.1300mm	No
Color 6	Magenta	Continuous	0.1800mm	No
Color 7	Black	Continuous	0.2500mm	Not Used
Color 8	Gray	Continuous	0.2500mm	Yes
Color 9	Light Gray	Continuous	0.2500mm	Yes
Color 10	Red			Yes

Appendix-B cont.

AiMCAD Layers

<u>Name</u>	<u>Color</u>	<u>Line Type</u>	<u>Lineweight</u>	<u>Object Color</u>
A-SPACE-ANNO	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-GROS-EXTR	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-GROS-INTR	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-IDEN	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-IDEN-RMAT	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-IDEN-RMDR	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-IDEN-RMNO	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-INTR	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-LEGN	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-OPEN	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-PATT	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-PLIN-AREA	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-PPLN-AREA	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-VRPN	WHITE	CONT.	DEFAULT	COLOR 7
A-SPAC-TPTN	WHITE	CONT.	DEFAULT	COLOR 7
A-TTLB-DWFL-BRDR	WHITE	CONT.	DEFAULT	COLOR 7
A-TTLB-DWFL-IDEN	WHITE	CONT.	DEFAULT	COLOR 7
A-TTLB-DWFL-VPRT	WHITE	CONT.	DEFAULT	COLOR 7
A-WALL		CONT.	DEFAULT	COLOR 30
A-WALL-ABOV		HIDD.	DEFAULT	COLOR 32
A-WALL-BLOW		CONT.	DEFAULT	COLOR 30
A-WALL-COMP		CONT.	DEFAULT	COLOR 22
A-WALL-PATT		CONT.	DEAFULT	COLOR 12

AutoCAD Layers

<u>Name</u>	<u>Color</u>	<u>Line Type</u>	<u>Lineweight</u>	<u>Object Color</u>
A-WALL	COLOR 3	CONT.	DEFAULT	COLOR 3
A-DOOR	COLOR 1	CONT.	DEFAULT	COLOR 1
A-GLAZ	COLOR 1	CONT.	DEFAULT	COLOR 1
A-VPRT	NO PLOT	CONT.	DEFAULT	COLOR 9
A-DIM	COLOR 6	CONT.	DEFAULT	COLOR 6
A-DEFP	NO PLOT	CONT.	DEFAULT	COLOR 7
C-BUILDINGS	COLOR 6			
C-SIDEWALKS	COLOR 9			
C-ROADS	COLOR 142			
S-STRS	COLOR 31			
S-STRS-ANNO	COLOR 31			

Appendix-B cont.

AutoCAD Layers NMSU Campus Base Map

<u>Name</u>	<u>Color</u>	<u>Line Type</u>	<u>Lineweight</u>	<u>Object Color</u>
0	WHITE	CONT.	DEFAULT	COLOR 7
1	RED	CONT.	DEFAULT	COLOR 1
02 AIS LINEWORK	252	CONT.	DEFAULT	252
A-SPAC-IDEN	WHITE	CONT.	DEFAULT	COLOR 7
C-BUILDING	MAGENTA	CONT.	DEFAULT	COLOR 6
C-PARKING PAVED	251	CONT.	DEFAULT	251
C-PARKING STALLS	142	CONT.	DEFAULT	142
C-ROAD PAVED	WHITE	CONT.	DEFAULT	COLOR 7
C-ROADS	142	CONT.	DEFAULT	142
C-SIDEWALK	253	CONT.	DEFAULT	253
C-UNPAVED ROADS	8	CONT.	DEFAULT	COLOR 8
CONST. LINE	YELLOW	CONT.	DEFAULT	COLOR 2
DEFPOINTS	WHITE	CONT.	DEFAULT	COLOR 7
NMSU	WHITE	CONT.	DEFAULT	COLOR 7
NMSU FILL	WHITE	CONT.	DEFAULT	COLOR 7
V-POINTS	RED	CONT.	DEFAULT	COLOR 1
X-BUILDING HATCH	9	CONT.	DEAULT	COLOR 9
X-PARK-LOT-NUM	RED	CONT.	DEFAULT	COLOR 1
X-ADDRESS	RED	CONT.	DEFAULT	COLOR 1
X-BUILD-NUM	RED	CONT.	DEFAULT	COLOR 1
X-BUILD-TEXT	RED	CONT.	DEFAULT	COLOR 1
X-EMBLEM	246	CONT.	DEFAULT	246
X-PAPER GRID	253	DASHED 2	DEFAULT	253
X-PAPER GRID LET	WHITE	CONT.	DEFAULT	COLOR 7
X-TEXT	RED	CONT.	DEFAULT	COLOR 1
XREF	WHITE	CONT.	DEFAULT	COLOR 7
ZONE 2000	240	CONT.	0.25	240
ZONE 2100	210	CONT.	0.25	210
ZONE 2200	190	CONT.	0.25	190
ZONE 2300	12	CONT.	0.25	12
ZONE 2400				
ZONE 2500	100	CONT.	0.25	100
ZONE 2600	120	CONT.	0.25	120
ZONE 2700	30	CONT.	0.25	30
ZONE 2800	190	CONT.	0.50	190
ZONE 2900	220	CONT.	0.50	220

