Design and Construction Standards

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Foreword

Mississippi State University welcomes all Design professionals and Contractors to participate in the building and renovation of facilities and properties owned by Mississippi State University. Mississippi State University has established within the Division of Campus Services the Office of Planning Design and Construction Administration. This office is to handle the planning, design and construction of all new and existing facilities. It is the goal of the Office of Planning Design and Construction Administration to assure that all building projects, both new and renovated, be of sound design, quality construction, within budget and on time. To accomplish this goal the Office of Planning Design and Construction Administration has established several objectives which will apply to all aspects of the project beginning with funding, design, Structure, materials, building systems, sustainability and cost. These objectives are as follows:

- To ensure that the project is fully funded and funding has been secured.
- To ensure that the programming and documents meet the Design and Construction Standards established by Mississippi State University.
- To ensure that no major decision is overlooked or forgotten.
- To be proactive and identify conditions that will affect the final design.
- To allot adequate time for the Professional to be proactive in lieu of reactive.
- To allow the Professional the ability to maintain control of the project during design and construction document preparation and during construction.
- To facilitate decisions quickly so as not to delay the project.
- To assure the commitment to a specific solution is made at all points thru out the design process and thru construction.
- To avoid constant redesign and expense when new information is introduced late in the design process.
- To ensure the budget is real and not fictitious.

- To ensure that infrastructure, parking, landscaping and exterior lighting are included on program and in the budget.
- To ensure that Mississippi State University is obtaining the maximum building for the cost budgeted.
- To ensure that all projects meet the 2012 IBC Code
- To ensure that all projects meet ASHRAE 2010 90.1 requirements
To ensure that all projects attempt to exceed the requirements of ASHRAE 2010, 90.1 by 30% where economically feasible.

To ensure that all projects meet the 2010 American Disabilities Act.

It is the policy of the University that all construction and renovation projects including those projects located off campus be submitted thru the Office of Planning Design and Construction Administration. Because of this policy and the intent of the University to keep a sense of unity within its facilities these design and construction standards are created. The design and construction standards are periodically revised. The design professional shall be responsible for ensuring that he has the latest revisions to these standards.
Consultants Requirements

1.1 General

The Design Professionals and their staffs shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the University’s standard Request for Variance form.

1.2 Campus Planning Requirements

All design professionals shall verify that all applicable portions and or requirements of the Design and Construction Standards are incorporated into the project’s design, contract documents and construction. Design Professionals may make request for variance to these standards in writing using the variance request form provided in this manual. Variances will either be approved and or rejected by the Office of Planning, Design and Construction Administration.

1.3 Definitions

1.3.1 **Professional:** shall mean the prime consulting firm and its sub consultants that have been retained by Mississippi State University to provide professional services to the University.

1.3.2 **Owner, MSU and University:** shall generally refer to Mississippi State University, The Bureau of Buildings and its representatives.

1.3.3 **FM:** shall refer to Mississippi State University’s Department of Facilities Management

1.3.4 **BOB:** Shall refer to the Bureau of Buildings

1.3.5 **IHL or Board:** shall refer to The Board of Trustees of the Institutions of Higher Learning for the State of Mississippi.

1.3.6 **LEED:** Shall refer to Leadership in Energy and Environmental Design

1.3.7 **Contractor or GC:** shall refer to the prime contractor who holds the construction contract with The State of Mississippi or Mississippi State University.

1.3.8 **OPDCA:** Shall refer to the Office of Planning Design and Construction Administration
1.3.9 ADA: Shall refer to the American Disabilities Act.
1.3.10 IBC: Shall refer to the International Building Code.
1.3.11 MSU: Shall refer to Mississippi State University

1.4 Related Documents & Requirements

Mississippi State University Design and Construction Standards have been developed by the Office Planning, Design and Construction Administration, in cooperation with other Mississippi State University departments to establish guidelines and minimum requirements for the improvement of the facilities located on the grounds of Mississippi State University.

1.4.1 Related Documents: The Design and Construction Standards shall supplement the requirements of the Design professional’s agreement as well as the current editions of the following documents.

- Institutions of Higher Learning Manual of Construction Procedures
- Mississippi State University Master Plan
- Mississippi State University requires all specifications to be in the Construction Specification Institute 2004 format or otherwise known as CSI Format.

1.4.2 Specifications: All specifications shall be written in the Construction Specification Institute (CSI) 2004 master format. The specification shall contain the master format’s standard Forty Eight divisions and section titles. Please note that Division 0 and Division 1 of these specifications shall be in the 1995 Master Format until such time as the Bureau of Buildings and other state agencies change their front end requirements.

1.4.3 Privately-Funded Projects: All privately funded projects, shall comply with the Mississippi State University Design and Construction Standards, and the related documents noted above.
1.5 Campus Infrastructure and Future Development

1.5.1 General: The professional shall discuss and review with the Office of Planning, Design and Construction Administration such items as long range planning, utilities, and other information that relates to construction on the campus and other properties of Mississippi State University.

1.5.2 Campus Plan: Mississippi State University has developed a 20 year master plan. All building projects shall adhere to the master plan and its intent. The master plan will be updated from time to time. All design professionals shall consult with the Office of Planning, Design and Construction Administration for updated information with respect to the campus plan.

1.5.3 Infrastructure: Each project shall be required to extend existing campus infrastructure to the project site as part of the scope of work. This extension of infrastructure shall be included in the overall project budget, unless program statements and program budgets indicate that the infrastructure improvements are provided by other funding sources. Infrastructure improvements may include improvements that are not adjacent to the project site but required to service this project.

1.5.4 Future Expansion: The design of each project shall take in to account the possible expansion of future facilities. This is to include the expansion of utilities, infrastructure and parking. The project shall include additional conduit for anticipated future electrical and communication needs. The construction documents shall clearly delineate all the provisions for future expansion.

1.6 Historic Campus District Guidelines

Mississippi State University has established a historic district to complement and enrich the campus core and immediate surrounding areas thru application of design concepts utilized in the pre-1930 buildings of the district. Each new and renovated building located within the district boundaries shall exhibit a considered response to each of the checklist
items noted below for review by the Office of Planning, Design and Construction Administration.

- **Orientation**: Alignment with the Drill Field and visual connections to and from the central campus open space are desirable.
- **Height**: Buildings on the Drill Field shall be limited to three full floors and a fourth level incorporated into roof volumes. Buildings beyond the drill field perimeter may be up to six floors in height.
- **Shape**: Plan strategies shall be responsive to building program needs and sympathetic to the orientation of adjacent buildings, roads paths and natural campus elements.
- **Openings**: Window and doors shall be traditional in character, design, and use of color. Glazing shall be energy efficient insulation type.
- **Materials**: The palette of materials available for use on building exteriors within the district shall be limited as follows.
  - **Brick**: Red range compatible to existing buildings constructed prior to 1930. Joint design and mortar color shall also be reflective of existing building construction. Campus Standard is the McCool Blend as manufacture by Columbus Brick, Columbus Mississippi.
  - **Stone**: Limestone in color and texture ranges similar to existing building installation may be utilized for lintels, sills, copings, water tables as well as monumental building elements.
  - **Roofing**: Pitched roofs may be covered with metal standing seam, Asphalt Shingles, slate, or simulated slate. Gutters, downspouts, drips and fascia panels shall be constructed of nonferrous metal. Soffit materials shall be non-ferrous metal or stucco. All roofing and accessories shall be reflective of existing color ranges.
  - **Signage**: Each building shall be provided with a free standing identification sign complying with campus standards.
  - **Roads and Walkways**: Sidewalks shall be concrete or brick. Paving may be asphalt, concrete or brick. Curbs may be constructed of concrete, Stone or Brick.
  - **Landscaping**: Site development within the district shall include traditional landscape elements and materials.
  - **Lighting**: Security and decorative site lighting shall utilize campus standard fixtures.

### 1.7 Aesthetic Guidelines for Campus
1.7.1: Mississippi State University has made a commitment to excellence in design, construction, renovation and landscaping of new and existing buildings, which will aid in the promotion of academic excellence. It is the intent of Mississippi State University to identify significant exterior features that will promote unity in buildings located on the campus. The following are exterior features shall be submitted to the Office of Planning Design and Construction Administration for review and or approval:

- **Brick / Masonry:** samples of masonry to show range of color.
- **Mortar:** Color and type.
- **Roofs:** Samples of Metal, shingles and or slate.
- **Windows / Door Frames:** Sample and colors
- **Street Lighting:** Cut sheets describing the type and appearance along with colors.
- **Campus lighting:** Cut sheets describing the type and appearance along with colors.
- **Precast Stone:** Samples indicating color and texture.
- **Exterior Facing Insulation System (EFIS):** EFIS will not be allowed to be used on buildings at Mississippi State University, except under special conditions and then only by approval of the Office of Planning, Design and Construction Administration.

1.7.2: The design of forms and spaces shall consider the contextual issues and relationships of the existing campus. Designs shall take into account issues such as sustainable design issues, topography, views, horizontal and vertical relationships to adjacent buildings and defensible spaces. The following should be considered:

- Scale, form, massing and shapes
- Color, Texture and character of materials
- Points of access, openness, degree of transparency and fenestration
- Careful design of spaces between buildings, distance to streets, and parking
- Defensible spaces
1.7.3: The attachment of exterior antennas, dishes, and or other communication equipment shall not be allowed unless approved by the Office of Planning, Design and Construction Administration.

1.7.4: The professional shall submit to the Office of Planning, Design and Construction Administration, for approval, color boards showing the exterior and interior colors and finishes.

1.8 Site Design Considerations

1.8.1: The architecture of the buildings shall respond to the advantages and opportunities afforded by the selected site, to include sustainable design considerations. It is the intent of Mississippi State University to become a pedestrian oriented campus and that vehicular and parking circulation do not interfere with pedestrian walkways and circulation corridors. All building projects shall incorporate into the design landscaped spaces surrounding the project to promote defensible functional areas for activities. These designed areas for activities shall incorporate seating to include benches and other outdoor furniture.

1.8.2: Parking areas should not be considered a detriment to the university, but a rather a way to integrate the necessary use of automobiles, into the natural environment, of the university. All parking areas shall meet the following:

- All parking designs shall be reviewed by the Office of Planning Design and Construction Administration.
- Parking areas should be organized as a series of small parking bays with planted islands separating them. No more than 10 contiguous parking spaces is recommended, or desired.
- On-street parking is not permitted as a substitute for required unit and visitor parking.
- Bicycle parking facilities should be provided within all areas. These facilities should not interfere with pedestrian movement.
The perimeter of parking areas bordering public streets or property should consist of a planting area at least 20 feet wide to screen public views.

Planted islands should be used in parking areas to reduce heat radiated from paving, improve auto circulation and safety, and screen automobiles from public views. To accomplish these goals, islands should be large enough for trees and low shrubs. A minimum of 9 feet by 20 feet is recommended.

As a general standard, there should be at least one tree planted for each 200 square feet of parking area islands and perimeter plantings.

Planted islands should include trees of at least 2 ½ inches caliper and shrubs at least 18 inches high. Evergreen plantings provide effective year-round screening and should be enriched with plants having seasonal color variation.

Preservation of healthy trees existing on a site should be a major consideration in the planning of any new parking area.

Planted Islands should be bermed to assist in the screening of automobiles.

Light fixtures that cast light primarily downward shall be used. Glare shields and other cut-off devices shall be used to minimize throw onto adjacent properties.

Wherever possible, the existing topography should be preserved intact to minimize disruptions in drainage.

In areas of slopes over 5 percent, parking bays should be terraced, with walls and substantial planting between changes of level.

Changes in elevation or earth berms may be used along the perimeter of parking areas to reinforce planting screens. The slope of earth should not exceed 1:3 rise to run, and should be densely planted with ground cover or shrubs to prevent erosion.
- Slopes of parking areas should not exceed 6 percent nor be less than 1 percent to provide adequate run-off.

**1.9 Bicycle Parking**

As Mississippi State University becomes a pedestrian oriented campus, bicycle traffic will increase. Mississippi State University has begun the placement of bicycle paths in heavily traveled corridors. Professionals in the design of their buildings shall consider bicycle paths and parking for bicycles. All Bicycle racks shall be per the University standard. Location of the bicycle rack shall be approved by the Office of Planning, Design and Construction Administration.

**1.10 Service Areas**

All new facilities will require service areas for such functions as trash pickup, delivery of supplies and materials. Service areas may require loading docks, mechanical and electrical equipment, and service parking. The service area shall be considered in the design of the facility and be an unobtrusive part of the facility. The service area shall be screened by architectural and landscaping design. The screening of these areas shall be submitted for approval to the Office of Planning, Design and Construction Administration.

**1.11 Pedestrian Walkways**

It is the intent that Mississippi State University becomes a pedestrian campus. To accomplish this Mississippi State University will in the future implement zoned parking on the perimeter of the main campus and increase the shuttle services to the interior of campus. Vehicular traffic on the main campus will be restricted to staff and maintenance vehicles. In addition gated parking will be implemented at some of the major buildings for staff parking. This reduction in vehicular traffic on campus will result in a more efficient shuttle system. Due to this approach all sidewalks will be required to be a minimum of 8’ wide in low traffic areas and 10’ wide in heavily traveled areas. In addition all sidewalks that abut a street or other pedestrian walkways will have handicap cuts in the curbs and or sidewalks, and meet all other ADA requirements. The professional shall review with the Office of Planning, Design and Construction Administration the requirements for the selected site.

**1.12 Equipment Screening**
The professional shall consider the placement, of service parking and all exterior mechanical and electrical equipment, in an unobtrusive area of the building. These exterior locations shall be screened by architectural and landscape design considerations. All architectural screening considerations shall be in keeping with the design of the facility and context of the campus.

1.13 Material Selection

Mississippi State University must insure that the facilities either new or renovated are designed so that major repairs or modifications will not be required for a considerable period of time. To do so new and or renovated facilities shall be constructed with materials that will last and require low maintenance. The selection of low maintenance materials shall extend from the exterior to the interior. Maintenance shall be a prime consideration in the selection of all finishes. New market materials shall have a proven track record before they will be used in facilities for Mississippi State University. All materials shall be in accordance with the Design and Construction Standards. Material not included in the Design and Construction standards must be submitted to the Office of Planning, Design and Construction Administration for approval.

1.14 Color Schedules

Professionals shall prepare for review color boards for presentation and approval of Mississippi State University. All exterior and interior colors shall be submitted to the Office of Planning, Design and Construction Administration for approval.

1.15 Accessibility

Mississippi State University is committed to providing the disabled, to include students, staff, faculty and visitors, access to all facilities and grounds owned and operated by the University. It is the responsibility of the project professional to meet all requirements of the American Disability Act, in design and construction of facilities for Mississippi State University. If and when there is a question with respect to an interpretation of a condition, the solution shall favor the American Disability Act. All parking shall increase the number of Handicap spaces required by the American Disability Act by a multiplier of 1.2.
1.16 Code Analysis and Compliance

Each professional shall be responsible for designing their project in accordance with the latest applicable codes and regulations that are in force at the time of their contract date. The University requires that every project have the following:

- Each project regardless of size shall have a code analysis performed by the designer or his consultant. This code analysis shall be provided to the Office of Planning, Design and Construction Administration in written form.
- If the project is a renovation or addition to an existing facility the code analysis shall include the impact to the overall building.
- All projects shall contain in the contract documents a code drawing or drawings and analysis sheet.

1.17 Construction Scheduling

Each project must and shall accommodate Mississippi State University’s calendar of classes and special events. Classes and special events may affect the normal work hours of the General Contractor. The project professional shall communicate with the Office of Planning, Design and Construction Administration to identify requirements for scheduling to be included in the Contract Documents.

1.18 Classroom and Lecture Room Facilities

As classroom design is very important to Mississippi State University. Objectives stated in program requirements will require the Professional to develop sufficient detail to ensure that design requirements are met. Requirements for fixed equipment, tables etc. shall be identified in the program and discussed with the Office of Campus Planning Design and Construction Administration. The following classroom guideline shall be adhered to:

- Each classroom will be equipped with an instructor’s podium and an adjacent work table.
- A mounted timepiece will be placed on / in each instructor’s podium.
- In accordance with National Fire Protection Safety Codes, all rooms will have exit signs over all entry / exit ways and alarm systems installed for emergency use.
- Windows will have shades, blinds, or drapes for darkening room for projection or media presentation.
CONSULTANTS REQUIREMENTS

In classrooms with a capacity of 75 or more, and where capable, seating should be fanned or tiered where available from the center to an angle no greater than 45 degrees for optimal viewing of instruction area.

Room temperature should be maintained between 71 degrees and 75 degrees at all times.

Windows should be operable to compensate for mechanical deficiencies in climate control.

An easily accessible light switch should be located by the entry / exit way of the room.

2’ x 4’, or 2’ x 2’ lighting fixtures should be maintained with standard wattage LED Bulbs and aligned in row format, either from front to back of room or parallel to seating.

Where available, dimming switches will be used to increase / decrease the amount of light necessary for projections and note-taking.

Instructor’s podium and work station should have surge protector electrical outlets within 6 feet of their positioning to allow for the operation of computer, projector, or other audio-visual equipment.

A general purpose cabinet will be placed in a corner at the instruction end of the room to store projection and audio-visual equipment.

All rooms will be equipped with a marker board at the instructing end of the room.

Marker boards will be white in color.

Marker boards will be mounted on the finished wall by continuous hangers. Adhesive backing will not be allowed due to the damage such mountings cause to walls when removed.

Marker boards will be mounted no lower than 3 feet from the floor and be at least 3 feet in width. The length of the surface will vary due to the different dimensions of rooms.

Hidden spline connectors should be used on all marker boards to allow for continuous writing across the surface.

Tack boards strips should be affixed above the chalkboard for the attaching maps, drawings and other materials during instruction.

All rooms should be equipped with a motorized projection screen of standard size for slide, overhead and other media displays.

In lecture rooms with a capacity of 75 or more, a mounted microphone along with a self-attaching microphone should be available at the instructor’s podium.

Wall mounted speakers should be placed at each side of the instructing area of the room.

All rooms should meet ADA regulations.
As a minimum, 2 stations on the front row of each seating arrangement should be designated for students with wheelchairs or other mechanical transportation. The stations should be close to the entry / exit way of the room.

### 1.19 Classroom Area Allowances

In accordance with United States Department of Education, Office of Educational Research and Improvement Space Planning Guidelines, the following classroom station ranges will be adhered to:

- 11 - 14 square feet per station for lecture halls
- 15 - 18 square feet per station for general purpose classrooms
- 18 – 21 square feet per station for seminar rooms
- Teaching labs vary by discipline:

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Square Feet per Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>40 – 80</td>
</tr>
<tr>
<td>Architecture</td>
<td>60 – 80</td>
</tr>
<tr>
<td>Biological Science</td>
<td>50 – 65</td>
</tr>
<tr>
<td>Business Management</td>
<td>30 – 40</td>
</tr>
<tr>
<td>Communication</td>
<td>40 – 50</td>
</tr>
<tr>
<td>Computer Science</td>
<td>40 – 60</td>
</tr>
<tr>
<td>Education</td>
<td>35 – 40</td>
</tr>
<tr>
<td>Engineering</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Fine Arts</td>
<td>60 – 80</td>
</tr>
<tr>
<td>Foreign Language</td>
<td>30 – 40</td>
</tr>
<tr>
<td>Health Professions</td>
<td>60 – 80</td>
</tr>
<tr>
<td>Veterinary Medicine</td>
<td>60 – 90</td>
</tr>
<tr>
<td>Home Economics</td>
<td>50 – 60</td>
</tr>
<tr>
<td>Law</td>
<td>40 - 50</td>
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<tr>
<td>Mathematics</td>
<td>20 - 30</td>
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<tr>
<td>Physical Science</td>
<td>60 - 75</td>
</tr>
<tr>
<td>Psychology</td>
<td>40 - 50</td>
</tr>
<tr>
<td>Social Science</td>
<td>30 - 50</td>
</tr>
</tbody>
</table>

### 1.20 Office Area Allowances
Mississippi State University has adopted the following square footage guidelines for offices in developing space needs:

- 350 NSF President
- 200 - 235 NSF Vice President / Dean
- 175 - 200 NSF Associate / Assistant Dean / Assistant Vice President / Academic Department Head
- 140 - 150 NSF Administrative Director / Assistant Director / Manager
- 120 - 140 NSF Administrative Assistant / Financial Officer / Staff Assistant / Technician / Analyst
- 140 NSF Full Professor / Associate / Assistant Professor
- 130 - 140 NSF Instructor / Adjunct Instructor
- 130 - 140 NSF Professional Staff / Graphic Designer / Architect / Engineer / Interior Designer
- 112 NSF Secretary / Receptionist
- 72 – 75 NSF Graduate Assistant

1.21 Support Spaces Design Guidelines

The following guidelines shall be adhered to in the design of support spaces within new and renovated facilities:

- **Custodial Closets:** Locate one on each floor. Minimum area for each custodial closet shall be 100 sf. Include in each closet the following:
  - A floor mounted sink
  - Hangers for mops and brooms
  - Doors shall be 36” wide
  - Walls shall have appropriate coatings to protect from moisture and physical abuse
  - Shelves to accommodate supplies
  - Do not locate electrical, telephone, communication or mechanical equipment in these areas
  - Closets shall have exhaust fans vented to the exterior
  - Electrical receptacles on an open wall

- **Vending Areas:** A vending machine area shall be provided in each building. Location of these areas should be carefully considered to allow access by vendors and to avoid noise considerations. These areas shall receive finishes requiring low maintenance.
 Consulting Requirements

Office of Planning Design and Construction Administration

- **Mechanical Rooms**: Doors should open to exterior of building when possible. Professional shall incorporate knock out panels in the design to facilitate removal and replacement of equipment.

- **Electrical Rooms**: Electrical distribution shall be provided in mechanical rooms or in dedicated electrical closets. All electrical closets shall be accessible to corridors or to other public spaces.

1.22 Project Name and Numbers

All documentation with respect to the project shall contain the appropriate project number as issued either by the Institutions of Higher Learning or the Bureau of Buildings. All project numbers shall be verified with the Office of Planning Design and Construction Administration. All project numbers shall be indicated on all correspondence, documents, cost estimates, schedules, invoices, and request for payment, submittals, shop drawings and legal documents.

1.23 Design Review Submittals:

All Projects will require design review, of the documents. The professional shall submit documents in the form of PDF’s for review to the Office of Planning Design and Construction Administration at completion of the following phases:

**Schematic Design**

- **General Description**
  - Scope of work narrative
  - List of applicable building codes on drawing title sheet
  - Review and update project program document
  - Schematic drawing to include site plan, floor plans and exterior elevation as minimum
  - Engineering systems description
  - Energy used and conservation analysis
  - Project Schedule
Consultant Requirements

- Estimate of Cost
- 3-D computer rendering indication mass and building elevation options
- Minutes of Meetings

■ Specifications
- System and Material Narrative description

■ Site
- Existing Conditions
- Demolition identified
- Building outline
- Site entrance
- Roads and driveways
- Parking locations
- Loading dock location
- Waste collection locations
- Walkway locations
- Stairway locations
- Future expansion
- Utility Requirements
- Site Utilities

■ Landscaping
- Existing conditions

■ Landscaping
- Demolition identified
- Building outline
Consultant Requirements

**Structural**
- Structural scheme
- Written description

**Building Exterior Envelope**
- Typical Elevations 1/8" scale
- Fenestration layout
- Material designations
- Energy code requirements

**Building Interior**
- Typical Floor Plans with legends min scale 1/16"
- Demolition
- Room numbers
- Area use identification & area in square feet
- Mechanical, electrical & other service closets and rooms
- Life safety plan
- Area tabulations compared to program requirements
- Show flexibility for expansion and alterations
- Preliminary layout of major spaces with fixed equipment

**Elevators**
- Elevator locations
- Equipment room locations

**HVAC**
- Identify all systems
- Exterior equipment locations
Consultant Requirements

- Special occupancy zones
- Energy code requirements

- HVAC
- Main water supply
- Restroom locations

- Fire Protection Mechanical
- Report documenting adequacy of utility
- Connection to utility
- Fire protection systems

- Lighting

- Electric Power Distribution
- Exterior equipment locations
- Electric closet locations

- Fire Alarm
- Connection to Fire Department

- Security Systems

- Other Graphics
- Rendering or models or other graphics as necessary to clearly present concept

- Cost
- Preliminary cost estimate

Design Development

- General Description
- Building code review and describe means of compliance for major code issues
- Preliminary drawings to include outline specifications, fire protection, life
Consultant Requirements

Safety plan and site plans
- Plan, floor plans, elevations, typical wall sections, and building sections
- Equipment list
- Engineering systems analysis
- Preliminary energy use and conservation analysis
- Updated project schedule
- Estimate of cost
- 3-D computer rendering and building exterior and critical interior spaces
- 3-D computer rendering indication mass and building elevation options
- Minutes of Meetings
- Comments to schematic review

Specifications

- Outline specification, with same section numbering, as final document.

Site

- General dimensions & elevations
- Site demolition plan
- Parking plan & elevations
- Site drainage
- Lighting plan
- Concept details of site fixtures and equipment
- Utility plans, elevations & details
- Plan to address existing hazardous material if applicable
- Dewatering plan
- Site demolition plans
- Soil retention work, if needed.
  - **Landscaping**
    - Planting Plan
    - Irrigation Plan
    - Existing irrigation
    - Irrigation legend
  - **Landscaping**
    - Demolition identified
    - Building outline
  - **Structural**
    - Foundation plan
    - Typical floor framing plan
    - Framing plans at unique features
    - Main member sizing
    - Structural sections
    - explanation of structural system and why it was chosen.
  - **Building Exterior Envelope**
    - All building elevations with dimensional heights
    - Typical wall sections
    - Overall building cross sections, 1/8” scale minimum
    - Roof layout, 1/8” scale minimum
  - **Building Interior**
    - All floor plans min 1/16” scale with key plans
    - Wall types, fire ratings, smoke control zones
Consultant Requirements

Plan to address existing hazardous materials if applicable

Fixed seating

Defined seating, serving, and kitchen facilities

Equipment & furniture layouts

Important interior elevations

Preliminary finish schedule

Preliminary door schedule

**Elevators**

Equipment description

**HVAC**

Updated design criteria

One line diagrams and other materials as required to describe the fundamental design concept for all mechanical systems

Indication of the amount of redundancy for all major pieces of mechanical equipment

Overall building air flow diagram indicating air handlers, exhaust fans, duct risers, and duct mains

Plans indicating shaft chase, recess requirements and sizes

Duct layout for typical spaces

Equipment schedules for major equipment

Equipment locations with enlarged mechanical plans

Control diagrams for all mechanical and plumbing systems

Description of major sequences of operation

Central automation operation
**Consultant Requirements**

- M/E smoke control scheme
- Preliminary calculations
- Air intake and discharge locations
- Mechanical Legend
- Efficiency of HVAC systems
- Verify energy standard

**Plumbing and Piping**
- Updated design criteria for each plumbing system
- One line diagrams that describe the fundamental design concept for all Plumbing systems
- Piping plans with indication of required service access areas
- Water header diagram
- Central cooling water header diagram

**Fire Protection Mechanical**
- Riser diagram
- One line layout
- Fire pump sizing calculations

**Lighting**
- Typical lighting plans
- Fixture switching layout
- Fixture types and schedule
- General light fixture descriptions
- Light level calculations
- Energy code requirements
■ Electric Power Distribution
  □ List of equipment on emergency power
  □ Energy generator location
  □ Equipment layout / sizes with devices
  □ Panel locations and schedules
  □ Load estimates
  □ Plan for temporary power during construction

■ Fire Alarm
  □ Fire alarm zones
  □ Smoke zones

■ Security Systems
  □ General security CCTV system description
  □ General description of card access system

■ Other Graphics

■ Cost
  □ Updated cost estimate

Construction Document 50%  

■ General Description
  □ Documentation on drawing as required by building codes
  □ Updated project schedule
  □ Contract documents
  □ Estimate of cost
  □ Identification of construction phasing plan including temporary requirements
Consultants Requirements

for each phase

□ Minutes of meetings
□ Comments

■ Specifications
  □ Complete specifications including draft front end documents

■ Site
  □ Extend of construction area and work
  □ Site demolition plan
  □ Traffic plan if exiting roads walks are impacted
  □ Site development and phasing plan
  □ Construction site access
  □ Staging area
  □ Soil erosion control plan
  □ Construction signage
  □ Pipe sizes
  □ Construction details
  □ Protection requirements for construction, plantings that remain

■ Landscaping
  □ Exiting Tree protection

□ Soil preparation and planting specifications
□ Guying diagrams
□ Piping diagrams
□ Pipe sizes
Consultant Requirements

- Landscape details

- **Structural**
  - Location of control joints
  - Beam, column and slab schedules
  - Mechanical and electrical concrete pads
  - Foundation details
  - Structural details
  - Structural notes

- **Building Exterior Envelope**
  - Roof mounted equipment
  - Roof details
  - Exterior details
  - Flashing details
  - Control joint definition and details
  - Parapet and coping details
  - Roof and drainage plan
  - Exterior door details

- Typical window details
- Details of unique features
- Expansion joint locations
- Large scale building cross section

- **Building Interior**
  - Dimensioned floor plans with key plans
Consultant Requirements

□ Enlarged plans
□ Partition details
□ Interior details
□ Interior elevations
□ Finish schedules
□ Door and hardware schedules
□ Room and informational signage
□ Schedule of proposed movable equipment that is not included in contract for reference
□ Schedule of lab fixtures if applicable
□ Enlarged plans at elevation changes such as stairs
□ Enlarged plans at toilet rooms
□ Reflected ceiling plans
□ Details of unique features
□ Details of fixed equipment

■ Elevators

□ Dimensioned plans
□ Enlarged plans and details
□ Sections and details of pit and hydraulic cylinder if applicable
□ Description of shaft sump pit
□ Elevator Car and equipment support details
□ Description of controls and fixtures
□ Door and frame details
- Interior details including lighting
- Elevator shaft section

**HVAC**
- One line flow diagrams for all mechanical systems
- Floor plans with all components and required service access areas drawn to actual scale.
- The plans indicate duct sizes and airflow relative to each room including CFM.
  - Indicate locations of control panels
- Valves and volume control boxes
- Provide a schedule that indicates the control sequence that applies to each room
- Detailed floor plans of mechanical rooms with all components and required service access areas drawn to scale

- Cross section through mechanical rooms and areas where there are installation coordination issues. Indicate required service access areas
- In common mechanical space indication of space zoning by system
- Connection to fire alarm and campus control systems
- Equipment details including structural support requirements
- Penetration details installation details
- Duct construction schedule indication materials and pressure class for each duct system
- Detailed controls drawings including clear differentiation for trade
Consultant Requirements

- responsibility for control
- fire and control power wiring
- Detail sequences of operation
- Design calculations

- Plumbing and Piping
  - Water Riser Diagram including assumed fixture counts per floor connection
  - Waste and vent riser diagrams including assumed fixture counts per floor connection
  - Central cooling water riser diagram
  - Chilled water riser diagram
  - Riser diagrams of other plumbing systems such as natural gas and pure water
  - Foundation drains
  - Pipe sizes
  - Typical plumbing details including structural support requirements
  - Water heating piping details
  - Coil piping detail
  - Penetration details
  - Design Calculations

- Fire Protection Mechanical
  - Fire protection service entrance details
  - Fire protection plans with indication of any required service access areas
  - Pipe sizes
  - Typical Sprinkler installation details including structural support requirements
  - Penetration details
- **Lighting**
  - Lighting plans of all areas
  - Control diagrams
  - Installation details including structural support requirements
  - Design Calculations

- **Electric Power Distribution**
  - Load summary
  - Panel Schedules
  - Details of power service to building
  - Power distribution plans that indicate the location of all receptacles
  - Plans and details of emergency power generation system and controls
  - Connections to other building systems including Fire alarm and HVAC systems
  - Details of special terminal devices
  - Penetration details
  - Design Calculations
  - Normal power riser diagram with circuit breaker and fuse sizes
  - Emergency Power riser diagram with circuit breaker and fuse sizes

- **Fire Alarm**
  - Indication of connection to fire alarm, HVAC and central campus monitoring systems
  - Connection details
  - Riser Diagram
  - Device Locations
■ Security Systems
  □ Riser diagrams
  □ Equipment closet layout and elevations
  □ Concealed and exposed raceways
  □ Installation details
  □ Security system riser diagrams
  □ Security equipment locations
  □ Card access equipment closet layout and elevations

■ Other Graphics
  ■ Cost
  □ Updated cost estimate

**Construction Document 95%**

■ General Description
  □ Documentation on drawing as required by building codes
  □ Updated project schedule
  □ Contract documents
  □ Estimate of cost
  □ Identification of construction phasing plan including temporary requirements for each phase
  □ Minutes of meetings
  □ Comments from 50% meeting

■ Specifications
  □ Complete specifications including front end documents

■ Site
Consultant Requirements

Extend of construction area and work
Site demolition plan
Traffic plan if exiting roads walks are impacted
Site development and phasing plan
Construction site access
Staging area
Soil erosion control plan
Construction signage
Pipe sizes
Construction details
Protection requirements for construction, plantings that remain

Landscaping
Exiting Tree protection
Soil preparation and planting specifications
Guying diagrams
Piping diagrams
Pipe sizes
Landscape details

Structural
Location of control joints
Beam, column and slab schedules
Mechanical and electrical concrete pads
Foundation details
Structural details
Consultant Requirements

- Structural notes
- Final calculations if requested

**Building Exterior Envelope**
- Roof mounted equipment
- Roof details
- Exterior details
- Flashing details
- Control joint definition and details
- Parapet and coping details
- Roof and drainage plan
- Exterior door details
- Typical window details
- Details of unique features
- Expansion joint locations
- Large scale building cross section

**Building Interior**
- Dimensioned floor plans with key plans
- Enlarged plans
- Partition details
- Interior details
- Interior elevations
- Finish schedules
- Door and hardware schedules
- Room and informational signage
□ Schedule of proposed movable equipment that is not included in contract for reference

□ Schedule of lab fixtures if applicable

□ Enlarged plans at elevation changes such as stairs

□ Enlarged plans at toilet rooms

□ Reflected ceiling plans

□ Details of unique features

□ Details of fixed equipment

■ Elevators

□ Dimensioned plans

□ Enlarged plans and details

□ Sections and details of pit and hydraulic cylinder if applicable

□ Description of shaft sump pit

□ Elevator Car and equipment support details

□ Description of controls and fixtures

□ Door and frame details

□ Interior details including lighting

□ Elevator shaft section

■ HVAC

□ One line flow diagrams for all mechanical systems

□ Floor plans with all components and required service access areas drawn to actual scale.

□ On the plans indicate duct sizes and airflow relative to each room including
**CFM.**

- Indicate locations of control panels
- Valves and volume control boxes
- Provide a schedule that indicates the control sequence that applies to each room
- Detailed floor plans of mechanical rooms with all components and required service access areas drawn to scale
- Cross section through mechanical rooms and areas where there are installation coordination issues. Indicate required service access areas
- In common mechanical space indication of space zoning by system
- Connection to fire alarm and campus control systems
- Equipment details including structural support requirements
- Penetration details installation details
- Duct construction schedule indication materials and pressure class for each duct system
- Detailed controls drawings including clear differentiation for trade responsibility for control
- Fire and control power wiring
- Detail sequences of operation
- Design calculations

**Plumbing and Piping**

- Water Riser Diagram including assumed fixture counts per floor connection
- Waste and vent riser diagrams including assumed fixture counts per floor
connection

- Central cooling water riser diagram
- Chilled water riser diagram
- Riser diagrams of other plumbing systems such as natural gas and pure water
- Foundation drains
- Pipe sizes
- Typical plumbing details including structural support requirements
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- Penetration details
- Design Calculations

**Fire Protection Mechanical**

- Fire protection service entrance details
- Fire protection plans with indication of any required service access areas
- Pipe sizes
- Typical Sprinkler installation details including structural support requirements
- Penetration details
- Design Calculations

**Lighting**

- Lighting plans of all areas
- Control diagrams
- Installation details including structural support requirements
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**Electric Power Distribution**
- Load summary
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- Connection details
- Riser Diagram
- Device Locations

**Security Systems**
- Riser diagrams
- Equipment closet layout and elevations
- Concealed and exposed raceways
Consultants Requirements

□ Installation details
□ Security system riser diagrams
□ Security equipment locations
□ Card access equipment closet layout and elevations

■ Other Graphics
■ Cost
□ Updated cost estimate

Construction Document 100%

Same requirements as 95%

1.24 Project Cost

During the design the Professional will be required to submit an estimate of cost at various phases of the project, to determine whether available funds are sufficient to allow the project to proceed. The estimate of cost shall include gross square footage (GSF), and net assignable square footage (NASF) for new construction and renovation. In addition the total area of the site to be developed shall be included in square feet or in acres. Estimate of cost shall be provided for the following phases:

- Schematics
- Design Development
- 50% Construction Documents
- 95% Construction Documents
- 100% Construction Documents

The estimated cost will be incorporated into the overall budget for the project. Once bid has been received the budget will be reevaluated to create the final budget and contingency amount.

1.25 Professional Fees and Payment schedule
Professionals and consultants shall be paid in accordance with their contract with Mississippi State University or The Bureau of Buildings.

1.26 Press Releases and Media Relations

No information regarding a project for Mississippi State University shall be released to the press or public agencies without the consent of the office of Planning, Design and Construction Administration. Only the University will release pertinent information about the project. The professional and the contractor shall not release any information without the approval of Mississippi State University.

1.27 Building Commissioning

All buildings in which the Bureau of Buildings serves as the owner will be commissioned. The fees for the commissioning of the project shall be accounted for in the budget analysis. The project shall be commissioned by an independent consultant specializing in these services. This commissioning is to ensure the proper operation of building components, and systems. This independent consultant shall be retained by the Bureau of Buildings as part of the overall project cost.

Projects in which the University serves as the owner do not have to be commissioned. Commissioning of these projects shall be at the discretion of Mississippi State University.

1.28 MSU Front End Documents

Mississippi State University has developed front end documents that shall be included in the project manual for bidding and in the Construction Documents. These documents shall be obtained from the Office of Campus Planning and Construction by the Professional for inclusion into the Construction Documents.

For projects that the Bureau of Buildings is considered the owner the front end documents that are included in their procedures manual shall be included in the manual in lieu the those developed by Mississippi State University.

1.29 Parking Areas
Parking Areas: Parking areas should not be considered a detriment to the university, but a rather a way to integrate the necessary use of automobiles, into the natural environment, of the university. All parking areas shall meet the following:

- All parking designs shall be reviewed by OPDCA.
- Parking areas should be organized as a series of small parking bays with planted islands separating them. *No more than 10 contiguous parking spaces is recommended, or desired.*
- On-street parking is not permitted as a substitute for required unit and visitor parking.
- Bicycle parking facilities should be provided within all areas. These facilities should not interfere with pedestrian movement.
- The perimeter of parking areas bordering public streets or property should consist of a planting area at least 20 feet wide to screen public views.
- Planted islands should be used in parking areas to reduce heat radiated from paving, improve auto circulation and safety, and screen automobiles from public views. To accomplish these goals, islands should be large enough for trees and low shrubs. A minimum of 9 feet by 20 feet is recommended.
- As a general standard, there should be at least one tree planted for each 200 square feet of parking area islands and perimeter plantings.
- Planted islands should include trees of at least 2 ½ inches caliper and shrubs at least 18 inches high. Evergreen plantings provide effective year-round screening and should be enriched with plants having seasonal color variation.
- Preservation of healthy trees existing on a site should be a major consideration in the planning of any new parking area.
Demolition Procedures

Building Name: Project Name Building No.: ####

- Initiate Project using the Project Initiation Form.
- Prepare and submit MDAH Notice of Intent form; obtain MDAH letter of approval to demolish.
- Prepare and submit IHL Board of Trustees agenda item for permission to demolish and remove the facility from inventory. Approval letter from MDAH must accompany this request. Obtain IHL letter of approval to demolish and remove from inventory (this letter of approval based on University obtaining MDEQ approval at appropriate time).
- Execute any MDAH requirements. Obtain photos for all agency records.
- Execute asbestos inspection (generally completed by General Contractor). Complete asbestos abatement and demolition plans and specifications, follow applicable bid laws to obtain bids, determine demolition contractor (or in-house) and schedule demolition, prepare and submit MDEQ Demolition/Renovation Notification Form; obtain MDEQ letter of compliance.
- Log into Bureau of Building’s (BoB) website to delete building from inventory. Follow the BoB’s instructions for deleting building from inventory and attach approval letters from IHL, MDEQ, MDAH and photos. After completion of BoB’s instructions, building demolition may proceed.
- Send copies of all approval documents to IHL staff and MSU Property Control, and indicate timeline for demolition.
Demolition Procedures

Demolish and dispose of building following all state and federal regulations.

Update property records and building records.
Div. 02 Existing Site Conditions

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 02 21 00: Surveys

1. All new projects site plans shall be developed from a new topographical map developed specifically for that project; not from “as built” information or previous project grading plans. Accurate information is critical and special conditions such as asbestos, lead paint, underground tanks shall be addressed.

2. All surveys shall be performed by a land surveyor licensed in the State of Mississippi. Mississippi State University shall contract directly with the surveyor. The professional for the project shall make recommendations as to the selection of the surveyor.

3. Surveyor shall allow Facilities Management the opportunity to review and comment on survey before final printing.

4. If design firms needs to create its drawings of measurements other that decimal units such as architectural units, a base point of 0,0 shall be used when rescaling the drawing. Any rescaling rotation or change in units should be noted outside the plotting limits on the CAD drawing.

5. At the completion of the new project, and as part of the close out documents the contractor shall have a as built survey performed showing final topographical information, to include inverts, grade elevations, and underground utilities, and all other pertinent information. This shall be included in the contract documents and at the expense of the general contractor.

6. All surveys shall be class B and utilize NAD 83 State Plane Coordinates.
Section 02 41 00: Geotechnical Investigations

1. Mississippi State University shall contract directly with geotechnical consultants. The professional for the project shall make recommendations as to the selection of the geotechnical consultant. The design professional shall coordinate and receive proposals for the University. The geotechnical consultant shall be licensed in the State of Mississippi.

2. The design professional shall coordinate with the Office of Planning Design and Construction Administration to develop the necessary testing locations, frequencies, depths etc. that will be included in such services.

3. The contract documents shall include the geotechnical investigations report, showing all soil boring locations, cross sections and soil reports.

Section 02 41 00: Selective Site Demolition

1. The general contractor shall conform to applicable code and ordinances for disposal of debris. He shall coordinate demolition work with utility companies, and conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

2. The general contractor shall test soils around buried tanks for contamination.

3. All demolished material shall be removed from University property. The removal of trees and shrubs shall include the removal of stumps and roots to the extent that no root greater than 2 inches in diameter remains within 5 feet of any underground structure or utility line nor under any footings or paved areas.