Appendix-B cont.

AutoCAD Layers NMSU Utilities

<u>Name</u>	<u>Color</u>	<u>Line Type</u>	<u>Lineweight</u>	<u>Object Color</u>
STEAM_ALL	140	CONT.	1.00	LIGHT BLUE
UTIL_STEAM	140	CONT.	1.00	LIGHT BLUE
UTIL_STEAM_VALVE	140	CONT.	0.50	LIGHT BLUE
CHW_ALL	214	CONT.	1.00	PURPLE
CHW_LINE	214	CONT.	DEFAULT	PURPLE
CHW_VALVE	214	CONT.	DEFAULT	PURPLE
UTIL_CHW	214	CONT.	DEFAULT	PURPLE
ELECT-GENSET	10	CONT.	DEFAULT	RED
ELECT-PAD	10	CONT.	DEFAULT	RED
ELECT-VAULTS	10	CONT.	DEFAULT	RED
E-SECONDARY	10	CONT.	DEFAULT	RED
E-STREETLIGHT	10	CONT.	DEFAULT	RED
EC 1 – 25K	10	CONT.	DEFAULT	RED
EC 2 – 5K	10	CONT.	DEFAULT	RED
EC 2 – 25K	10	CONT.	DEFAULT	RED
EC 3 – 5K	10	CONT.	DEFAULT	RED
EC 3 – 25K	10	CONT.	DEFAULT	RED
EC 4 – 5K	10	CONT.	DEFAULT	RED
EC 4 – 25K	10	CONT.	DEFAULT	RED
EC 5 – 5K	10	CONT.	DEFAULT	RED
EC 5 – 25K	10	CONT.	DEFAULT	RED
EC 6 – 5K	10	CONT.	DEFAULT	RED
EC 6 – 25K	10	CONT.	DEFAULT	RED
EC 7 – 5K	10	CONT.	DEFAULT	RED
EC 7 – 25K	10	CONT.	DEFAULT	RED
ELECTRICAL_ALL	10	CONT.	1.00	RED
ELECT ROOM	10	CONT.	DEFAULT	RED
EMERG. GENERATOR	10	CONT.	DEFAULT	RED
EPEC	10	CONT.	DEFAULT	RED
LIGHTPOLE	10	CONT.	DEFAULT	RED
POWER PANEL	10	CONT.	DEFAULT	RED
POWER POLE	10	CONT.	DEFAULT	RED
POWER_LINE	10	CONT.	DEFAULT	RED
SWITCHGEAR	10	CONT.	DEFAULT	RED
TRAFFIC LIGHT	10	CONT.	DEFAULT	RED
TRANSFORMER	10	CONT.	DEFAULT	RED
UTIL-ELECT	10	CONT.	DEFAULT	RED
VAULT	10	CONT.	DEFAULT	RED

Appendix-B cont.