Section 02 41 16013: Building Demolition

1. The general contractor shall conform to applicable code and ordinances for disposal of debris. He shall coordinate demolition work with utility companies, and conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

2. Demolition of existing structures shall be governed by the International Building Code.

3. Mississippi State University shall have first right of refusal for all salvageable materials.
4. Material that the University chooses to keep shall be delivered by the General Contractor to a location on campus as directed by Facilities management.

Section 02 82 00: Asbestos Remediation

1. The design professional shall include in the contract documents the removal of all asbestos material.
2. This material shall be removed from University grounds and delivered to a certified land fill that handles such material.

Section 02 61 00: Removal and Disposal of contaminated Soils

1. The design professional shall include in the contract documents the removal of all contaminated soils
2. This material shall be removed from University grounds and delivered to a certified land fill that handles such material
Div. 03 Concrete

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 03 00 00: Concrete

1. All concrete foundation systems shall be in accordance with the recommendations by the geotechnical consultant, in coordination with the structural engineer for the project. Driven steel or wood piling shall be used without permission of Facilities Management. All requests shall be submitted to the University Architect for review and approval.

2. The design professional shall submit to the University Architect a letter certifying that the structural engineer has read the geotechnical consultant’s report and consulted with geotechnical engineer of record.

3. The design professional shall submit to the University Architect in writing the rational for the selected foundation system.

4. Compression strength and all other required laboratory analysis shall be performed by a qualified independent laboratory. The Laboratory shall be approved by the project professional. The cost for the laboratory shall be included in the contract documents and shall be the responsibility of the general contractor.

5. Concrete stairs risers shall have a continuously sloped face projecting 1” out to nosing. Noising on interior exposed concrete stairs shall have a cast in place abrasive steel or aluminum noising. Aluminum noising shall have a asphaltic bond break where in contact with concrete. Exterior concrete treads shall slope ¼” to nose for drainage.

6. Testing Laboratory Quality Assurance: Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following tests and inspections. Tests shall be performed in accordance with ACI 301.
7. Perform a slump test as deemed necessary for each load of concrete. Record if water or admixtures are added to the concrete at the jobsite. Perform additional slump tests after job site adjustments.

8. Mold four specifications per set for compressive testing; one set for each 100 or less cubic yards of each class concrete placed per day. Test one at 7 days, 2 at 28 days, and hold one as a spare to be broken as directed by the Architect/Engineer if compressive strengths do not appear adequate.

9. For each set of molded specimens record the following:
   a) Slump
   b) Temperature, ambient and concrete
   c) Air content
   d) Location of placement
   e) Verification of correct design mix

10. The ready mixed concrete plant shall be certified for conformance with the requirements of the National Ready Mix Concrete Association.

Section 03 10 00: Concrete Forming

1. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Mississippi.
2. Formwork shall take into account weight of concrete when loaded. Form work to be cambered to allow for settlement as avoiding slabs with low spots.
3. Submit location of construction Joints in framed construction for approval.

Section 03 20 00: Concrete Reinforcing

1. Welded wire reinforcing shall be specified to be in flat sheet and not rolls. Welded wire shall be placed on brick or steel chairs. Wood or concrete masonry units are unacceptable.
2. Reinforcing Steel: ASTM A615, 60 KSI yield grade; deformed billet steel bars. Use a grade of steel if required by the design professional.
3. Fiber Reinforcement: No fiber reinforcement shall be used without submittal and review by the office of Planning Design and Construction Administration.

Section 03 23 10 PT Unbonded Tendons
1. Tendons shall be permanently protected against corrosion as recommended by the Post-Tensioning Institute.
2. Tendon Supplier shall be certified by the PTI program for Certification of Plants producing Unbonded Single Strand Tendons.
3. Sheathing Material shall be high density polyethylene or polypropylene extruded over the coated tendon or produced by a heat sealing process.

Section 03 30 00: Cast in Place Concrete

1. Concrete work shall be specified to meet the latest requirements of the American Concrete Institute Standards.
2. No lightweight concrete is to be used.
3. Hot and Cold weather requirements for placement of concrete shall be clearly defined.
4. Waffle slab construction and post tension construction are not allowed on projects for Mississippi State University without specific approval of the office of Planning Design and Construction Administration.

Section 03 35 20: Architectural Concrete Stain

1. The installer shall be an established firm regularly engaged in the installation of scored and stained concrete systems, with a minimum of three (3) years’ experience in successfully applying the same or similar systems. The installer must be able to supply references of jobs of a similar nature completed within the last three (3) years.
2. The installer shall be provided with a test area of minimum of 6’ x 6’ to produce a sample of both stain and finish. This sample must be approved by the architect and the University Architect, before application in designated area. This sample shall be produced by the same installer who installs actual finished product.

Section 03 45 00: Architectural Precast Concrete

1. Architectural precast concrete (APC) includes, but is not limited to: wall and spandrel panels, door and window sills and surrounds, accent bands, copings and caps for building; accent bands for site elements (in Gatehouse walls).
2. Certain requirements for the work of this Section which may be more restrictive or more stringent than normal industry standards for installation and finished work,
due in part, to the close interfacing with work of other Sections (and in particular with Brick Masonry). Aesthetics (artistic effect) and water tightness will be given prime consideration in the examination and acceptance of the installed architectural precast concrete.

3. Design all Architectural Precast Concrete work under direct supervision of a Professional Structural Engineer, with documented satisfactory experience in the types of units required, and licensed in the State of Mississippi.

4. Design all component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

5. The Engineer will stamp (seal) all Design and Erection Drawings and all Calculations used in construction of APC work.

Section 03 62 00 Non-Shrink Grouting

1. Grout shall be flowable, non-shrink, non-metallic in accordance with CRD-C-621 and ASTM C1107

2. Protect grout and areas to be grouted from excessive heat and cold in accordance with manufacturer’s Specifications. Protect grout from excessive drying shrinkage resulting from wind or direct sunlight. Protect areas grouted from excessive vibrations.
Div. 04 Masonry

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 04 01 21: Masonry Stain

1. Masonry Stain shall be equal to Nawkaw Corporation – NECT-90 Nawkaw Emulsion Color Treatment or approved equal.
2. The contractor and applicator shall jointly and severally warrant masonry stain material against failure in material and workmanship for a period of twenty-five (25) years from the date of application.

Section 04 05 19 16: Flashing

1. Provide stainless steel flashing where flashing is exposed or partly exposed. Metal flashing shall comply with SMACNA.
2. Provide self-healing flexible flashing for areas not exposed to the exterior light.
3. Flexible flashing shall consist of a pliable adhesive rubberized-asphalt compound, bonded to a high density, and cross laminated polyethylene film to produce an overall thickness of not less than 0.040 inches.
4. All horizontal joints in flashing shall be sealed to prevent water migration horizontally.

Section 04 05 19 19: Weeps

1. Provide weeps as recommend by the Brick Institute of America.
2. Weeps shall be open head joints.
3. Plastic pipe and cotton wicks are not allowed.
Section 04 05 19 20: Cavity Drainage Material

1. Provide free draining mesh made from polymer strands that will not degrade with the wall cavity.
2. Drainage cavity shall be kept clear of excess mortar droppings and brick spoils.
3. Mortar net shall be equal to “Mortar Net” as manufactured by Hohmann & Barnard, Inc. or CavClear Masonry Mat as manufactured by CavClear/Archovations Inc. to be full height in all cavity walls between back of brick and face of structure.
4. “Mortar Net” will be manufactured of high density polyethylene or nylon strands woven into a 90% open mesh. Mesh shall be full depth of cavity with dovetail shaped notches seven (7) inches deep to prevent mesh from being clogged. Install “Mortar Net” at all through wall flashing locations at brick ledges, door and window headers and intermediate flashings.

Section 04 05 23: Control Joints

1. Control joints shall be provided where indicated and required by the Brick Institute of America. They shall be sawed type or built in type, as the case requires.
2. All control joints shall be made laterally stable thru the use of rubber like keys and use of sash block concrete masonry units where required.
3. Joints shall occur directly opposite each on both faces of the wall, and shall be filled with no staining elastic sealing compound, unless fire caulking is required.

Section 04 21 13: Brick Masonry

1. All face brick shall be submitted to the Office of Planning Design and Construction Administration for approval of color and texture.
2. Face Brick shall comply with ASTM C 216
3. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 3000 psi.
4. Initial Rate of Absorption: Less than 30 g / 30 sq. in. per minute when tested per ASTM C 67
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated “not effloresced.”
6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet and shall have a history of successful use in the University’s area.


8. Color and Texture: Match existing building or as approved by the Office of Planning Design and Construction Administration.

9. Provide samples for verification for each type and color of face brick, special brick shapes and accessories embedded in masonry.

10. Build up to five sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

11. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Immediately remove grout, mortar, and soil that come in contact with such masonry.

12. Provide shapes with exposed surfaces matching finish and color of exposed faces of adjacent units.

13. Variation from Plumb or level do not exceed 1/8 inch in 10 feet or 1/4 inch in 20 feet or 1/2 inch maximum.

14. Variation in Joint width, do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

15. Variation in plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

Section 04 22 00: Concrete Unit Masonry

1. Face dimensions 16” long x 8” high x 8” deep nominal.
2. Use dry units no frozen or wet units shall be used.
3. Discard cracked, chipped and spalled masonry units.
4. All units shall be laid in full bed of mortar on horizontal and vertical joints.
5. All unit masonry shall be stored in dry condition to protect from the elements and prevent contamination, deterioration or damage due to moisture, temperature changes, contaminants, corrosion and other causes.
6. Concrete Unit Masonry shall comply with ASTM C90.
7. Variation from Plumb or level do not exceed 1/8 inch in 10 feet or 1/4 inch in 20 feet or 1/2 inch maximum.
8. Variation in Joint width, do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.
9. Variation in plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

Section 04 72 00 Cast Stone Masonry

1. Submit 10 inch square for each type of stone required for approval by owner.
2. Obtain cast stone units from a single source and single manufacturer.
3. Cast stone masonry shall comply with ASTM C 1364.
4. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
5. Variation from Plumb or level do not exceed 1/8 inch in 10 feet or 1/4 inch in 20 feet or 1/2 inch maximum.
6. Variation in Joint width, do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.
7. Variation in plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.
Div. 05 Metals

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 05 12 00: Structural Steel Framing

1. Fabricate structural steel members in accordance with AISC – Specification, for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. Provide ultrasonic testing reports for all complete penetration shop welds. Maintain one copy of each report on site.
3. Provide shop workmanship equal to the best modern practice conforming to listed industry standard and in accordance with the latest requirements of the American Institute of Steel Construction.
4. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, fire proofing material and high strength bolted connections.
5. Store material off ground to permit easy access for inspection and identification.
6. Paint steel that is not encased in concrete, plaster or sprayed fireproofing.
7. Field Paint steel that has been welded or that is unpainted after connections have been tightened.
8. Galvanize shelf angles that support the exterior building veneer.

Section 05 21 00: Steel Joist

1. Perform all Work, in accordance with the SJI Standard Specifications, Load Tables, and Weight Tables.
2. Shop prime joists. Do not prime surfaces that will be field welded.

Section 05 31 00: Steel Deck

1. Design metal decking in accordance with SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.
2. Galvanize both sides, G60 coating, ASTM A653.
Section 05 41 00 Cold-Formed Exterior Steel Stud Framing

1. Deflection of steel studs shall not exceed L/600
2. Manufacturer shall have a minimum of three years documented experience in the manufacturing of products required by the Contract Documents. The manufacturer shall be certified by the Steel Stud Manufacturers Association (SSMA).
3. Design framing system under the direct supervision of a professional structural engineer licensed in the state where the Project is located.
4. Provide a minimum of one mockup of exterior wall framing sufficient in size to illustrate various construction conditions. Include stud framing, including runners, bridging, outlet box framing and other accessories. Mock up to show typical window frame, door frame and expansion joint.
5. Studs and accessories which are 97 mil, 68 mil, or 54 mil shall meet the requirements of ASTM A1003 with a minimum yield of 50,000 psi. Studs and accessories which are 43 mil or 33 mil shall meet the requirements of ASTM A1003 with a minimum yield of 33,000 psi.
6. Studs and accessories shall have a G60 galvanized coating meeting the requirements of ASTM A653.

Section 05 44 00: Light Gauge Steel Pre-engineered / Manufactured Trusses

1. Fabricator Qualifications: Fabrication shall be performed by experienced cold-formed metal framing truss fabricator with not less than two years’ experience designing and fabricating cold-formed metal trusses equal in material, design, and extent to the systems required for this project. Primary fabrication shall be conducted in permanent facility dedicated to the manufacturing of cold-formed metal trusses. Job site fabrication is strictly prohibited.
2. Erectors Qualifications: Truss erection shall be performed by a qualified installer experienced in structural light gauge steel framing and recommended truss installation practices.
3. Fabricate truss components of commercial quality steel, ASTM A653 galvanized finish with a minimum yield point of 45 KSI.
4. Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet, ASTM A653 galvanized finish with a minimum yield of 33 KSI.
5. Finish: Provide components with protective zinc coating complying with ASTM A653, minimum G60 coating.
6. Splicing of webs is not permitted.
7. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A780 and the manufacturer's instructions.

**Section 05 50 00: Metal Fabrications**

1. All ferrous metal shall be properly cleaned and given one shop coat as specified for structural steel. Anchors that are built into masonry or concrete shall be coated with asphalt paint. All exposed ferrous metal shall receive painting.

2. Furnish steel lintels and continuous shelf angles where required on the drawings. Steel lintels will not be required over hollow metal door frames that are located on nonbearing partitions of 4" thickness. Lintels shall be of size and quantity noted on drawings and shall have an 8" minimum bearing at each end unless otherwise shown. All miscellaneous angles, clip angles, bolts, etc. shall be furnished where called for and/or noted where required in conditions not specifically noted.

3. Furnish and install all steel pipe, angles, beams, clips, bolts, plates, etc., that may be required to support the following:
   A. Mechanical Equipment
   B. Roof Access
   C. Electrical Equipment
   D. Gates
   E. Fence

4. Where required provide drilled anchors equal and similar to Rawl "Chem-stud." Use these anchors to attach treated wood blocking to concrete filled CMU.

5. Fabricate vertical ladders, conforming to ANSI A14.3, of 2-1/2"x 3/8" steel flat bars for stringers and 1" diameter steel rods for rungs, unless shown otherwise on drawings. Install ladders so that distance from the rungs to finished wall surface will not be less than 6'. Install brackets as required for securing ladders into the masonry, steel structure, or wood blocking within the wall. Install safety cages where required by code. Provide a minimum 36” overrun of stringers at top of all locations.

6. Cast iron downspout shoes shall be Equal to R-4929-A3 as manufactured by Neenah Foundry Company, Neenah, WI.

7. Furnish and install galvanized steel pipe railings as detailed of sizes as shown on concrete documents, Schedule 40, pipe unless otherwise shown. Railings to be all welded construction with welds ground and polished and furnished with shop prime coat.
8. Roof scuttle shall be equal to Type “S-20”, 2’-6” x 3’-0” as manufactured by Bilco Co., New Haven, CT. Cover shall be zinc-coated steel not less than 14 gauge with 3” beaded flange, neatly welded. Insulation shall be glass fiber 1” thickness, fully covered and protected by a metal liner. Furnish at locations indicated on contract documents. Furnish Bilco “Ladder Up” safety post for mounting to ladder rungs of fixed steel ladder below roof hatch.

9. Provide MSU standard bollards equal to those manufactured by Alexander Iron Works, Alexander City, Alabama. Post cap shall be “Cherry Street” and post shall be 4” steel. Anchor posts in concrete and fill solidly with minimum 3000 psi concrete.

10. Where indicated on drawings, furnish and install expansion joint covers equal to those manufactured by C/S Group or as noted. Metal shall be extruded metal 6063-T5

Section 05 51 13: Metal Pan Stairs
1. Engage a qualified professional engineer, to design stairs and railings.
2. Metal stairs shall withstand the effects of gravity loads and stresses within limits and under conditions indicated. Uniform Load 100 lbf/sq. ft. Concentrated Load: 300 lbf applied on an area of 4 sq. in, Uniform and concentrated loads need not be assumed to act concurrently. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
3. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

Section 05 52 13: Pipe and Tube Railings:

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2. Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
Div. 06 Wood Plastics and Composites

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 06 10 00: Rough Carpentry

1. Lumber Grading Rules and Wood Species shall be in conformance with Voluntary Product Standard PS 20. Grading rules of the following associations apply to materials furnished under this Section: Southern Pine Inspection (SPIB) and Western Wood Products Association (WWPA).
2. Lumber specified to be treated shall be pressure treated equal in all respects to Womanizing, Cellon or Osmose K-33 and in strict accordance with FS TT-W-571g and the standards set forth by the American Wood Preservers Association. Under no circumstances shall creosote, oil, or any other method that will bleed be used.
3. Provide pressure-treated wood for all framing, blocking, furring, nailing strips built into exterior masonry walls, wood in contact with concrete and in conjunction with gravel stops and roofing.
4. Apply two brush coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber.

Section 06 22 00: Millwork

1. Millwork shall be described as counters, wall and base cabinets, hardware for same, plastic laminate tops and any other items of finished wood or millwork not specifically shown or indicated to be items of equipment.
2. Millwork shall be manufactured in accordance with the following References
   A. ANSI A208.1: Wood Particleboard, 1989
   B. ANSI/BM/HMA A156.9: 1982 American National Standard for Cabinet Hardware
   C. Architectural Woodwork Quality Standards, Guide Specifications and
Quality Certification Program, AWI 1988
D. NEMA LD3: 1985 High Pressure Decorative Laminate; National Electrical Manufacturer's Association, 1985
E. American Plywood Association (APA)
F. Western Wood Products Association (WWPA)
G. American Woodwork Institute Section 200, 400, 500, 1500, and 1600.
Div. 07 Thermal and Moisture Protection

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 07 11 13: Bituminous Damproofing

1. All damproofing materials and primers shall be obtained through one source from a single manufacturer.
2. All damproofing shall be installed by a troweled on application with a minimum of 2 coats. Rolled, brushed or sprayed on applications are not acceptable.

Section 07 21 00: Thermal Insulation

1. Extruded Polystyrene Board Insulation: ASTM C 578 of type and minimum compressive strength indicated below with maximum flame-spread and smoke development indexes of 75 and 450, respectfully, per ASTM E 84.
2. Vapor Retarder Tape: Pressure sensitive moisture resistant faced tape recommended by insulation manufacturer for sealing joints, ruptures and penetrating items in insulation board.
3. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
4. Provide glass fiber blanket insulation free of formaldehyde with 100 percent acrylic binders.

Section 07 24 13: Polymer Based Exterior Insulation and Finish System (EFIS)

1. EFIS finish system shall not be allowed except in special situations. Verify use with the Office of Planning Design and Construction Administration.
Section 07 31 13: Asphalt Shingles

1. Obtain ridge and hip cap shingles and self-adhering sheet underlayment from single source from single manufacturer.
2. Fire-Resistance Characteristics: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
4. Material Warranty Period: 25 years from date of Substantial Completion, prorated, with first 12 years non prorated.

Section 07 31 34: Polymeric Slate Tile Roofing

1. All components of the polymeric slate tile roof system are to be products manufactured or supplied by a single manufacturer.
2. Tiles shall be made of Starloy TM, 80% recycled rubber & Plastic compound, 12 inches wide by 18 inches long with a nominal thickness of ¼ inch. Color shall be selected by Architect and approved by the Office of Planning Design and Construction Administration.

Section 07 41 14: Sheet Metal Roofing

1. Shall be factory roll formed prefinished, 12” wide one piece snap together architectural panel. Sheet material shall be 24 gauge base metal Grade 50 AZ 55 Galvalume. Roofing system shall include metal trim and closures.
2. Exposed metal surfaces shall be a fluorocarbon coating. Roof panels shall be formed full length.
3. Colors shall be selected by Architect and approved by the Office of Planning Design and Construction Administration.

Section 07 52 00: Modified Bitumen Roofing System

1. All flat roofs shall be 2 Ply SBS- Modified Bituminous Membrane Roofing.
2. Roofing Membrane Sheet: shall be grade S, Type 1, polyester reinforced SBS modified asphalt sheet smooth surfaced.
3. Roofing Membrane Cap Sheet: Shall be Grade S Type 1, polyester reinforced SBS modified asphalt sheet smooth surfaced.
4. Granule Color: Granule color shall be white.
5. Roofing Asphalt: shall be Type IV. Hot applied application.

Section 07 53 23: Single Ply EPDM Roofing
2. EPDM roofing shall not be allowed except in special situations. Verify use with the Office of Planning Design and Construction Administration.

Section 07 60 00: Flashing and Sheet Metal
1. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
2. Color Anodic Finish Coil Coated: As selected by Architect from full range of industry colors and color densities. Color Range: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
3. Exposed Coil Coated Finish: Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Through-Wall, Ribbed, Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry, with ribs at 3-inch intervals along length of flashing to provide integral mortar bond. Manufacture through-wall flashing with snap lock receiver on exterior face to receive counter flashing.
5. Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
6. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

Section 07 92 00: Joint Sealants:

1. Before installing sealants, field test their adhesion to the project joint substrates.
2. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
5. Latex Joint Sealants Acrylic latex or siliconized acrylic latex.
6. Acoustical Joint Sealant standard non-sag, paintable, non-staining latex sealant.
7. Joint Sealant Backing of material that are non-staining and are compatible with joint substrates, sealant, primers and other joint fillers.
Div. 08 Openings

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 08 11 00: Metal Doors and Frames

1. All doors shall be a minimum of 3’-0” wide. All steel doors and frames shall be product from one manufacturer and supplier. Acceptable manufacturers are listed below:
   a. Curries Manufacturing, Inc. Mason City, Iowa
   b. Ceco Door Products, Brentwood, Tennessee
   c. Mesker Door Company, Huntsville, Alabama
   d. Republic Builders Products, McKenzie, Tennessee
   e. Steelcraft Manufacturing Company, Cincinnati, Ohio
2. Supports, plates and Anchors shall not be less that 16 gauge sheet steel. Hardware reinforcing gauges shall be not less that minimum in ANSI/SDI-100 except that reinforcing in doors and frames for hinges and closers shall be 7 gauge.
3. Frames shall be cold rolled steel galvanized steel. 14 gauge for exterior and interior frames.
4. Doors shall be SDI-100, Grade II, Heavy duty level “B”, model 3, seamless hollow steel construction. Face sheets and edge closures shall be minimum 16 gauge for exterior doors and 18 gauge for interior doors. After fabrication all doors and frames shall have thoroughly cleaned components and applied bonderizing treatment with baked on rust inhibitive prime coat suitable as base for finish paints. All interior doors to private offices shall have a view lite in the door.
5. Doors shall meet all IBC Codes

Section 08 12 01: Fire Rated framing Systems
Section 08 14 16: Flush Wood Doors

1. All doors shall be a minimum of 3’-0” wide. All flush wood doors shall be product on one manufacturer and supplier. Acceptable manufacturers are listed below:
   a. Weyerhaeuser, Marshfield, Wisconsin
   b. Algoma Hardwoods, Algoma, Wisconsin
   c. Buell Door Company
   d. Egger Industries, Two Rivers, Wisconsin
2. All flush interior doors shall be AWI Premium Grade, 1-3/4” thick with stiles and rails edge glued to core.
3. All doors shall have hardwood edges and wood trim at glazing.
4. Flush wood doors shall be five (5) ply construction only; Seven (7) ply will not be allowed.
5. All interior doors shall be prefinished, Plain sliced, Premium white maple with factory stain with matching door edges.
6. Stain colors shall be selected by Architect and approved by the Office of Planning Design and Construction Administration.
7. All door edges on flush wood doors shall be sealed.
8. All interior doors to private offices shall have a view lite in the door.
9. Doors shall meet all IBC Codes.

Section 08 41 13: Aluminum Framed Entrances and Storefronts

1. Storefronts and doors shall be assembled by one manufacturer.
2. Storefronts shall be free of scratches and other serious blemishes. Color to be selected by the Architect and approved by the Office of Planning Design and Construction Administration.
3. ¼” safety glass shall be used in storefronts and doors
4. Aluminum storefronts shall be equal to Kawneer No. 350 medium stile, off set pivots, standard F2 push pull

Section 08 71 00: Door Hardware

1. All door hardware shall be through one source from a single manufacturer. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from only one manufacturer, although several may be indicated as offering products complying with requirements.
2. Hardware supplier shall be a direct factory contract supplier who has in his employment a certified hardware consultant (AHC) who is available at all reasonable times during the course of the Work, and for project hardware consultation to the Owner, Architect, and Contractor.

3. Exit Doors: Operable at all times from the inside without the use of a key or any special knowledge or effort.

4. Fire-rated openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80. This requirement takes precedence over other requirements for such hardware. Provide only such hardware which has been tested and listed by UL for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required whether or not listed in the Hardware schedule.

5. Electronic Security Hardware: Coordinate installation of the electronic security with the Architect and provide installation and technical data to the Architect and other related sub-contractor(s). Upon completion of the electronic security hardware installation, verify that all components are working properly and state in the required guarantee that this inspection has been performed.

6. Approved Hardware Manufactures:

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7. Materials shall be as follows:
A. Locksets: Mortise Type Locks and Latches shall be heavy-duty with hinged, anti-friction, 3/4 inch throw latch bolt with anti-friction piece made of self-lubricating stainless steel. Functions and design as indicated on the hardware groups. Deadbolt functions shall be 1 inch projection made of hardened stainless steel. Both deadbolt and latch bolt are to extend into the case a minimum of 3/8 inch when fully extended. Furnish locksets and latch sets with sufficient curved strike lip to protect door trim. Provide locksets with 7-pin patent protected interchangeable core cylinders. All mortise cylinders shall have a concealed internal set screw for securing the cylinder to the lockset. The internal set screw will be accessible only by removing the core from the cylinder body. All mortise locksets and latch sets must conform to ANSI A156.13, Series 1000, Operational Grade 1 and be listed by UL. Lockset must fit ANSI A115.1 door preparation. Locksets and latch sets to have self-aligning, thru-bolted trim. Auxiliary dead latch to be made of one piece stainless steel, permanently lubricated. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers which contain a hollow cavity are not acceptable. Spindle to be such that if forced it will twist first, then break, thus preventing forced entry. Levers to be operated with a roller bearing spindle hub mechanism. Locksets with the IDH listed in the specifications will have Request to Exit Switch, Door Monitor Switch and electric locking integrated into the lockset.

B. Locks shall have minimum 3/4 throw. All deadbolts shall have 1-inch minimum throw.

C. Comply with requirements of local security ordinances.

D. Lock Series and Design: Best, 35H7 15H. Cylinders: Best 7-Pin

8. Hinges: Out swinging exterior doors shall have continuous pin. All hinge open widths shall be minimum, but of sufficient size to permit door to swing 180. Furnish hinges with five knuckles and flush bearing.

A. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.

B. Provide hinges as listed in schedule.

C. Provide continuous hinges as scheduled.

9. Exit Devices: Furnish all sets at wood doors with sex bolts unless otherwise specified.
10. Surface Door Closers: Full rack and pinion type with removable non-ferrous cover. Provide sex bolts at all wood doors. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized and adjustable.
   A. Provide multi-size 1 through 6 at all doors rated or not.
   B. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
   C. Drop brackets are required at narrow head rails.
   D. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings shall have the minimum force per the governing authority.

11. Kick plates: Provide with four beveled edges, 10 inches high by width less 1.5 inches on single doors and 1 inch on pairs of doors. Furnish Type "A" screws to match finish.

12. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

13. Screws: All exposed screws shall be Phillips head.

14. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

15. Materials shall be as follows:
   A. Generally to be BHMA 626 Satin Chrome where indicated.
   B. Protection Plates, Push, Pulls shall be BHMA 630.

16. Spray door closers to match other hardware, unless otherwise noted.

17. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

18. Provide construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

19. All cylinders shall be Best Patented 7-pin, interchangeable core. Furnish for all locks and exit devices and as called for in Hardware Sets.

20. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

22. Furnish keys in the following quantities:
   - 1 each Grand Master keys
   - 4 each Master keys
   - 2 each Change keys each keyed core
   - 9 each Construction master keys
   - 1 each Control keys

23. Best Certified Personnel will install permanent cores and collect the construction cores. All Construction cores and keys remain the property of the factory. The cost of the Installation of the Permanent Cores shall be a part of this section.

24. Keying schedule: Submit three copies of separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks have been fulfilled.

Section 08 71 13: Automatic Door Operators

1. Automatic door operators shall be equal to Stanley Magic automatic swing door operators. Color to be selected.

Section 08 80 00: Glazing
Div. 09 Finishes

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 09 22 13: Furring

Section 09 22 16: Metal Stud Framing System

Section 09 27 13: Glass Fiber Reinforced Plaster Fabrications

Section 09 29 00: Gypsum Drywall

Section 09 30 13: Ceramic Tile

1. Non-absorbent, unglazed porcelain color through mosaic tile is required for shower or wet area floors. Slip resistant textured glazed or unglazed porcelain tile may be used in some wet areas where the COF (wet) is met and in non-wet areas. Glazed porcelain or polished tiles are suggested for walls. Porcelain floor tile should have a breaking strength of 250 lbs. or greater; COF wet of .60 or greater and water absorption of .5% or less. Manufacturer’s suggested backing materials for mounting, mortars; grout and installation methods should be followed. Stainless epoxy grout is required for stain resistance and long term maintenance. Tile must meet A.D.A. requirements.

2. Attic stock to equal to 2% of each type and color porcelain tile will be provided to owner, wrapped in heavy wrapping and clearly marked for identification with manufacturer, color number and name and area tile was used.

Section 09 51 00: Acoustical Ceiling Treatment

1. All ceilings shall be designed to be easily accessible for maintenance and other access needs such as technology installations. A single type of ceiling tile, size and
suspension system shall be used throughout a building to minimize maintenance and repair costs. Exceptions must be approved by Mississippi State University Planning Design and Construction. Hidden spline suspension systems will not be allowed. 15/16” exposed grid is the standard. The use of plaster for ceilings shall not be allowed. The use of plaster for patching existing plastered surfaces will be allowed.

2. Ceiling suspension assemblies shall be supported directly from the building structure and shall be supported at all four corners of fluorescent light fixtures. Ceilings shall not be supported from ductwork, electrical conduit, heating or plumbing lines and vice versa. Each utility system and the ceiling grid system shall be a separate installation and each shall be independently supported from the building structure. When interferences occur, provide trapeze type hangers or other suitable supports for each system. Locate hangers and supports where they will not interfere with access to mixing boxes, fire dampers, valves, and any other system which will require servicing.

3. Stainless steel hanger wires must be specified for canopy suspension systems and for other systems in locations subject to moisture penetration or condensation.

4. Anchorages: Power-driven anchors are prohibited and shall be noted in the specifications. Ceiling suspension systems shall be secured to the structure with toggle, molly bolts, self-drilling anchors, cast-in inserts, or bolts in expansion shields. The use of wood, lead, or plastic plug anchors is also prohibited.

5. Attic stock equal to 3% of each type and size of ceiling tile shall be provided to owner. This stock shall be wrapped in heavy wrapping and clearly marked for identification.


7. Odd sizes are not allowed. Acoustical ceiling tiles shall be rated Class A with Flame Spread of 25 or less. Suspension grid system shall be 15/16” size and shall meet the same code requirements as a whole ceiling assembly. A Fire Resistive ceiling will be used in applicable fire rated assemblies.

8. Attic stock will be provided to the owner at the end of project equal to 3% of each type and size of ceiling tile used. This stock will be wrapped in heavy wrapping and clearly marked for identification with manufacturer, pattern and color number and name.

Section 09 54 01: Wood Ceiling System
Section 09 65 00: Resilient Tile Flooring

1. VINYL COMPOSITION TILE: Through-pattern Vinyl Composition Tile shall be 12” x 12” size by .125” thickness. Color and pattern shall extend through the thickness of tile. Tile must pass Flooring Radiant Panel Test with Class 1; pass Flame Spread; pass N.B.S. Smoke Chamber Test with less than 450. Adhesive recommended by manufacturer shall be used and conform to the tile flame spread. Tile should be installed according to manufacturer instructions. Slip resistance shall meet A.D.A. requirements. Adhesive and tile shall be asbestos free. Attic stock of two cartons of each VCT used shall be provided to owner at project completion.

2. SOLID VINYL TILE: Tile shall pass ASTM E648 Critical Radiant Flux with rating of Class 1; pass Smoke Chamber Test with less than 450; pass Flame Spread. A.D.A. slip resistance requirement must be met. Adhesive recommended by manufacturer shall be used and conform to tile flame spread. Adhesive and tile shall be asbestos free. Attic stock of two cartons of each pattern and color of solid vinyl tile shall be provided to owner at project completion.

3. RUBBER FLOOR TILE OR SHEET FLOORING: Rubber Tile or Sheet Flooring shall be appropriate for heavy traffic requirements. Sheet Flooring or Tile shall meet ASTM E 648/NFPA 253 –Class 1; ASTM E 662/NFPA 258 less than 450 Smoke Generation; pass Flame Spread. Tile shall meet A.D.A. slip resistance requirements. Floor tile shall be installed per manufacturer instructions, using manufacturer’s suggested adhesive. Tile and adhesive shall be asbestos free. It is recommended that a low profile raised surface or slightly textured surface be used for slip resistance. Rubber flooring will not be used for commercial kitchen or areas where flooring may be exposed to animal fats, vegetable oils or petroleum based materials. Attic stock of two cartons of each pattern and color rubber floor tile used shall be provided to owner upon project completion. Stock of rubber sheet flooring of 6’ or 12’ width x 6’ shall be provided to owner upon completion of project.

4. VINYL SHEET FLOORING: Vinyl sheet flooring shall meet heavy traffic requirements. Sheet flooring shall have heat-welded or chemically welded seams to make it waterproof. It shall meet A.D.A. slip resistance requirements. Flooring shall be installed per manufacturer instructions using manufacturer’s suggested adhesive. Sheet vinyl shall pass Flooring Radiant Panel Test with Class 1; N.B.S. Smoke Chamber Test with less than 450; pass Flame Spread. Attic stock of vinyl sheet flooring of 6’ or 12’ width x 6’ shall be provided to owner at completion of project.
Section 09 65 13: Resilient Base

1. Rubber cove base is recommended in continuous roll. Matched molded outside corners may be used. Internal corners will be formed on the job. Standard sizes of 4” or 6” height, 1/8” thickness shall be used. Base shall meet ASTM E 648 – Class 1 rating; Smoke Density of 450 or less and Flame Spread requirements. Base should be flexible enough to resist cracking and be smooth and free of imperfections. Resilient wall base should be installed with manufacturer’s recommended adhesive and according to manufacturer’s directions. Base should be adhered to wall surface leaving no gaps along the top edge. Attic stock of 50’ of each size and color base shall be provided to owner. Stock shall be marked for clear identification with Manufacturer and color number and name.

Section 09 65 13.23: Resilient Stair Treads and Risers

1. RUBBER OR VINYL STAIR TREADS: Treads shall be heavy duty raised profile surface appropriate to the location and job. Raised surface shall be low profile for easier cleaning. Tread shape shall conform closely to stair tread contour. Treads shall meet A.D.A. requirements. Separate risers shall be installed. Rubber treads are not recommended in commercial kitchens or areas where treads might be exposed to animal fats, vegetable oils or petroleum based materials. Treads and risers shall be rated Class 1 per ASTM E 648; rated 450 or less for Smoke Density and pass Flame Spread. Treads and Risers shall be installed using manufacturer’s recommended nose filler and adhesives according to manufacturer’s directions. Attic stock of two treads per multi-story stairwell in stair width and sufficient amount of riser material for two steps shall be provided to owner upon completion of project.

Section 09 66 01: Epoxy Terrazzo Flooring System

Section 09 68 00: Carpet Broadloom or Tile

1. Carpet shall be selected based upon project requirements. Carpet is not recommended for stairs. Olefin fiber is not acceptable. Carpet shall meet Electrostatic Propensity of 3.5 KV or less; pass Methenamine Pill Test for flammability; meet or exceed Class 1 glue down in Floor Radiant Panel Test; pass NBS Smoke Chamber Test with less than 450. Patterns and dye lots shall be matched. T-seaming as a method of installation is not recommended. Broadloom carpet and carpet tiles should be installed according to manufacturer’s instructions.
Woven broadloom carpet shall have all edges sealed by experienced installer. Woven or tufted broadloom carpet shall also be seam sealed as part of installation. All broadloom carpet seams shall be permanent, straight and unnoticeable. Attic stock shall be provided to owner of two cartons of each pattern and color carpet tile used. Stock of 12’ x 18’ of each pattern and color of broadloom carpet shall be provided.

2. Provide a premium adhesive recommended by the carpet manufacturer. Adhesive must comply with flame spread rating required for carpet installation. Adhesive must be asbestos free.

3. Carpet with Olefin yarn or blend thereof is not acceptable and will not be used.

Section 09 72 00: Wall covering

1. Wall Coverings are not recommended for exterior walls or any wall where excess moisture is likely to cause the growth of mold or mildew.
2. Wall surfaces will be prepared for wall covering according to manufacturer’s recommendations.
3. Paper wall covering is not recommended.
4. Wall Covering should be free of imperfections including shading. Installed wall coverings should be free of adhesive residue and should have straight seams with no gaps.

Section 09 72 01: Vinyl Wall covering

1. In most instances a Type II wall covering in 54” width will be used.
2. Wall Coverings will be rated Class A, Smoke Density of 45 or less and Flame Spread of 15 or less.
3. Patterns should be matched with seams cut straight leaving no gaps or visible adhesives.
4. Air bubbles are not acceptable.
5. End butted seams are not acceptable.
6. Manufacturer’s recommended preparation, adhesive, and installation technique should be followed.
7. The wall covering and adhesive should be mold and mildew inhibiting.
8. Perforated wall covering should be considered in areas which may be exposed to higher humidity.
9. Attic stock of two double rolls of each vinyl wall covering used shall be provided to owner. This should be wrapped and clearly identified as to manufacturer, pattern, color and where that wall covering was used.

Section 09 72 02: Acoustic Wall covering
1. All acoustic wall covering must be rated for wall covering. Floor carpets are never used in wall applications.
2. Wall covering will be rated Class A and pass NFPA – 265 Corner Burn Test. Acoustic Wall Covering should have minimal NRC rating of .20 or better when applied to Gypsum Board. End butted seams are not acceptable.
3. Manufacturer’s recommended surface preparation, adhesive and installation instructions will be followed. Seams shall be cut straight with no gaps and no visible adhesive. Air bubbles are not acceptable.
4. Attic stock of 8 yards of each acoustic wall covering used will be provided to owner at completion of job or project. These will be wrapped and marked for clear identification of manufacturer, pattern, color and where that product was used: ie. Room 121, 2nd floor Conf. Rm. etc.

Section 09 72 03: Fabric Wall covering

1. Fabric wall coverings shall be free of defects or stains.
2. This wall covering shall be installed per manufacturer’s instructions for preparation, adhesive and installation method. All seams will be straight cut without gaps, unfrayed, matching patterns if required and free of adhesive. Air bubbles are not acceptable. No butt seams are allowed in strips.
3. Wall Covering shall be rated class A, Smoke Density of 45 or less, colorfast rating to light and crocking of Class 5. A Teflon finish is recommended.
4. Attic stock of 8 yards shall be provided to owner. This stock shall be wrapped and labeled to clearly identify the manufacturer, pattern, color and particular area this wall covering was used.

Section 09 74 13: Wood Wall Coverings

Section 09 84 33: Sound Absorbing Wall Units

Section 09 91 00: Painting
1. A premium quality paint, shellac, varnish, or stain shall be used. Type of paint shall be dependent on the location and the product or area being painted.
2. Area to be painted shall be properly prepared and primed.
3. A minimum of two finish coats of paint shall be applied to walls and trim with additional coats required if coverage is necessary.
4. The manufacturer’s suggested preparation, primers and application techniques shall be followed. Painted surfaces shall be free of runs. Painted edges shall be clean and free of overlaps.
5. NOTE: where wall covering is to be painted, wall covering must be securely adhered to wall surface and properly primed to receive paint.
6. Paneling to be painted must be properly primed before paint is applied.
7. Drop cloths and any other protection of furniture, flooring, etc. shall be used.
8. Attic stock of a full one gallon container of each paint type and color, fully labeled with manufacturer, type of paint, color name and number of paint, and generally where paint was used; ie. Ceilings, trim, office or class room walls, hallway walls, door stain, etc.

Section 09 72 01: Window Coverings

1. Solar roller shades or horizontal 2” Wood or Aluminum slats should be used. Inside mounted installation should be used where possible.
2. Solar roller shades are recommended for large glass expanses.
3. Manually operated systems are acceptable.
4. Shades shall meet NFPA 701, light filtering minimum 5% or less openness factor. Cal 19 Small Scale Fire Test and Bacterial & Fungal resistance AASTM E 2180 must be met. UV blockage shall be 95% or better. Continuous loop stainless steel chain may be finished in a color to match fabric.
5. Aluminum 2” blinds: .0008” OR .0006” slats are acceptable. Slats shall be flexible and resistant to corrosion. Finish shall repel dust and be resistant to fungal and bacterial growth.
6. Blinds shall be built and installed so no visible sag is present over time.
7. Blind shall have a matching valance covering head rail as well as a bottom rail. Blind, rods, slats, ladders, wand shall be neatly finished with no frayed edges, burrs, sharp edges or other harmful defects. Operating mechanisms shall operate smoothly and
be child safe. Acceptable brands are Hunter Douglas, Bali and Graber. Applicable codes must be met.

8. Wood 2” blinds: Bottom rail and head rail with valance shall be finished to match wood slats. Slats shall be 1/8” thick. Wood slats should not warp or sag over time. Cloth tapes may be used. Blind should operate smoothly and safely. All parts should be free of frayed edges, burrs, sharp edges or other defects which may be harmful. Limitation is usually 72” width and there may be limitation on length as well. Follow manufacturer’s recommendations as to maximum sizes and installation instructions. Hunter Douglas, Bali or Graber are acceptable brands. Use contract quality of highest standards. Applicable codes must be met.
Div. 10 Specialties

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and/or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 10 11 01: Visual Display Surfaces

Section 10 14 00: Signage

1. All signs shall be through one source from a single manufacturer. All signs shall comply with the Americans with Disabilities Act (ADA), and with code provisions as adopted by Mississippi State University.

2. All signs shall be based on the products indicated below. Provide the named product or a comparable product by one of the following manufacturers.
   a. ASI Sign Systems, Inc
   b. American Graphic Inc.
   c. Innerface Sign Systems, Inc.
   d. Mills Manufacturing, Inc.
   e. Mohawk Sign Systems

3. Fabricate signs with edges mechanically and smoothly finished to comply with the edge condition square cut. Signs shall allow insertion of changeable messages in the form of transparent covers with paper inserts. Text on signs shall be accompanied with Grade 2 Braille.