G-POLY-.75	50	CONT.	DEFAULT	YELLOW
G-POLY-1	50	CONT.	DEFAULT	YELLOW
G-POLY-1.5	50	CONT.	DEFAULT	YELLOW
G-POLY-1.25	50	CONT.	DEFAULT	YELLOW
G-POLY-2	50	CONT.	DEFAULT	YELLOW
G-POLY-3	50	CONT.	DEFAULT	YELLOW
G-POLY-4	50	CONT.	DEFAULT	YELLOW
G-STEEL-.75	50	CONT.	DEFAULT	YELLOW
G-STEEL-1	50	CONT.	DEFAULT	YELLOW
G-STEEL-1.5	50	CONT.	DEFAULT	YELLOW
G-STEEL-1.25	50	CONT.	DEFAULT	YELLOW
G-STEEL-2	50	CONT.	DEFAULT	YELLOW
G-STEEL-2.5	50	CONT.	DEFAULT	YELLOW
G-STEEL-3	50	CONT.	DEFAULT	YELLOW
G-STEEL-4	50	CONT.	DEFAULT	YELLOW
G-anod	50	CONT.	DEFAULT	YELLOW
G_GAS_LINE	50	CONT.	DEFAULT	YELLOW
G_GAS_METER	50	CONT.	DEFAULT	YELLOW
G_GAS_REG_STAT	50	CONT.	DEFAULT	YELLOW
G_GAS_REGULATOR	50	CONT.	DEFAULT	YELLOW
G_GAS_VALVE	50	CONT.	DEFAULT	YELLOW
G-GASLINE_PT	50	CONT.	DEFAULT	YELLOW
G_valve_#	50	CONT.	DEFAULT	YELLOW
GAS_ALL	50	CONT.	1.00	YELLOW
C-SEWER	102	CONT.	DEFAULT	GREEN
C-SEWER-LABELS	102	CONT.	DEFAULT	GREEN
SEPTIC_TANK	102	CONT.	DEFAULT	GREEN
SEWER TEXT	102	CONT.	DEFAULT	GREEN
SEWER_ALL	102	CONT.	1.00	GREEN
SEWER_CLEAN_OUT	102	CONT.	DEFAULT	GREEN
SEWER_LINE	102	CONT.	DEFAULT	GREEN
SEWER_MANHOLE	102	CONT.	DEFAULT	GREEN
SEWER_MH_LARGE	102	CONT.	DEFAULT	GREEN
UTI-Sewer_Line	102	CONT.	DEFAULT	GREEN
UTIL-SEWER	102	CONT.	DEFAULT	GREEN
TUNNEL	36	CONT.	DEFAULT	BROWN
TUNNEL POLYLINE	4	CONT.	DEFAULT	BLACK



Appendix-B cont.

C-WATER-DOM	154	CONT.	1.00	BLUE
C-WATER-DOM-VALV	154	CONT.	1.00	BLUE
C-WATER-FIRE-SERV	154	CONT.	1.00	BLUE
C-FIRE-SERVICE-VALV	154	CONT.	1.00	BLUE
DWS-1 INCH	154	CONT.	1.00	BLUE
DWS-2 INCH	154	CONT.	1.00	BLUE
DWS-3 INCH	154	CONT.	1.00	BLUE
DWS-4 INCH	154	CONT.	1.00	BLUE
DWS-6 INCH	154	CONT.	1.00	BLUE
DWS-8 INCH	154	CONT.	1.00	BLUE
DWS-10 INCH	154	CONT.	1.00	BLUE
DWS-12 INCH	154	CONT.	1.00	BLUE
UTIL-WATER	154	CONT.	1.00	BLUE
WATER TANK	154	CONT.	1.00	BLUE
WATER_LINE	154	CONT.	1.00	BLUE
WATER_METER	154	CONT.	1.00	BLUE
WATER_VALVE	154	CONT.	1.00	BLUE
WELL	154	CONT.	1.00	BLUE