4. Room signs, Stairway signs and Toilet signs shall be constructed of Laminated Cast Acrylic Sheet with unframed perimeter. Text shall be Futura MD BT and shall be provided by owner after bidding. Copy shall be tactile and Braille. Message shall be fixed and changeable. Sign shall be 6” X 9” with minimum 5/8” high characters. Changeable message shall not be included in stairway and Toilet signs. All signs shall have white characters with background color to be selected from manufacturer’s full range of colors.
Section 10 14 01: Interior Modular Interchangeable Signs

Section 10 14 16: Cast Metal Plaque
1. Cast Metal Plaques shall be aluminum casting of alloy and tempered as recommended by manufacturer for cast process used for finish indicated.
2. Plaque shall be 24” wide X 36” high.
3. Letter style and text shall be selected from manufacturer’s full range and approved by the Architect and the Office of Planning Design and Construction Administration.
4. Plaques shall have raised flat band border with manufacturer’s background texture. Texture shall be selected by Architect and the Office of Planning Design and Construction Administration.
5. Plaque shall be mounted wit concealed studs for substrates encountered.

Section 10 21 13: Toilet Partitions
1. All toilet partitions shall be floor mounted and overhead braced.
2. All toilet partitions and urinal screens shall be constructed of solid high density polyethylene (HDPE) or polypropylene (PP) panel material. Partitions shall not be less that 1 inch thick, shall be seamless with eased edges and with homogenous color and pattern throughout the thickness of the material.
3. All accessories to include pilaster shoes, sleeves, caps brackets and hardware shall be stainless steel. Overhead cross bracing shall be fabricated from the same material as the toilet partition.

Section 10 26 13: Corner Guards
1. All toilet accessories shall be based on the products indicated below. Provide the named product or a comparable product by one of the following manufacturers.
   a. Bay West
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation
2. Toilet Tissue (Roll) Dispenser
   a. Basis of Design Product: Bay West 723
   b. Description: Silhouette Dubl-Serv
   c. Mounting: Surface mounted
d. Operation: Controlled delivery; pushing back empty core releases reserve roll

e. Capacity: Designed for 3 7/8” diameter tissue rolls

f. Material and Finish: Plastic, black translucent

3. Warm Air Dryer
   a. Basis of Design Product: Bradley Corporation
   b. Mounting: Semi recessed
   c. Operation: Touch button activated with timed power cut off switch
   d. Cover Material and Finish: Cast iron, with enamel finish

4. Grab Bar
   a. Basis of Design Product: Bobrick B-5837
   b. Mounting: Flanges with concealed fasteners
   c. Material: Stainless Steel, 18 gauge thick, finish smooth No 4 satin finish

5. Mirror Unit
   a. Basis of Design Product: Bobrick B-290 2448
   b. Frame: ¾” X ¾” stainless steel angle, corners to be welded and ground smooth, provide concealed mounting with theft resistant locking device
   c. Frame: ¾” X ¾” stainless steel angle, corners to be welded and ground smooth, provide concealed mounting with theft resistant locking device

6. Mop and Broom Holder
   a. Basis of Design Product: Bradley corporation
   b. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
   c. Length: 36 inches
   d. Hooks: Three
   e. Mop / Broom Holders: Four, spring loaded rubber hat, cam type.
   f. Material and Finish: Stainless steel, No.4 finish (satin). Shelf shall not be less than nominal 0.05 inch thick stainless steel. Rod shall be approximately ¼ inch diameter stainless steel

Section 10 44 16: Fire Extinguishers

1. Fabricate and label fire extinguishers to comply with NFPA 10, “Portable Fire Extinguishers”.
2. All fire extinguishers and fire protection cabinets shall be through one source from a single manufacturer.
3. Special warranty shall be provided on manufacturer’s standard form in which manufacture agrees to repair or replace components of portable fire extinguisher that fail in materials or workmanship within six years from date of Substantial Completion. Failures include but are not limited to the following:
   a. Failure of hydrostatic test according to NFPA 10
   b. Faulty operation of valves or release levers

4. Fire extinguishers shall be equal to Larsen Manufacturing Company. Cabinet for fire extinguisher shall be suitable for fire extinguisher per manufacturer’s recommendations.

5. All portable extinguishers shall be in visible locations and free from obstructions. Signage shall be provided to indicate the extinguisher location where visual obstructions cannot be avoided.
Div. 12 Furnishings

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 12 05 13: Fabrics

1. Drapery and valance fabrics shall comply with NFPA 701. Fabric shall be dimensionally stable, lightfast, and shrink resistant. Maximum shrinkage allowable shall be 2%.

2. Lining fabric shall be stain and water resistant and meet NFPA 701. Blackout lining shall meet NFPA 701. Maximum shrinkage allowable shall be 2%. Lining may be rated FR.

3. Upholstery fabric shall pass Calif Tech Bulletin 117 Section E, UFAC CLASS 1. It is recommended that upholstery fabrics generally pass Abrasion Resistance of 60,000 or better double rubs Wyzenbeek method. Class room furniture fabric should pass Abrasion Resistance of 60,000 double rubs or better Wyzenbeek method. Properly rated foam and fiber shall be used in upholstering furniture for University use according to location of furniture.

4. All new upholstered seating shall meet Calif Tech Bulletin 117. It is recommended that Dormitory and Assembly Occupancy that is not sprinkled, upholstered seating meet Calif Tech Bulletin 133. Class room and auditorium upholstered seating fabric should pass Abrasion Resistance of 60,000 or better double rubs Wyzenbeek method.

5. Attic stock of 6 yards fabric should be provided to owner for any multiple seating areas such as auditoriums, class rooms, etc. This fabric should be securely wrapped and labeled with manufacturer, pattern, color and specific room this fabric was used.

Section 12 20 00: Window Treatments
Section 12 61 00: Fixed Auditorium Seating

Section 12 93 01: Site Furnishings

1. It is not the intent of Mississippi State University to limit competition, however there are certain aesthetic considerations related to design elements and themes which must be adhered to throughout the entire campus of Mississippi State University or the governing requirement may be related to product function, maintenance, and supply considerations.

2. In addition to providing items of specific function, it is mandatory that any substitutions shall closely resemble the appearance and size of the campus standard.

3. The campus standard for the site furnishings are as follows:
   a. Cigarette Disposal System: NO Butts Bin Company
   b. Trash Can Container: Contact Campus Landscape at 662-325-2773
   c. Site Benches: Contact Campus landscape at 662-325-2773
   d. Bollards: Robinson Iron Works

4. Equal products to those listed above will be considered based on appearance and size with respect to the campus standard.

Section 12 93 13: Bicycle Racks

1. Provide prefabricated looped steel pipe racks for parking and securing bicycles at exterior locations at building.

2. Bicycle rack shall be equal in quality to products manufactured by Brandir International, Inc. Model: RB – 071G.
Div. 14 Conveying Systems

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 14 20 00: Elevators

1. All elevator specifications shall be reviewed and approved by MSU Facilities Management, this however in no way will relieve the professional of any responsibility for the design of the elevator system.
2. The specifications for the elevator phone service shall be reviewed and approved by Information and Technology Services.
3. The warranty period shall be for a minimum one year and shall coincide with the warranty period of the General Contractor.
4. Elevators shall comply with ANSI A17.1 and ADA/ADAG.
5. All elevator certifications shall be witnessed by the Starkville Fire Department.
6. All elevator equipment rooms and or control cabinets, shall have air conditioning and humidity controls.
7. For passenger elevators the elevator speed shall be no less the 150 FPM. Speed for freight elevators shall be as required by the specifics of the project.
8. All elevators in case of power failure shall have battery pack to lower the elevator to the appropriate floor for exiting requirements. The battery pack shall be included in the base bid of the elevator.
9. Elevator equipment and control rooms shall not be near to classrooms or sound sensitive areas.
10. Hydraulic elevators shall be equipped with PVC cylinder sleeve.
Div. 21 Fire Suppression

The design guidelines contain herein include the requirements for systems, materials, fittings, valves, and pumps utilized for the fire protection systems at Mississippi State University. It is the intention of this document to provide a minimum standard for fire protection materials, fittings, valves and pumps at the university so as to provide the highest level of fire and life safety possible. Professionals shall verify that all applicable portions of the standard are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or the contractor during the planning, design and construction of the project shall be submitted to the Office of Planning, Design and Construction Administration for approval. All requests for variance shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 21 10 00: Water-Based Fire-Suppression Systems

The design and installation of the fire suppression system will be in accordance with current additions of the following codes, standards and guidelines:

- NFPA 13 Standard for Installation of Sprinkler Systems
- NFPA 14 Standard for Installation of Standpipe and Hose Systems
- NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 24 Installation of Private Fire Service Mains and their Appurtenances
- NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems
- NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals
- NFPA 72 National Fire Alarm Signaling Code

Provide a complete automatic sprinkler system as defined by the latest edition of NFPA 13. All fire sprinkler systems installed are required to be wet pipe systems unless the area being protected cannot be maintained above 40 degrees F, as required per NFPA 13. These areas that cannot be maintained above 40 degrees F, will require a dry pipe system to be installed. **Antifreeze systems of any size are not permitted on campus. Heat tape or heating cables are not permitted for use as a freeze protection on fire suppression systems.**

All fire protection systems shall be monitored by a fire alarm system as established in Division 28 Electronic Safety and Security.

Quality Assurance:

The contractor shall conform to the following:

- All materials and performance shall meet the appropriate ANSI, ASME and ASTM Codes
- Welding Materials and Procedures shall conform to the ASME Code.
• Only welders certified in accordance with ANSI/ASME Section 9 shall be employed. Each item of the equipment shall be new, UL Listed and FM Approved. Each major item of equipment shall bear the manufacturer’s name or trademark, serial number, UL stamp and FM label.

Submittals:

Refer to provisions established in Division 01 General Requirements, Section 01 34 0- Shop Drawings, Product Data and Samples.

Manufacturer’s data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, part numbers of equipment and give information necessary for verifying equipment approval.

The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14, NFPA 20 and NFPA 24 for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall include ceiling grid or reflected ceiling layout and shall be coordinated with other trades prior to submittal. Shop drawings shall be submitted with a minimum (1/8”) scale and all details at a minimum (1/4”) scale.

Hydraulic calculations for standpipe systems shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Provide a 10 psi or 10% safety factor, whichever is greater, for all standpipe system hydraulic calculations.

Provide hydraulic calculations for automatic standpipes, where required per NFPA 14, to provide 100 psi when flowing 500 gpm at the most remote standpipe outlet at 250 gpm at each additional standpipe. Provide hydraulic calculations for manual standpipes to demonstrate the pressure available at the top of each standpipe while flowing the demand required per NFPA 14 utilizing both the available water supply and the nominal City of Starkville fire truck pumper through the fire department connection (FDC).

Prior to preparing shop drawings and hydraulic calculations, the design engineer is required to verify the adequacy of water pressure and other pertinent water supply data. The engineer shall provide the record data at the point of the new utility connection as follows:

1. Building name
2. Test hydrant (hydrant numbers and locations) and hydrant elevation
3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

No work shall be performed until the State Fire Marshal’s office has approved the shop drawings, calculations, and data sheets.

Any modifications to shop drawings previously approved by the State Fire Marshal’s office, will need to be submitted as a revision to the State Fire Marshal’s office for approval before changes can be made on the project. A current copy of shop drawings, approved by the State Fire Marshal, shall be kept on the jobsite at all times during construction.
Fire-Suppression Sprinkler System Piping and Equipment:

Pipe:

1. Above ground pipe
   a. All wet sprinkler system piping shall be a minimum of schedule 40 black steel piping with cast or malleable iron threaded or steel grooved end fittings.
   b. BlazeMaster, CPVC, PB and other plastic piping shall not be specified or approved for use on MSU projects.
   c. All concealed pipe and exposed pipe that is not painted red is required to be marked “Fire Protection.” Pipe markers must be wrap around type with white letters at a minimum of 1” in height. Spacing and location as follows:
      i. Above ceiling corridors: Every 20’ for mains. One on each branch line.
      ii. Above rooms with ceilings: Every 20’ for mains (at least one in each room). One in every room on each branch line.
      iii. Exposed area non-painted pipe: Every 20’ for mains and branch lines (at least one on each branch line) and in each room.
      iv. Exposed areas painted pipe: Pipe markers not required (as long as pipe is painted red – any other to follow above).

2. Underground pipe
   a. Any changes in underground piping direction shall be provided with a thrust block or joint restraint as required per NFPA 13 (10.8.2) and NFPA 24 (10.8.2 and A10.8.2).
      Changes in direction where entering buildings shall be provided with thrust blocks and joint restraint.
   b. Underground pipe shall be installed by either a fire sprinkler contractor or an underground contractor licensed to install fire service mains.
   c. No underground pipe shall be covered until a joint inspection by the State Fire Marshal’s office and design professionals.

Mechanical Grooved Couplings:

1. When grooved couplings are used, rolled-grooved joints are required with fittings and couplings designed for working pressure of 300 psi. Malleable iron housing clamps: ASTM A47; UL listed; engage and lock, designed to permit some angular deflection, contraction and expansion.

2. Galvanized couplings are required for galvanized pipe.


4. Steel bolts, nuts and washers: ASTM A183 heat treated with a minimum tensile strength of 110,000 psi.
Valves:

1. Unless specified otherwise, all valves shall be FM approved and UL Listed and be suitable for the maximum anticipated system pressure or a minimum of 175 psi working pressure, whichever is greater.

2. All valves in the sprinkler system shall be FM approved and UL Listed butterfly type indicating valves except for the following, which should be gate valves:
   a. All indicating valves on the suction side of a fire pump
   b. Where indicated on contract drawings

3. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained in a NEMA type 1, general purpose indoor rated housing. Closing the valve shall cause the switch contacts to change position.

4. Where OS&Y valves are installed, the following shall apply:
   a. Valves 2-1/2 inches and larger shall be iron body with brass seats, discs and stems. Include tamper switches listed for use with OS&Y valves
   b. Valves 2 inches and smaller shall be brass body, stem, and seat. Include tamper switches listed for use with OS&Y valves.

5. Check valves shall comply with the following:
   a. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.
   b. Check valve 2 inches and smaller shall be UL listed and FM Approved brass body and all brass fitted.
   c. Check valves shall be accessible for inspection and testing.

6. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.

7. Post Indicator Valve
   a. Gate valves on incoming water service shall be operable by a UL listed and FM Approved post indicator valve with tamper switch monitored by the associated building fire alarm control panel.
   b. Wall mounted post indicator valves are not permitted.

8. All valves controlling water supply for sprinklers shall be accessible for use by emergency and maintenance personnel.
9. Except for underground water supply valves located in roadway boxes, all valves controlling water supply to sprinklers shall be supervised by the fire alarm system.

10. A control valve shall be located at the base of each riser.

**Piping Accessories:**

1. All hangar components other than all thread shall be UL listed and FM approved. No sprinkler piping is to be supported by any mechanical or electrical devices and/or equipment (ducts, lights, etc). Hangar assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.

2. Provide sleeves where pipes penetrate beams, floors or walls and install prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.

3. Sleeves for underground pipe shall have mechanical rubber seals and be watertight.

4. Floor, wall and ceiling plates shall be pressed steel or cast iron split plates, chromium plated. Floor, wall and ceiling plates shall not be used in lieu of appropriate methods for maintaining the rating integrity of a firewall.

5. Pressure gauges shall be UL listed and FM approved for fire service.

**Drains and Test Piping:**

1. All portions of the system shall be equipped with drains of the size specified in NFPA 13. All drains including auxiliary drains shall be piped to the sanitary sewer system designed to handle full flow from the drain.

**Sprinklers:**

1. Sprinklers shall be UL listed and FM approved and shall not include O-ring seals. Any sprinkler that incurs damage, is painted, or is sprayed with any obstructive material during construction shall be replaced at no cost to the University. Installation of sprinklers shall be coordinated with other work, including duct and electrical fixture installation, to prevent obstructions.

2. Sprinklers located less than eight feet above finished floor or that may be subject to mechanical damage shall be provided with guards listed for use with the model of sprinkler installed.

3. All flexible hose assemblies shall be composed of UL listed and FM approved braided hoses. Corrugated flexible assemblies will not be accepted.
Dry Pipe System:

1. Dry pipe systems shall be installed where the area being protected cannot be maintained above 40 degrees F, as required per NFPA 13.

2. Pitch dry pipe system piping a minimum of ¼ inch per 10 feet for dry system mains and minimum of ½ inch per 10 feet for dry system branch lines.

3. All sprinklers that are not upright heads shall be full length dry pendent sprinklers that connect directly to the dry system branch line tee fittings.

4. Provide a tank or riser-mounted air compressor listed for fire protection use and sized to refill the entire dry pipe system within 30 minutes as required per NFPA 13.

5. Utilize the compressor manufacturer’s listed air maintenance device and supervisory air pressure switch to maintain and monitor the dry pipe system air pressure.

6. All dry pipe valves must be externally resettable.

Guarantee:

1. The contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional costs to the owner, any part thereof, which may become defective within the period of one (1) year after the date of final acceptance by the Engineer, ordinary wear and tear excepted. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

Qualifications:

1. System design and installation shall be supervised by a licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years of experience with sprinkler systems. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified AUTOCAD format. The signature of the RME or engineer constitutes an affidavit that the statements, representations and information presented in the submittal constitute a complete operational system conforming to applicable state laws and recognize good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

Training:

1. Contractor shall provide services to instruct Owner’s personnel in operation and maintenance of system for a minimum of two 4 hour sessions.
Section 21 30 00: Fire Pumps

Provide a complete fire pump system as defined by the latest edition of NFPA 20. The design and installation will be in accordance with current additions of the following codes, standards and Guidelines:

- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 14 Standard for the Installation of Standpipe and Hose Systems
- NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 24 Installation of Private Fire Service Mains and their Appurtenances
- NFPA 25 Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems
- NFPA 72 National Fire Alarm Signaling Code
- IFC International Fire Code
- IBC International Building Code

The work addressed in this section consists of a fire pump system which will be coordinated with all of the following:

- Fire Alarm System
- Emergency Power System
- Water Based Fire Suppression System

Quality Assurance:

Each item of the equipment shall be new and approved by FM Global. Each major item of equipment shall bear the manufacturer’s name or trademark, serial number, and FM Label.

Submittals:

Refer to provisions established in Division 01 General Requirements, Section 01 34 0- Shop Drawings, Product Data and Samples.

Manufacturer’s data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, part numbers of equipment and give information necessary for verifying equipment approval.

The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14, NFPA 20 and NFPA 24 for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall include ceiling grid or reflected ceiling layout and shall be coordinated with other trades prior to submittal. Shop drawings shall be submitted with a minimum (1/8”) scale and all details at a minimum (1/4”) scale.
Hydraulic calculations for standpipe systems shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Provide a 10 psi or 10% safety factor, whichever is greater, for all standpipe system hydraulic calculations.

Provide hydraulic calculations for automatic standpipes, where required per NFPA 14, to provide 100 psi when flowing 500 gpm at the most remote standpipe outlet at 250 gpm at each additional standpipe. Provide hydraulic calculations for manual standpipes to demonstrate the pressure available at the top of each standpipe while flowing the demand required per NFPA 14 utilizing both the available water supply and the nominal City of Starkville fire truck pumper through the fire department connection (FDC).

Prior to preparing shop drawings and hydraulic calculations, the design engineer is required to verify the adequacy of water pressure and other pertinent water supply data. The engineer shall provide the record data at the point of the new utility connection as follows:

1. Building name
2. Test hydrant (hydrant numbers and locations) and hydrant elevation
3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

No work shall be performed until the State Fire Marshal’s office has approved the shop drawings, calculations, and data sheets. The contractor is solely liable for any work performed before this approval.

Any modifications to drawings approved by the State Fire Marshal’s office, will need to be submitted as a revision to the State Fire Marshal’s office for approval before changes can be made on the project.

Products:

Fire Pump, Motor and Controller:

1. The pump furnished for the fire protection service shall be equipped with a driver, controller and pump accessory items specified by the pump manufacturer.

2. The pump and controller shall be UL Listed and FM approved for fire service, per NFPA 20.

3. The fire pump shall be SINGLE stage, centrifugal horizontal split-case pump specifically labeled for fire service. The power source shall be electricity.

4. The pump and motor shall be mounted on a common baseplate of formed steel.

5. The pump casing shall be cast iron with 125 pound rated suction, unless the maximum pressure at the suction side of the pump exceeds 125psi, and 250 pound rated discharge flanges machined to American National Standards Institute (ANSI) dimensions.
6. The pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump’s maximum diameter impeller plus the maximum allowable suction head, but in no case not less than 250 psi.

7. The main fire pump controller shall be a factory assembled, wired, and tested unit.

8. The controller shall be of the combined manual and automatic type designed for across-the-line starting. Variable Frequency Drive controllers are not acceptable.

9. The minimum withstand rating of the controller shall not be less than 30,000 Amps RMS Symmetrical at 480 volts.

10. The controller shall include a motor rated combination disconnect switch /circuit breaker, mechanically interlocked and operated with a single externally mounted handle. When moving the handle from “OFF” to “ON”, the interlocking mechanism shall sequence the isolating disconnect switch “ON” first and then the circuit breaker. When the handle is moved from “ON” to “OFF”, the interlocking mechanism shall sequence the circuit breaker open first and then the isolating disconnect switch.

11. The controller shall have externally mounted, individual, visible indicators for “Power Available”, “Phase Reversal” and “Pump Running”.

12. The controller shall be furnished from the factory with the auto run timer disabled.

13. Individual “Power Failure”, “Phase Reversal” and “Pump Running” shall be wired for connection to the Main Fire Alarm Control Panel.

14. Where required by NFPA 20, the controller shall be equipped with an automatic transfer switch. Power to the transfer switch shall be supplied by one of the NFPA 20 power sources.

15. The manufacturer shall test the entire controller assembly prior to shipment. The test shall include each function the controller may be required to perform. The manufacturer shall test the circuit breaker at 300% full load, 600% load, and short circuit current settings. The manufacturer shall perform a high potential test on the controller power circuits at no less than two times the rated voltage plus 1000volts. Documentation of the above listed tests shall be submitted before the fire pump acceptance test.

16. Provide an automatic transfer switch on all fire pump controllers.
Fittings:

1. The pump manufacturer shall furnish piping accessory items for the pump installation which will adapt the pump connection to the fire protection system and test connections as follows:
   a. Fittings subject to pump discharge pressure shall be ANSI 250 psi rated.
   b. Fittings subject to suction pressure shall be ANSI 125 psi rated, unless the maximum pressure at the suction side of the pump exceeds 125 psi.

Jockey Pump and Motor Controller:

1. The contractor shall furnish and install a jockey pump coupled to a motor rated for the required pump, not to exceed 5 HP (Maximum), 480 volts, 60 Hz, 3 phase.
2. The jockey pump shall be installed in accordance with NFPA 20.
3. The control valves to and from the jockey pump shall be supervised butterfly valves installed in accordance with this standard.

Jockey Pump Controller:

1. The jockey pump controller shall be factory assembled, wired and tested, and specifically designed for this type of service.
2. The jockey pump controller shall be UL Listed and FM approved.
3. The pressure shall have a range of 0-300 psi and have independent high and low pressure settings. The pressure switch shall be mounted inside the controller. The pressure set points shall be in accordance with NFPA 20 Appendix A.
4. The controller manufacturer, prior to shipment, shall hook up and test the jockey pump controller as a complete assembly. This test shall include each function the controller may be required to perform. The manufacturer perform a high potential test of the controller power circuits at not less than two times the rated voltage plus 1000 volts. Documentation of the above tests shall be submitted prior to the pump acceptance test.
5. All jockey pumps shall be served by emergency power circuits.

Field Acceptance:

Upon completion of the fire pump and sprinkler piping installation, a field acceptance test shall be conducted at a minimum, rated and peak loads of the fire pump by controlling the quantity of water discharged through an approved test device. All acceptance testing outlined in NFPA 20 shall be conducted by the installing contractor in the presence of a Mississippi State University representative.
(FM Alarm Services). Documentation of all factory and field tests shall be submitted at the conclusion of the field acceptance test.

A field acceptance test of the jockey pump and controller shall be performed at the same time as the main fire pump acceptance test. The acceptance test shall include each function the controller may be required to perform including manual start-stop and automatic start-stop.

Guarantee:

The Contractor shall guarantee all workmanship and materials to be as represented by him, and shall repair or replace, at no additional costs to the Owner, any part thereof, which may become defective within the one year period after the date of final acceptance by the Engineer.

Warranty:

Warranty for all system components, equipment and labor must be good for one year after final acceptance.
Div. 22 Plumbing

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 22 07 19: Plumbing Piping Insulation
1. Seal end joints of pipe insulation to pipe.
2. Fiberglass insulation shall be used for domestic water and hot water piping.
3. A pre-installation conference shall be specified to endure that proper techniques are followed.

Section 22 11 13: Facility Water Distribution System
1. All buried piping shall be bedded in a minimum of 6” sand and have a minimum backfill of 12” of sand above top of pipe. Provide 18” – 24” clearance between pipes.
2. Building piping shall have main runs located above the corridors whenever possible. Provide isolation valves to shut down each floor or sections of a floor.
3. Domestic water piping for potable and non-potable water shall be copper type ‘L’ hard drawn with soldered joints.
4. Install backflow preventers in mechanical room If reduced pressure type, provide drain funnel an pipe to floor drain.

Section 22 13 16: Sanitary Waste and Vent Piping
1. Waste and vent piping shall be cast iron no hub with 4 band mechanical clamps.
2. Indirect drains shall be copper type ‘M’ for 1” and smaller. Type ‘DWV’ for 1 ¼” and larger with sweat joints.

Section 22 14 13: Facility Storm Drainage Piping

1. Storm Drainage piping shall be cast iron no hub with 4 band mechanical clamps.

Section 22 13 19: Sanitary Waste Piping Specialties

1. Floor drains shall be located in all toilets. Provide trap primers for all floor drains and floor sinks.

Section 22 40 00 Plumbing Fixtures

1. Water closets shall be wall hung vitreous chins with chair carrier, minimum 2025” trap way, low flow design of 106 gallons per flush.
2. Urinals to be vitreous chins, wall hung with floor mounted carrier, low flow design 1.0 gallons per flush.
3. Sinks shall be 18 gauge stainless steel.
4. Flush valves to be dual filtered bypass, ADA compliant handle, and low flow design.
5. Toilet seats to be solid plastic with stainless steel self-sustaining check hinges.
6. Sink and lavatory faucets shall be ¼ turn ceramic disk cartridge type with wrist blade handles.
7. P traps to be 17 gauge with integral cleanout.
8. Trap wrap to be molded plastic type.
9. Trap wrap to be molded plastic type.
10. Traps shall have mechanical connection not soldered at wall connection to allow for removal and use as a cleanout.

Section 22 61 13.53: Laboratory Compressed Air Piping

1. Processed air and gas piping for air compressors shall be duplex type. 100% capacity each compressor, with ASME stamped receiver.
2. Compressed air piping shall be copper tubing type ‘K’ or ‘L’ less that 1/2.” soft annealed, ½” – 1.5” hard drawn, greater that 1.5” schedule 40 black steel.
3. Gas piping for oxygen shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½” – 1.5” hard drawn.
4. Argon gas piping shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½” – 1.5” hard drawn.
5. Carbon dioxide gas piping shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½”–1.5” hard drawn.
6. Helium gas piping shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½”–1.5” hard drawn.
7. Nitrogen gas piping shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½”–1.5” hard drawn.
8. Nitrous oxide gas piping shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½”–1.5” hard drawn.
9. Acetylene gas piping shall be stainless steel type 316 with Swagelok fittings.
10. Hydrogen gas piping shall be stainless steel type 316 with Swagelok fittings.
11. Vacuum pumps shall be duplex type, 100% capacity each pump. Piping shall be copper tubing type ‘K’ or ‘L’, less that ½” soft annealed, ½”–1.5” hard drawn.
12. Installation for piping of all medical gasses shall be in accordance with NFPA 99.

Section 22 66 53: Laboratory Chemical Waste and Vent Piping

1. Lab acid waste and vent piping shall be high silicon (14%) cast iron, or glass with mechanical joints, or polypropylene with mechanical joints above grade and thermal fusion joints below grade.
2. Provide shut off valves for all services into laboratory space to allow for single lab to be isolated.

Section 22 67 13.13: Distilled Water Piping

1. Distilled water piping shall be perfluoroalkoxy pipe (PFA) Teflon schedule 40 or 80 with thermal fusion, mechanical or threaded joints.
2. Provide shut off valves for all services into laboratory space to allow for single lab to be isolated.

Section 22 67 13.16: Reverse Osmosis Water Piping

1. Reverse osmosis water piping shall be polyvinylidene fluoride (pvdf) kynar resin SDR 11-21 with thermal fusion joints.
2. Provide shut off valves for all services into laboratory space to allow for single lab to be isolated.
Section 22 67 13.19: Deionized Water Piping

1. Deionized water piping shall be polyvinylidene fluoride (pvdf) kynar resin SDR 11-21 with thermal fusion joints.
2. Provide shut off valves for all services into laboratory space to allow for single lab to be isolated.
Professionals shall verify that all applicable portions of these standards are incorporated into
the final construction documents and adhered to during the construction of the project.
Variances from these standards by the professional and or contractor during the planning,
design and construction of the project shall be submitted to the Office of Planning Design and
Construction Administration for approval. All requests for variances shall be submitted on the
Office of Planning Design and Construction Administration’s standard Request for Variance
form.

Section 23 11 00: Facility Fuel Piping

1. Liquid petroleum (LP) gas piping above grade shall be black steel, schedule 40.
2. Liquid petroleum (LP) gas piping below grade shall be high density polyethylene
   (HDPE) with elector/heat fusion joints. Pipe shall be installed per 49CFR Part 192 by
   a certified installer.

Section 23 11 23: Facility Natural Gas Piping

1. Natural gas piping above grade shall be black steel, schedule 40.
2. Natural gas piping below grade shall be high density polyethylene (HDPE) with
   electro/heat fusion joints. Pipe shall be installed per 49CFR Part 192, by a certified
   installer.
# DIVISION 26 – ELECTRICAL SYSTEMS

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DIVISION 26 ELECTRICAL

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.
SECTION 26 00 00 GENERAL REQUIREMENTS

Purpose & Scope

This manual has been issued to provide minimal criteria for the design and construction of electrical and communication systems at Mississippi State University. The criteria contained herein are intended to ensure economical, durable, efficient, uniform and reliable systems and installations. These standards are not to be regarded as a specification.

Whenever unique conditions and problems are not specifically covered in these standards, use the applicable referenced industry standards and other documents for design guidance. Direct communication with Mississippi State University Facilities Management (FM) is encouraged. This communication may avoid unnecessary resubmission of plans and specifications due to a misunderstood comment.

Codes & Standards

The minimum requirements of NFPA 70 National Electrical Code (NEC), NFPA 70E Workplace Electrical Safety and ANSI C2 National Electrical Safety Code (NESC) shall be met. In some cases, this design manual establishes design criteria that exceed NFPA 70, NFPA 70E and IEEE C2 minimum standards in some areas.

Where referenced in these Standards, the publications and standards of the following organizations shall apply: American Association of Safety Highway Traffic Officials (AASHTO), American National Standards Institute (ANSI), American Society of Testing and Materials (ASTM), Factory Mutual (FM), Institute of Electrical and Electronic Engineers (IEEE), Illuminating Engineering Society of North America (IESNA), Insulated Power Cable Engineers Association (IPCEA), National Electrical Contractors Association (NECA), National Electrical Manufacturers Association (NEMA), Inter-National Electrical Testing Association (NETA), National Fire Protection Association (NFPA), and Underwriters Laboratory (U.L.).

Workmanship

Electrical equipment and appurtenances shall be installed in a neat and workmanlike manner. Installation to comply with NECA 1-2006 Standard Practices for Good Workmanship in Electrical Contracting.

Electrical Equipment Clearances

Adequate equipment clearances shall be maintained to allow safe ingress and egress from electrical equipment and safe access to and around equipment. Engineer shall ensure that equipment layout conforms to all applicable requirements of NEC, NESC and NFPA,
including but not limited to:

- Working space
- Clear space
- Dedicated equipment space
- Clearance of other equipment
- Egress requirements

Materials

All materials and equipment furnished shall be new, specification grade, free from defects, and shall conform to the standards of the U.L. where such standard has been established, and shall be so labeled.

Demolition

Items scheduled for demolition must be removed completely and not abandoned in place.

Record Documents

Engineer shall ensure that the Contractor is directed to deliver two (2) copies of record documents to Mississippi State University Facilities Management (FM) prior to final acceptance of Project. Record documents shall include contract drawings, specifications, addenda, change orders, reviewed shop drawings, reviewed submittals, hardware schedules, field and laboratory test records, equipment brochures, parts lists, operating instructions and other modifications to the contract. Drawings shall mark all modifications; record actual construction; provide vertical and horizontal location of all underground utilities referenced to permanent surface improvements; and provide location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structures.

Existing Utilities

Engineer shall ensure by specification that, prior to any excavation, the Contractor is directed to contact Mississippi One Call at 1-800-227-6477 or 811 to request utility facilities be located. Requests must be made a minimum of 48 hours prior to the time of the needed services. Once the Contractor takes possession of the project site, FM will perform one (1) major locate of University-owned utilities at the construction site at the beginning of the project. Contractor shall be responsible for recording all underground utility lines on their construction documents and physically maintaining markings until the project is complete. Should subsequent re-locating of University-owned facilities be required, the Contractor will be required to pay FM $1,000.00 per utility system (communication, power, etc.) to help FM
defray the costs of multiple utility locate requests. Should subsequent re-locating of University-owned utility facilities be required, the Contractor is encouraged to secure the services of an independent utility locating service to mark University owned facilities. Contractor shall use every precaution to avoid interferences with existing underground and surface utilities and structures, and protect them from damage. The Contractor shall repair or pay for all damage caused by his operations to all existing utility property, whether owned by the University or third parties.

**Electrical Renovations and Additions**

Consultant or Contractor, as appropriate, shall survey existing building to determine if adequate space is available for proposed electrical work and equipment. Consultant or Contractor shall confer his finding to Facilities Management for approval. Where equipment must be modified to be physically utilized in a Project, the following must be evaluated:

- **Age of equipment**: The length of time in service of the wiring, devices and equipment should be reviewed prior to considering reuse. The equipment should be capable of remaining in use for a minimum of 10 years of additional life or having 40 percent of remaining life; if not the equipment shall be replaced.
- **Physical condition of equipment**: Where equipment has been in operation for a number of years, Facilities Management shall, in cooperation with Consultant or Contractor, conduct a physical inspection of terminals, insulation, switching contacts, control wiring etc., to determine whether equipment shall be replaced or modified.
- **Obsolescent equipment**: Where equipment is obsolete and spare or replacement parts are not commonly available, equipment shall be replaced.

**Existing Facilities**

Engineer shall ensure by specification that:

- The Contractor shall protect from damage all existing facilities to remain or equipment to be returned to FM.
- Any item marred or damaged by the Contractor shall be properly repaired, repainted or replaced to the satisfaction of FM.
- Any electrical or communication infrastructure or facilities in place prior to construction and not scheduled for removal shall remain and continue to function during construction, or if a part of the project site, post-construction.
- The Contractor shall take special precautions to prevent damage to
property caused by improper connections that may provide improper voltage or phase rotation.

- The Contractor restores all landscape (shrubbery, flowers, trees, lawn, etc.) and hardscape (walks, parking lots, streets, drives, etc.) to at least the conditions that existed prior to the commencement of work using materials and workmanship to match those of the original construction and installation.

Service Voltages

Select electrical characteristics of the power system to provide a safe, efficient, and economical distribution of power, based upon the size and types of loads to be served. Use distribution and utilization voltages of the highest level that is practical for the load to be served. The following guidelines apply:

- Single-phase, three-wire 120/240 volt systems shall be used to serve single-phase lighting and power loads less than 50 kilovolt-amperes (kVA). This voltage level is usually provided to small-scale and residential facilities.

- Three-phase, four-wire, 208Y/120 volt systems shall be used for lighting and power loads less than 150 kVA or less. A 208Y/120 volt system is usually most economical when most of the load consists of 120-volt lighting and utilization equipment, and the average feeder length is less than 200 feet. The 480Y/277 volt system is preferred wherever possible because the higher voltage is more energy-efficient and has more potential for future load growth.

- Three-phase, four-wire, 480Y/277 volt systems shall be used for lighting and power loads greater than 150 kVA. This voltage level should also normally be used if large motors are a significant portion of the total load or if most of the load can be served by 480Y/277 volts. Utilize dry-type transformers as needed to serve smaller 208Y/120 volt loads.

Normal Power Source

Electric distribution systems shall consist of a single loop-feed pad-mounted transformer for each building for loads of 150 kVA or less at 208 volts, or 1,500 kVA or less at 480 volts. Higher kVA ratings are allowed if the design analysis demonstrates that the system reliability and economic operation are acceptable. The transformer size will establish interrupting rating and coordination requirements for downstream equipment, which can alone necessitate either dual transformers serving separate loads at the service entrance or a higher service entrance voltage rating. Generally, ratings above 1,500 kVA will necessitate the use of dual transformers and service entrances.
Emergency Power Source

Provide an emergency power source system consisting of a diesel engine power generating unit and an automatic transfer switch used to provide electrical power for critical or life safety electrical loads during an interruption of the normal power supply. Types of critical and life safety electrical loads include the following:

- Alarm and detection systems.
- Fire pump where required by Code.
- Smoke removal system.
- Exit, emergency and egress lighting.
- Energy management system control panel(s).
- Control air compressors.
- Lighting and receptacles in transformer vaults, mechanical rooms, electrical rooms, communication rooms, EG rooms and HVAC equipment serving EG rooms.
- Essential communications and computer systems.
- Security and surveillance systems.
- Lighting and power required to conduct essential operations.
- Hydraulic or traction elevators, as applicable.

Service & Service Entrance

Locate service entrance equipment in readily accessible spaces to facilitate disconnection of power in case of emergency. Coordinate the service entrance location with the University’s electric utility distribution system to ensure that service and feeder circuit lengths are as short as practical. Service conductors should be installed underground from transformers, regardless of whether the transformers are on poles or pad-mounted.

Building Power Distribution

For new buildings, the power distribution system shall separate life safety and emergency, lighting, power and mechanical loads into dedicated panelboards with dedicated feeders originating from the service entrance equipment. For renovations and small projects, the engineer shall separate loads as much as possible without adding panels.

Electrical Equipment Rooms

Distribution switchboards, panelboards and dry transformers shall be in electrical rooms. Rooms shall be vertically stacked (with sufficient overlap) to permit straight/vertical route of cable raceways between multiple levels. Electrical equipment room space required by major items of equipment such as switchboard, secondary dry-type-transformers, panelboards,
automatic transfer switches, fire alarm control panels, motor control centers, cable routing, etc. should be designed in accordance with the requirements of the NEC. Equipment room shall provide at least 25% spare capacity to allow for installation of future equipment and storage of pertinent electrical maintenance items.

Ensure that equipment can be removed and replaced without interference with other systems or equipment, and without requiring building modifications. Provide ventilation as necessary to permit equipment to operate within normal ambient temperature limitations; otherwise, de-rate the equipment accordingly for a lower capability and potentially shorter service life.

Do not allow piping, ducts, and other equipment unrelated to the electrical equipment to pass through or over the space reserved for electrical equipment. When fluid systems are located near electrical equipment, furnish the equipment with splash-shields and water-resistant enclosures. New electrical rooms should be constructed to the appropriate fire rating such that sprinkler systems are not required inside these spaces.

**Equipment Accessibility**

All electrical equipment and electrically fed mechanical equipment shall be readily accessible for maintenance. For example, exhaust fan motors shall not be installed on pitch roofs or on separate roofs without permanent access.

**Short Circuit, System Coordination & Arc Flash Analysis**

Overcurrent protective devices in the system must be designed to isolate faults safely with minimal equipment damage and minimal disruption to facility operation. All equipment exposed to the short circuit current must be capable of withstanding the mechanical and thermal stresses caused by the current until the short circuit is isolated.

Engineer shall specify that Contractor shall provide a short circuit and coordination study for the equipment being furnished as an integral part of selecting and sizing electrical distribution components for the new or renovated facility. The coordination study shall determine appropriate fuse sizes and breaker settings for overload protection and selective coordination. Study shall ensure electrical systems are selectively coordinated to the maximum degree practical.

As part of the short circuit and coordination study, arc flash hazard study shall be included. The study shall include the following:

- Determine and document all possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.
- Calculations to conform to NFPA 70E standards. All incident energy units
shall be calculated in calories per square centimeter.

- Provide recommended boundary zones and personal protective equipment (PPE) based on the calculated incident energy and requirements of NFPA 70E for each piece of electrical equipment.

Engineer shall specify that Contractor shall provide labeling on each piece of electrical equipment based upon the results of the arc flash hazard study. At a minimum, the labeling shall contain the following information: PPE level, Flash Hazard Boundaries, Flash Protection Boundary, and Shock Hazard Boundaries such as Limited Approach Boundary, Restricted Approach Boundary, Prohibited Approach Boundary, and study date.

Power Quality & Harmonic Distortion

Secondary electrical systems shall be designed to mitigate the harmonic effects of non-linear loads because of connections to electronic loads, including computer workstations, UPS, copiers, electronic ballasts, etc.

Electrical Testing

For low voltage electrical systems, ensure the following tests are performed:

- Torque logging of electrical connections.
- Phase rotation verification, before and after.
- Ground electrode impedance testing.
- Insulation resistance testing of all 600-volt conductors.

For medium voltage electrical utility systems, refer to attached Section 33 71 83 - Medium Voltage Testing Requirements for specific testing requirements for medium voltage cable and cable accessories.

For fire alarm systems, refer to attached Section 26 32 13 - Emergency Power Systems for specific emergency power system testing requirements.

For fire alarm systems, refer to attached Section 28 31 00 - Fire Alarm and Detection for specific fire alarm system testing requirements.
SECTION 26 05 19 WIRE AND CABLES

General

Power and lighting distribution conductors shall be a minimum size of #12 AWG copper. Specify stranded conductor for feeders and branch circuits #10 AWG and larger. Control wiring shall be a minimum size of #14 stranded AWG copper. Instrumentation and special systems wiring shall be in accordance with the manufacturer’s recommendations and shall not be less than #18 AWG copper. Branch circuit wiring shall be sized for a maximum of 3% voltage drop. Fully loaded multi-outlet receptacle circuits shall be assumed in sizing wiring for receptacle outlets. Insulation for premises wiring is THHN for dry locations; THWN for wet. All conductors, without exception, shall be copper; aluminum is strictly prohibited. Size all neutral wires for 3 phase systems equal to or larger wire size than the phase conductors. 120/208 volt branch circuits in all labs and offices or other areas with non-linear loads shall have a separate neutral conductor for each circuit. No more than one conductor for each phase plus individual neutrals and an equipment grounding conductor are allowed in a conduit. All raceways shall contain code-sized, green insulated equipment grounding conductor. Use of type “AC”, “BX” or “NM” cable is not permitted. Use of type “MC” Cable is not permitted except for “MC” cables serving lighting fixtures.

Conductors

All conductors, including power, lighting, control, telecommunications and power-limited wiring shall be installed in raceways. Raceways include conduits, ducts, trays, surface raceways and wireways. Service entrance and feeder conductors shall not be spliced. Wiring of different voltage levels (i.e., 208/120 volt and 480/277 volt) shall not be combined in the same raceway, pull box or junction box. Wire color code is shown below:

<table>
<thead>
<tr>
<th>208/120 volt systems</th>
<th>480/277 volt systems</th>
<th>Other systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A -- Black</td>
<td>Phase A -- Brown</td>
<td>Travelers --</td>
</tr>
<tr>
<td>Purple Phase B -- Red</td>
<td>Phase B -- Orange</td>
<td>Switch legs --</td>
</tr>
<tr>
<td>Pink Phase C -- Blue</td>
<td>Phase C -- Yellow</td>
<td></td>
</tr>
<tr>
<td>Neutral -- White</td>
<td>Neutral -- Gray</td>
<td></td>
</tr>
<tr>
<td>Ground -- Green</td>
<td>Ground -- Green</td>
<td></td>
</tr>
</tbody>
</table>

Conductor Terminations

Specify solderless spring type pressure connectors with insulating covers for wire splices and taps, #10 AWG and smaller. Specify mechanical or compression connectors for wire splices and taps, #8 AWG and larger. Split bolt connectors are not acceptable. Un-insulated conductors and connectors shall be insulated with electrical tape to 150 percent of the insulation value of conductor.
Terminal lugs for wires #6 AWG and smaller shall be solderless, compression type copper. Terminal lugs for wires #4 AWG and larger shall be compression type, long barrel, seamless, tin-plated copper, with NEMA two hole terminal pads.

All wire connectors used in underground or exterior pull boxes shall be UL-listed for damp and wet locations.
SECTION 26 05 26 GROUNDING

General
A grounding system meeting the requirements of the NFPA70 shall be designed for each University building or electrical system. The neutral of the 208Y/120 or 480Y/277 volt system shall be grounded at the service entrance equipment. All electrical equipment shall be connected to the grounding system. All separately derived electrical systems shall be grounded per NFPA 70 requirements.

Grounding conductors shall be provided for all feeders and branch circuits. Conduits shall not be the only grounding path. Provide protection for grounding conductors subject to physical damage. If a ferrous metallic conduit is to be used for protection, the conductors shall be bonded to the conduit at both ends.

Engineer shall detail the installation of grounding system (i.e. ground mats, connection to water service, building steel, footing grounds, etc.) on the drawings and in specifications.

Service Entrance Grounding
Engineer shall specify utilization of building steel (where available), metal underground piping (natural gas piping shall not be used), building concrete footing, and a ground mat consisting of at least three driven ground rods 10 foot on center for the service entrance grounding electrode systems. The maximum acceptable impedance to ground at the service entrance is 5 ohms and the grounding system should be designed accordingly. The project specifications shall require testing and documentation of this ground impedance. Test results shall be included in record documents. Grounding electrode systems shall be bonded together at the service entrance within the main switchgear enclosure(s). No independent grounding electrode systems are allowed.

Feeders
Feeders shall have a separate insulated equipment grounding conductor installed.

Branch Circuits
Receptacle, lighting, power utilization equipment, etc., shall have separate insulated equipment ground conductors installed.

Terminations
Terminations of grounding system conductors shall be done using listed lugs and fittings specifically made for the use intended.
**Inspection**

Engineer and FM representative shall inspect the main distribution equipment to verify that the main bonding jumper between the system ground and the grounded conductor (neutral in most cases) has been installed.

**Materials**

Grounding conductor shall be stranded copper only. Grounding mats and risers for buildings shall be minimum #4/0 AWG bare, stranded copper. All equipment grounding conductors #6 AWG or smaller shall have green insulation. All equipment grounding conductors larger than #6 AWG shall be identified at accessible points per NEC requirements.

Ground connections and ground cable splices that are accessible for maintenance and repair shall be thermal welding or copper compression type connectors UL listed for grounding purposes. Ground lugs, where provided as standard manufacture’s items on equipment furnished, may be used. All ground connections underground or inaccessible for maintenance and repair shall be thermal welded only.
SECTION 26 05 33 RACEWAYS AND BOXES

Raceways

Minimum conduit size is 3/4” (interior) and 1” (exterior) for premises wiring. For fixture and small equipment drops, 1/2” flexible metal conduit not exceeding six feet may be used. Where empty conduits are required to be installed, provide a continuous #12 nylon draw line with identification tag securely attached to both ends.

Conduit shall be concealed in all public areas (walls, ceiling, and floor surfaces). Conduit shall not be exposed except in mechanical, electrical, communication and custodial rooms or other locations approved by FM.

All conduits shall be galvanized rigid conduit (GRC), unless permitted otherwise. Intermediate metal conduit (IMC) may be used as a substitute for GRC, except for work installed in earth or concrete, or where installed less than 6’ above finished floor. RGS and IMC conduit systems shall be watertight. Electrical metallic tubing (EMT) may be used as a substitute for GRC for conduits 2” and smaller for power circuits in indoor locations in concealed/protected areas not subject to physical damage. Liquid tight flexible metal conduit shall be used for final connection to fan/pump motors or vibrating loads maximum length 36”. Flexible metal conduit shall be used for final connections to lighting fixtures in dry locations, maximum length 72”. Condulet type fittings shall not be used on any service entrance conductor conduit or on any conduit containing conductors sized #1/0 AWG or larger. Conduits 2” or larger shall not have more than 180 degrees of bend of 100’ of pull between pull points. Set screw connectors are not acceptable; use compression fittings only.

Outlet & Pull Boxes

All junction boxes shall be accessible after construction is finished. Junction boxes shall not be installed in inaccessible areas (i.e., above solid ceilings that have no attic space, etc.).

Outlet and junction boxes shall be a minimum of 4” square x 2-1/8” deep. Interior outlet boxes shall be galvanized steel. No box extensions are allowed. Interior pull boxes shall be galvanized steel with screw on covers of the type and size required. Exterior outlet and pull boxes shall be weatherproof cast type suited for application.

Electrical boxes and covers to be color-coded as follows: Normal Power - Silver (Unpainted); Emergency Power - Yellow; Standby Power - Orange; Fire Alarm System - Red; Telecommunications - White; Security - Blue.

Supporting Devices

Support of raceways must be by factory made supports and/or hangers. Junction boxes need to be supported independent of the conduit to the structure above. Conduits shall not be
supported from ductwork, pipes, or other systems foreign to electrical installation.

Penetrations
Raceways penetrating roof shall be coordinated with architect. Architect shall provide roof penetration detail for all roof penetrations for electrical raceways.

Seal penetrations in fire-rated walls and floors using mechanical stop fittings or UL listed foamed silicone elastomeric compound. Seal penetrations in non-fire-rated walls with product such as Silicone RTV foam membrane.

Exterior Branch Circuits
Rigid non-metallic conduit may be used for outdoor branch circuits buried below grade on the exterior of the building. All components shall be of the same manufacturer and used specifically for their intended purpose. Branch circuits shall maintain a minimum burial depth of 36”. Transition to metal conduit shall be made at minimum 12” below grade such that only metal conduit exits concrete or ground. No PVC ells shall be used; utilize metal ells only. Two coats of asphaltum or bitumastic paint shall be applied to all underground metallic conduits. Install a magnetically detectable red plastic marking tape 12” above top of conduit.

Junction boxes and box covers for exterior branch circuits shall be constructed of polymer concrete, Quazite or equal, and shall be furnished with neoprene gaskets, stainless steel screws and cover with “ELECTRIC” logo. Junction boxes shall be rated for incidental vehicular traffic, ANSI Tier 22.
SECTION 26 09 13 ELECTRICAL POWER MONITORING

Revenue Meter

Provide revenue meter in NEMA 1 enclosure. Meter shall be provided with RS-485 Serial (BACnet MS/TP Protocol) output. Provide 4-pole voltage test block, 6-pole shorting current test block and a voltage fuse block in metering cabinet. Ring type connectors and captive screw terminals shall be used on all metering circuits. Use SIS type, gray colored wire for all meter wiring within meter cabinet.

Locate metering device so that the metering enclosure is no farther than 5’ from main switchboard instrument compartment. Metering device shall be mounted such that meter display is at an elevation of approximately 54” above finished floor.

Current transformers shall revenue class, 600 volt, properly sized for anticipate loading. Current transformers shall be installed within main switchboard incoming cable and/or main circuit breaker compartment, arranged to monitor entire electrical load on main switchboard.

Ensure main switchboard has adequate space for installation of metering current transformers and provides fused voltage and control inputs required for revenue meter. Refer to Section 26 24 13 - Service Entrance and Service Entrance Equipment.

Furnish and install conduit and #10 XHHW TC cable between metering cabinet and main switchboard for metering power, voltage and current inputs.

Furnish and install conduit and RS-485 BACnet compatible cable between metering cabinet and building automation system.

Refer to typical metering detail in this section.

Acceptable Manufacturers:

Revenue Meter: Veris “E50H5A” or equal.

Current Transformers: Veris Series Rope “U018” or equal.
NUMBERED NOTES

1. METERING CABINET, NEMA 4, HINGED, 3-POINT LOCKING, 30" X 24" X 12", COMPLETE WITH BACK PANEL, COOPER/B-LINE "302412-43PT" OR EQUAL. PROVIDE "DANGER - HIGH VOLTAGE" WARNING LABEL AND "ENERGY METER" LABEL.

2. ENERGY METER, THREE PHASE, FOUR WIRE, VERIS "E50H5A".

3. TERMINAL BLOCK, HEAVY DUTY, SHORT CIRCUITING TYPE, WITH 6 SHORTING SCREWS, MARATHON "1606SC", OR EQUAL.

4. FUSE HOLDER, MODULAR, THREE POLE, DIN-RAIL MOUNTED, BUSSMAN "CHCC3DIU", OR EQUAL.

5. FUSE HOLDER, MODULAR, THREE POLE, DIN-RAIL MOUNTED, BUSSMAN "CHCC1DIU", OR EQUAL.

6. FUSE, CLASS CC, 0.5 A, BUSSMAN "LP-CC-1/2", OR EQUAL.

7. GROUNDING BLOCK, ERICO "EBL08" OR EQUAL.
SECTION 26 22 13 DRY TYPE TRANSFORMERS

General
Transformer losses represent a significant expense. Provide capacity for 25% future load growth but do not grossly oversize transformers. Transformers in offices, electronic equipment areas and other areas having loads of with significant harmonic content shall be K-rated for non-linear loads and shall be provided with 200% rated neutral terminals. Do not use oversized transformers to accommodate non-linear loads.

Do not locate ventilated dry-type transformers in environments containing contaminants including dust, excessive moisture, chemicals, corrosive gases, oils, or chemical vapors. Transformers should be designed for floor mounting. Wall mounted dry type transformers shall not be specified without approval of FM.

Rating
Exact voltages and taps to be as designated on the plans or the transformer schedule. Insulation system shall be NEMA ST-20 standard for 220°C rise. For transformers rated 1125 kVA and below, the insulation system shall be rated for 115°C rise above 40°C ambient. For transformers rated over 112.5 kVA, the insulation system shall be rated for 80°C rise above 40°C ambient. Transformers 15 KVA and smaller shall have four 2-1/2% taps, two FCAN and two FCBN. Transformers larger than 15 kVA shall have six 2-1/2% taps, two FCAN and four FCBN. Generally, sound levels shall meet NEMA ST-20. For transformers installed near offices or classrooms, specify that transformer noise level shall not exceed the requirements of NEMA ST-20.

Installation
Mount transformers on a concrete housekeeping pad, minimum 4” thick. Ensure transformers are located to have adequate ventilation to avoid overheating. Install neoprene pad vibration isolators and washers, Fabreeka or equal, suitable for isolating transformer noise from building structure. Engineer shall specify that, in order to minimize noise transmission, Contractor shall securely fasten all enclosure panels and ensure that all shipping hold-down bolts (which secure the coil/core assembly to the enclosure) are un- tightened or removed in accordance with manufacturer’s recommendations. Engineer shall also specify that in the sole opinion of FM, should any dry transformer cause excessive noise or vibration, the Contractor shall be responsible for remedial work required to reduce noise and vibration levels to manufacturer’s specifications for the unit in question.

Ground and bond transformers in accordance with the NEC. Refer to Section 26 05 26 - Grounding. Make electrical connection using flexible conduit, minimum length.
Acceptable Manufacturers:
Square D; General Electric; Siemens; Eaton; or equal.
SECTION 26 24 13 SERVICE ENTRANCE & SERVICE ENTRANCE EQUIPMENT

General

Locate service entrance equipment in readily accessible spaces to facilitate disconnection of power in case of emergency. Coordinate the service entrance location with the University’s electric utility distribution system to ensure that service and feeder circuit lengths are as short as practical.

Service Entrance Raceways & Conductors

Service conductors should be installed underground from transformers, regardless of whether the transformers are on poles or pad-mounted. Service entrance conductors shall be installed in concrete encased PVC ducts. Minimum conduit size is 4”. Provide 25% spare conduits, one conduit minimum. Concrete encased ductbanks shall utilize Schedule 40 PVC conduits with a minimum of 3” of concrete encasement. Utilize interlocking plastic duct spacers that provide 3” of clearance between ducts. Support ducts with duct spacers placed at intervals not exceeding 5’. All PVC duct shall have solvent-weld joints and all joints shall be watertight. Concrete shall be minimum 3000 psi and shall be placed with the aid of a mechanical vibrator. The top of concrete encasement shall be a minimum of 36” below finished grade. Ducts shall be designed, configured and installed to eliminate standing water. Make changes in direction of duct run using long sweep bends with a minimum radius of 25’. Where ducts turn up into the surface, use rigid galvanized steel (RGS) elbows. Two coats of asphaltum or bitumastic paint shall be applied to all underground metallic conduit and ells to provide corrosion protection. Unused spare ducts shall be sealed using rubber duct plugs compressed with galvanized steel plates, Condux or equal.

All ductbank and direct buried duct runs shall be marked with a warning tape installed no less than 6” and no more than 12” above the top of the duct bank concrete or direct buried duct. Place warning tape along the approximate center line of the duct bank run. Warning tape shall be permanent, bright-colored, continuous printed, plastic tape compounded for direct burial not less than 6” wide and 4 mils thick.

Care shall be taken during installation to ensure no debris enters the duct system. After installation of the duct system is complete, a steel sectional mandrel shall be pulled through the conduit. The mandrel diameter shall be ½” less than the inside diameter of the ducts. Replace any duct section blocked. Mandrel pulls shall be witnessed by a FM representative. Contact FM at least 48 hours in advance to arrange FM witnessing.

Service Entrance Equipment

Locate service equipment at the service entrance point. Service entrance equipment shall be
a switchboard (preferred) or a panelboard. Switchboard or panelboard shall be U.L. listed suitable for use as service entrance equipment. Ensure equipment is capable of safely performing all interrupting functions based on the available system capacity and characteristics. Provide a single disconnecting means for each facility.

Ensure equipment capacities are adequate for the estimated load demands plus a contingency of 25% for future load growth. A larger reserve contingency can be applied if a specific need for future load growth can be documented.

Service entrance switchboards and panelboards main and feeder circuit breakers shall be provided with adjustable long time, short time and ground fault protection (LSG). Instantaneous protection shall not be provided since it limits the coordination with downstream molded case circuit breakers. Two levels of ground fault protection are desired. Selectivity is critical to the University in order to limit the extent of power outages.

Switchboard

Select switchboards of the dead front, floor-mounted, freestanding, metal-enclosed type with copper bus and utilizing circuit breakers as circuit protective devices. Completely isolate the incoming service entrance cable terminal compartment from the main bussing using suitable insulating type barriers. Bus and connecting stabs shall be sized for the full capacity of the breaker frame size. Provide fully rated vertical and horizontal bus sections. Space-only cubicles and appropriate bus provisions should be installed for future protective device additions, as necessary to accommodate planned load growth. Provide a minimum of two spare breaker spaces. Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents.

Circuit Breakers

Use molded case circuit breakers (MCCB) wherever possible. Select low voltage power circuit breakers only where the added cost incurred by their use can be justified by operational considerations. Provide electronic trip units with adjustable long time, short time and ground fault protection (LSG). Instantaneous protection shall not be provided since it limits the coordination with downstream molded case circuit breakers.

Metering

Ensure main switchboard has adequate space for installation of metering current transformers. Provide 4-pole voltage test block (metering potentials), 2-pole test block (meter control power), and voltage fuse blocks. Provide accessible cubicle for test blocks and terminal strips. Test and fuse and blocks shall be mounted on back of the meter panel door.
Ring type connectors and captive screw terminals shall be used on all metering circuits. Use SIS type, gray colored wire for all meter wiring within switchboard.

**Installation**

Install switchboard on concrete housekeeping pad, minimum 4” thick. Ensure switchgear is secured in accordance with the manufacturer’s instructions. Cables shall be routed and secured to the switchgear to minimize forces applied to conductor terminals. Clearly and permanently mark all circuit disconnect devices, including switches and breakers, to show the purpose of each disconnect. Switchboard shall be installed and tested per the requirements of NETA ATS-2009. Engineer shall ensure that circuit breaker trip and time delay settings have been adjusted to values as instructed by Engineer.

Refer to Section 26 09 13 - Electrical Power Monitoring for specific electric power monitoring requirements.

Refer to Section 26 05 26 - Grounding for specific service entrance grounding requirements.

**Preferred Manufacturers**

Square D; General Electric; Siemens; Eaton; or equal.
SECTION 26 24 16 PANELBOARDS

General
Service entrance panelboards shall provide electronic trip units with adjustable long time, short time and ground fault protection (LSG). Instantaneous protection shall not be provided since it limits the coordination with downstream molded case circuit breakers. Where panelboards are installed downstream of switchboards, two levels of ground fault protection are desired. Selectivity is critical to the University in order to limit the extent of power outages.

Locate panelboards in electrical rooms or closets. Do not locate panelboards in janitor closets or toilet room entries. Locate panels near columns, on permanent corridor walls or other permanent features to prevent future relocations. Surface mounted panels are preferred to flush panels. Where flush panelboards must be mounted in finished areas, flush panelboards shall include a spare 3/4” conduit for each three (3) spaces remaining in the panelboard; conduits shall be stubbed out from the panelboard into an accessible ceiling space.

Panelboards
Furnish each panelboard with main circuit breaker. Where applicable, the panelboard shall be U.L. listed suitable for use as service entrance equipment. Provide a minimum of 25% spare capacity in each panelboard and panelboard feeder circuit for future load growth. Panelboard, panelboard main circuit breaker and feeder circuit serving panelboard shall all share the same ampacity rating. Engineer shall not derate panelboard by utilizing undersized feeder circuit conductors and overcurrent protective devices (example: serving a 225 ampere panel with a 150 ampere feeder circuit breaker and feeder circuit conductors). Provide 25% spare breaker spaces in panelboard; equip half of spare spaces with spare breakers. Spare breaker spaces shall be fully equipped. Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents.

All panelboards to be bolt in type with ampacity and integrated short-circuit ratings as specified by the Engineer. All current carrying components shall be copper. Phase bus to be rated 100%. Neutral bus shall be rated 100% or as specified by the Engineer for non-linear loads. Grounding bus to be rated 100%. Main circuit breakers shall be bolted to the top or bottom of the bus.

Circuit Breakers
Molded case circuit breakers shall be bolt-in type, with integral thermal and instantaneous magnetic trip in each pole. Ensure circuit breakers for air conditioning branch are UL listed as Type HACR for air conditioning equipment branch circuits. Ensure circuit breakers used as switches in 120 volt and 277 volt lighting circuits are UL listed as Type SWD or HID. Provide arc-fault circuit interrupter protection in accordance with NEC.
Installation

Locate panelboards in dedicated spaces. Coordinate so that piping, ducts, etc. are routed around dedicated spaces above and in front of panelboards per NEC. Filler plates shall be installed for unused spaces in panelboards. All panelboard spaces shall be numbered with odd numbers on the left side and even numbers on the right side. Provide typed circuit directory for each panelboard.

Normal power panelboards shall include a black plastic laminated nameplate with white text indicating the panel by name and the source feeding this panel. Emergency power panelboards shall include a red plastic laminated nameplate with white text indicating the panel by name and the source feeding this panel.

In new buildings, panelboards shall be designated by floor/source/voltage/riser/panel#, where:

- floor = building floor per architectural drawings
- source = N for normal, E for emergency
- voltage = H for 480V or 480/277V, L for 120/208V
- riser = number risers consecutively beginning with 1
- panel = number panels by floor beginning with 1

In existing buildings, match existing panel nomenclature.

Preferred Manufacturers

Square D; General Electric; Siemens; Eaton; or equal.
SECTION 26 24 19 MOTORS & MOTOR CONTROLLERS

General

Provide motor control centers (MCC) in mechanical rooms and other multi-motor locations. A MCC shall be used in lieu of distribution panels and separate starters in these locations. Otherwise, provide separate motor controller.

Full voltage controllers shall be used for all motors 20 HP and smaller. Larger motors shall utilize soft-start or VFD controllers. Motors over 20 horsepower shall be provided with adjustable time delay relays on “restart after power outage” to minimize inrush. Engineer shall specify that Contractor verify that these delay settings are properly set to ensure “stagger-starting” of motors.

Motor and circuit disconnects shall be provided at all motor and equipment locations. Utilizing the “lock-out” feature on remotely located motor controllers is not acceptable as a disconnecting means. The University has dedicated maintenance crews who do such things as oil and grease bearings and replace belts on equipment. These personnel are not expected to be familiar with the location of starting equipment for the device being serviced. A non-fusible disconnect shall be provided on or adjacent to equipment for FM maintenance personnel use.

Motor branch circuits to be 480-volt, three-phase wherever possible. Motor branch circuits (other than 120-volt fractional horsepower motors) shall be protected by fuses. Large motors, such as chiller motors, shall be fed directly from the service entrance equipment wherever possible. All motor circuits shall be dedicated except fractional horsepower exhaust fans that can be easily served and controlled from local lighting and power circuits.

Replace motors with energy efficient models instead of rewinding a standard-efficient motor. If an energy efficient motor has been rewound previously, evaluate replacement in lieu of rewind (repeated bake-out of the stator in the shop - so as to remove old windings - decreases the premium magnetic properties of the stator steel laminations and damages inter-laminar insulation, reducing the efficiency rating, if the oven temperature is above 680 degrees, per Electrical Apparatus Service Association guidelines).

Motors

All motors 1/2 horsepower and larger shall be 3-phase, 208 volt or 460 volt based on system secondary distribution voltage. Motors less than 1/2 horsepower shall be single phase, 115 volt or 208 volt. All motors 1 horsepower and larger shall be premium efficiency. Motors used with adjustable frequency drives shall be NEMA rated for inverter duty use. All motors are to be copper wound, high efficiency type. Indoor location may utilize open drip-proof construction; outdoors should be totally enclosed fan cooled.
Motor Control Centers

Select motor control centers (MCC) of the dead front, floor-mounted, freestanding, metal-enclosed type with copper bus. MCC shall be standard manufacturer design and construction to permit ready installation, removal or replacement of standard components.

Provide 25% bussed spaces for future expansion. Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents.

Full voltage controllers shall normally be used. Controllers to be NEMA rated only. Do not include IEC rated controllers in the specification. Use NEMA Size 1 starter minimum. Controllers to have solid state overload relays sized to the motor’s nameplate current. Relay shall provide overload, phase loss and under/over voltage in each phase. Provide short circuit protection for each motor and motor controller by a motor circuit protector. Each controller should include a minimum of two NO and two NC auxiliary contacts. Provide a separate control transformer with primary and secondary fusing for each starter. Provide “HAND-OFF-ON” (HOA) selector switch and red “MOTOR RUN” and green “MOTOR READY” pilot lights. Use LED type pilot lights. Provide adjustable time “on-delay” relay on all controllers serving motors 20 horsepower and larger.

Motor starters to be provided with HOA switches of maintained contact type for use with energy management systems. All motor starters for pumps and exhaust fans are to be equipped with auxiliary contacts for use with energy management systems.

Individual Motor Controllers - Three Phase

Individual 3-phase motor controllers shall be combination type with fusible disconnects. Controllers to be NEMA rated only. Do not include IEC rated controllers in the specification. Controllers to have solid state overload relays sized to the motor’s nameplate current. Relay shall provide overload, phase loss and under/over voltage in each phase. Provide short circuit protection for each motor and motor controller by a motor circuit protector. Each controller should include a minimum of two NO and two NC auxiliary contacts. Provide a separate control transformer with primary and secondary fusing for each starter. Provide “HAND-OFF-ON” (HOA) selector switch and red “MOTOR RUN” and green “MOTOR READY” pilot lights. Use LED type pilot lights. Provide adjustable time “on-delay” relay on all controllers serving motors 20 horsepower and larger.

Individual Motor Controllers - Single Phase

Single phase manual starters for fractional horsepower motors shall consist of a quick make, quick break, toggle switch with one piece melting alloy type thermal overloads. Where applicable, pilot lights shall be long life neon.
Where fractional horsepower motors are to be automatically started, use starters meeting the requirements for three phase motor controllers.

Disconnect Switches

Disconnect switches shall be heavy duty with visible, quick-make/quick break blades and equipment grounding kit. Terminal lugs shall be rated for 75°C type.

Preferred MCC Manufacturers

Allen Bradley; General Electric; Square D; Siemens; Eaton.
SECTION 26 27 26 WIRING DEVICES

General
Provide receptacles in janitor’s closets, toilet rooms, corridors and other special purpose spaces for maintenance use. Provide receptacles in all corridors every 50’ on center and no further than 25’ from the end of the corridor for cleaning. Provide receptacles on each staircase landing and at exterior doors for cleaning. Provide at least one emergency receptacle in mechanical, electrical and communication rooms, connected to the building standby emergency power system. Provide ground fault circuit interrupter (GFCI) receptacles as dictated by good engineering practice. Exterior receptacles shall be GFCI, “in-use”, weatherproof type.

Materials
Wiring devices shall be heavy duty, specification grade, self-grounding devices. Snap switches shall be “quiet type”, rated 20 amperes, 120-277 volts. Switches shall be ivory color for normal power, red for emergency power. Duplex receptacles shall be rated 20 amperes, NEMA 5-20. Receptacles shall be ivory color for normal power, red for emergency power. Device plates shall be stainless steel in finished areas, and galvanized or cast to suit boxes at locations where exposed wiring is permitted.

Installation
Ground each receptacle by means of a separate code size conductor connecting the receptacle ground terminal to the branch circuit panel-board ground bus. Do not rely on the conduit system for grounding. Do not use wiring devices as junction or feed-through.
All receptacles and fixed equipment shall have a permanent label indicating circuit and panel number.
SECTION 26 32 13 GENERATOR SYSTEMS

General

Emergency generators shall be housed in the mechanical or electrical rooms. Generators located outside shall be readily accessible by vehicular crane and other maintenance vehicles.

Sizing/Loads Connected
Loads to be connected to the emergency power distribution system shall include the following:

- Alarm and detection systems.
- Fire pump where required by Code.
- Smoke removal system.
- Exit, emergency and egress lighting.
- Energy management system control panel(s).
- Control air compressors.
- Lighting and receptacles in transformer vaults, mechanical rooms, electrical rooms, communication rooms, EG rooms and HVAC equipment serving EG rooms.
- Essential communications and computer systems.
- Security and surveillance systems.
- Lighting and power required to conduct essential operations.
- Hydraulic or traction elevators, as applicable.

New installations of standby EG systems shall provide a minimum of 20% growth capacity. Additionally, EG systems shall be sized so that the transient voltage drop on the EG system due to inrush or motor starting is no greater than 10%. Standby EG systems installed to provide emergency power to non-linear loads, such as uninterruptable power supplies or variable frequency drives, shall be sized in accordance with EG manufacturer’s recommendations and actual equipment to be installed.

Generator
The engine shall be liquid-cooled (that is, shall have a radiator cooling system) with thermostatic temperature control and shall operate on diesel fuel. Standby EG systems shall be provided with jacket water heaters. The jacket water heater shall be connected to the emergency power distribution system.
Underground fuel tanks are not acceptable. Above ground fuel tanks shall be double wall welded steel construction and sized to provide the EG system with fuel for a minimum of 24 hours operating at continuous full-load power output. Above ground fuel tanks may be sub-base mounted or remote located as appropriate for the application and shall be provided with a rupture basin. Interstitial monitoring and “fuel in basin” alarms shall be provided. Day tanks shall be installed where applicable or required. Construction shall be same as fuel tank. All fuel piping shall be double wall construction. For EG systems installed interior, provide an accessible fuel fill location outside of building.

EG systems installed inside a building shall be located in a room, preferably along an outside wall, that is dedicated to only the EG and ancillary equipment. Engineer shall ensure that:

- Adequate access into the generator room from outdoors for maintenance, replacement or removal of any and all equipment housed in the room is provided
- Adequate means of cooling and ventilating the EG room is provided
- HVAC equipment and any other "space" equipment shall be connected to the emergency power distribution system
- Adequate insulation so that EG running noise levels are not obtrusive to building occupants is provided
- Coolant lines to extension heat exchangers shall be protected from freezing and mechanical damage

EG systems installed outdoors shall be housed in a steel, heated, free standing, weather tight enclosure. The enclosure shall be constructed upon a skid base that shall have sufficient stiffness to allow transportation and handling of the entire package with all equipment mounted and ready for operation. Wall framing, dampers, shutters and bird screens shall be aluminum. Provide lockable, access doors on both sides of enclosure. Where EG controls are too high to be readily accessible from ground level, provide a catwalk around enclosure to facilitate maintenance and testing.

Provide engineered exhaust system for engine exhaust. Insulate all piping. Mufflers shall be installed on EG exhaust systems. They shall be "critical" sound rated to provide maximum noise attenuation. Install muffler and exhaust wrap systems where applicable or required to augment exhaust system sound attenuation. Care shall be taken to ensure that the EG exhaust is located away from the air intake area of the building and adjacent buildings so that engine exhaust does not infiltrate buildings.

Engineer shall ensure that the generator shall be specified with the following features:

- Electronic fuel ignition control
- Governor shall be electronic, adjustable isochronous, with speed sensing
• Permanent magnet excitation
• Voltage regulator shall be solid-state type, separate from exciter, temperature compensated with phase control sensing
• Digital controls and metering
• Molded Case Main Circuit Breaker

Standby EG systems shall be self-monitoring. A local annunciator shall display the status, ("normal," trouble" and "alarm") of EG system components. Signals to be monitored include:

• Generator running
• Generator system alarm or trouble
• Leak detection system alarm

**Automatic Transfer Switch (ATS)**

Automatic transfer switches (ATS) shall conform to the requirements of NEC and UL 1008. ATS shall be UL listed and labeled for intended purpose. The ATS shall be supplied by the engine/generator supplier and tested in accordance with NETA ATS-2006 (and NFPA 110 where applicable) to ensure a completely coordinated system.

The ATS shall consist of a power transfer module and a microprocessor control module interconnected to provide complete automatic operation. The power transfer module shall be mechanically held and electrically operated by a single solenoid mechanism momentarily energized from the source to which the load is to be transferred. The control module shall have solid-state sensing and control logic. Interfacing relays shall be industrial control grade. The ATS shall include a microprocessor based metering device that provides real time measurements of three phase power system.

The ATS shall be inherently double throw and mechanically interlocked to ensure only two positions, normal or emergency. The ATS shall be rated for continuous duty and braced to withstand the symmetrical short circuit current available at the ATS terminals. Utilize bypass isolation type ATS for any ATS rated 600 amperes or larger or for critical building systems.

ATS shall provide with the following features:

• Adjustable time delay on engine starting
• Adjustable time delay on transfer (normal to emergency and emergency to normal)
• Adjustable time delay on stop
• Under and over frequency and voltage relaying
• Programmable exerciser
• Delayed transition feature to de-energize elevator controller when switching from emergency to normal source
• Test switch to simulate power outage
• 2-N.O. and 2-N.C. auxiliary contacts

Acceptance Testing

Engineer shall specify that the Contractor shall have a factory-authorized service representative inspect, test and instruct the FM designated employees in the proper system operation and in all required periodic maintenance. Testing shall be in accordance with NFPA 110, including cycle crank and performance tests. FM shall be given minimum 48 hours’ notice prior to testing. Testing shall be performed using all installed generator loads supplemented with additional load to generator’s nameplate rating. During testing, factory representative shall provide a minimum of four (4) hours of training to FM personnel on the operation of the system and in all required periodic maintenance.

Prior to or at acceptance testing, Contractor shall deliver to FM two (2) copies technical literature, including a manual of sequential operations, recommended preventative maintenance, parts lists with recommended spares, and all pertinent control manuals and wiring diagrams at the conclusion of the project.

Installing contractor shall provide fuel for field-testing and top off fuel tank at substantial completion of project.

Acceptable Manufacturers:

(Generator): Cummins; Kohler; Caterpillar; Generac; Taylor Power.

(ATS): ASCO “4000 Series”; or equal.
SECTION 26 51 00 INTERIOR LIGHTING

General
Lighting design shall meet recommended standards of the IESNA. Submission of Schematic Design documents shall include illumination levels for interior areas. Typical areas to be included in submission are offices, classrooms, corridors, etc.

Interior lighting design, including both the luminaries and control systems, shall fully comply with the minimum requirements established in ASHRAE 90.1, 2010 edition. Additionally, interior lighting design lumens per watt lighting power densities shall be at least 30% lower than the requirements established in ASHRAE 90.1, 2010 edition.

Interior lighting design shall emphasize accessibility for re-lamping, cleaning, and maintenance. The location of fixtures over hazardous chemicals, mechanical equipment, and laboratory benches shall be avoided. Special provisions shall be made for lamps located in high-ceiling areas to provide access (e.g., means of lowering fixture).

Use 277V for lighting where available. Do not mix 120V and 277V systems for lighting applications for safety considerations.

Areas of computer usage shall utilize fixtures specifically designed for glare control. Where feasible, the use of indirect and direct/indirect systems shall be considered. Pendant fixtures should not be used in classrooms or audio visual rooms as they will restrict the location of video projectors. It is preferred that lighting fixtures be recessed or flush with the ceiling.

Provide local control capable of dimming or capable of reducing lighting levels by 1/2 or 2/3 in all building areas, except in corridors, restrooms, vestibules, and mechanical, electrical, communication and custodial spaces. LED luminaires should be utilized in new construction and renovation. Luminaires should be specified to exceed 100 lumens per watt wherever feasible.

Care shall be taken to utilize only one lamp color in any given space and to provide uniform color rendering throughout a project. Generally, the university utilizes 4000 kelvin temperature for indoor spaces. As the use of the space should ultimately dictate the light color selection, 3000K or 3500K can be utilized where warmer color temperatures are desirable. The Office of Planning Design and Construction should be consulted when space conditions dictate the use of light color temperatures other than those referenced in this standard.

Stairwell lights shall be wall-mounted fixtures that can be reached by hand from the landing floor or located over the landing to permit the safe use of ladders. If stairwell lights must be ceiling-mounted, the maximum height shall be 10 feet.
Lighting Control

Life safety, exit, and night lighting fixtures shall not be equipped with switches. All other light fixtures shall be switched or controlled. Office, conference, and other administrative or presentation spaces shall have dual-level switching or dimming. Dimming is preferred in conference rooms and A/V rooms.

Utilize occupancy sensors in all buildings. Sensors shall utilize both passive infrared and ultrasonic technology. Where ambient light can be utilized, light sensing should be incorporated in the sensors. Sensors shall be capable of bi-level lighting control or 100% dimming and shall provide manual override mode to allow the sensor to operate as a servicer switch in the event of a sensor failure.

In small classrooms, individual offices, conference rooms, auditoriums, and other areas with direct line of sight, utilize wall switch sensors. In spaces without direct line of sight, utilize ceiling mounted or wall/corner sensors to control lights.

Room and area controls shall be able to perform the following functions:

- Provide manual on/ automatic off control of fixtures
- Provide 100% dimming control of fixtures
- When adequate light levels are sufficient, sensor shall hold secondary lights off until daylight levels drop below user preset lighting level.
- Turn off lights after a preset time of non-occupancy ranging from 1 to 30 minutes. Standard settings for new installations shall be for fixtures to be turned off after 5 minutes of non-occupancy. Restrooms can be set to 15 minutes prior to being turned off.

Daylight harvesting shall be employed in areas where feasible. When natural light to the space can be combined with or used in place of electrical lighting to meet IESNA required lighting levels, the design should incorporate the appropriate technologies. This includes but is not limited to photo-sensors, dimmable ballasts, LED fixtures, light tubes, sky-lights.

Fixtures

Fixtures should be specification grade minimum. New fixtures shall utilize LED technology for optimal life and efficacy. Luminaire enclosures shall be designed with acrylic or other UL approved plastics. Lenses on troffers should have a 1/8” cross section minimum. Glass globes are not acceptable in any application.

LED drivers shall be designed to be operated at standard operating voltage of driver, and not “over-driven”. Product testing of LED fixtures shall comply with the requirements of U.L. 1598 and 8750 and be tested in accordance with IES LM-79 and LM-80. LED lamp color
should be typically be 4000 degree Kelvin. Other color temperature selections, which may be acceptable depending upon the application, should receive prior approval from the Office of Planning, Design and Construction.

Incandescent, fluorescent, metal-halide or halogen lamps should not be used without approval of MSU. If the use of incandescent lamps is approved, they should be rated for 130 volts.

Exit signs shall have LED-type lamps or use photo-luminescent technology where/when approved by the local fire code official and MSU EHS.

**Emergency and Exit Lighting**

Connect emergency egress lighting and exit signs to emergency power system. Battery back-up in fixtures for emergency lighting shall be used only with permission of FM and MSU EHS.
SECTION 26 56 00 EXTERIOR AND SITE LIGHTING

General

Exterior lighting design shall emphasize accessibility for re-lamping, cleaning, and maintenance. The Engineer shall avoid placing fixtures in locations which cannot be easily accessed, without the use of special equipment, by maintenance personnel. Engineer shall also coordinate the installation of pole mounted fixtures with the landscape plantings to ensure future growth of the plantings do not block the projection of light.

Exterior lighting fixtures shall use LED sources. Engineer shall minimize the use of wall mounted or ground mounted fixtures. Pole mounted fixtures are preferred. Engineer shall not specify ground fixtures utilizing submersible ballasts. Refractors and lenses should be glass. Engineer shall minimize light pollution by the use of cut-off fixtures and faceted reflectors.

Exterior Lighting Control

MSU controls exterior lighting fixtures by utilizing a time clock in series with individual photocells at each lighting fixture. This arrangement provides the University flexibility to turn off exterior lighting for certain nighttime hours and ensures that fixtures with failed photocells do not burn during day-light hours.

Exterior and site lighting fixtures shall be served by circuits dedicated to exterior site lighting. Circuits shall be routed through a NEMA style lighting contactor(s) and controlled by a programmable electronic time clock with battery back-up, Tork Model #DG100 or equal. Circuits and lighting contactors shall be grouped logically (e.g. area lighting around building, parking lot lightings, etc.) for control. Each exterior lighting fixture shall be furnished with an individual photocell.

Lighting Pier Foundations

All pole bases shall be steel reinforced cast-in-place concrete. All wiring entrances into pier foundations shall be below grade. The diameter of pier foundation is to be 4” greater than the pole base to provide a 2” reveal around the base. In parking lots, the top of the pier foundation shall be 36” above finished grade. In all other areas, the top of the pier foundation shall be 12” above finished grade. The top of the pier foundation shall have a 1” chamfer along the edge.

Grounding

Refer to Section 26 05 26 - Grounding for grounding details.
Walkway Lighting - Historic District
Utilize 4000K LED acorn luminaries with IES Type III distribution mounted on 12’ pole for exterior walkway lighting in Historic District selected to meet IES guideline lighting levels. All fixtures and poles in the Historic District shall be finished black.

Accepted Manufacturers (luminaries): Holophane “Washington” series, Catalog # WSE2 P50 40K AS BK 3 BK 4 H PCLL; or equal.

Accepted Manufacturers (poles): Holophane “North Yorkshire” series, Catalog # NYA 12 F5J 20 P07 ABG BK; or equal.

Area Lighting - Historic District
Utilize 4000K LED acorn luminaries with IES Type V distribution mounted on 12’ pole for area lighting in Historic District. All fixtures and poles in the Historic District shall be finished black.

Accepted Manufacturers (luminaries): Holophane “Washington” series, Catalog # WSE2 P50 40K AS BK 5 BK 4 H PCLL; or equal.

Accepted Manufacturers (poles): Holophane “North Yorkshire” series, Catalog # NYA 12 F5J 20 P07 ABG BK; or equal.

Sidewalk Lighting
Utilize 5000K LED Path/Area Luminaires with IES Type III distribution mounted on 18’ pole for sidewalk lighting in all areas outside the Historic District. All fixtures and poles outside the Historic District shall be finished dark bronze.

Accepted Manufacturers (luminaries): American Electric Lighting Autobahn Series ATB2; Lithonia D-Series Size 0 LED Area Luminaire; or equal.

Accepted Manufacturers (poles): Lithonia Catalog # SSS-18-4C-DM19-DBMSU; Cooper Catalog # SSS4A18SF; or equal.

Street & Parking Lot Lighting
Utilize 5000K LED Area Luminaires with IES Type III distribution mounted on 35’ pole for street and parking lot lighting in all areas outside the Historic District. All fixtures and poles outside the Historic District shall be finished dark bronze.

Accepted Manufacturers (luminaries): American Electric Lighting Autobahn Series ATB2; Lithonia D-Series Size 0 LED Area Luminaire; or equal.

Accepted Manufacturers (poles): Lithonia Catalog No. SSS-35-6G-DM19-DBMSU; Cooper Catalog # SSS6M35SF; or equal.
DIVISION 27 - COMMUNICATION SYSTEMS

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DIVISION 27 COMMUNICATIONS

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.
SECTION 27 00 01 PROJECT SCOPE AND RESPONSIBILITY

Architect/ Engineer/Contractor

Purchase and installation of all copper cable for Data and Voice communications. It also encompasses the installation of fiber optic cable necessary to establish intra-building (closet to closet) and inter-building (building to backbone outside plant) connection to the campus network. The contractor will also purchase and provide copper and fiber termination components including equipment racks listed in the “Parts and Materials” list noted in the appendix.

MSU/University ITS

MSU/University ITS will be responsible for terminating and certifying all copper and fiber telecommunication cable using components purchased and provided as part of the project contract.

MSU Specific Materials

MSU has standardized on vendor specific telecommunications cable, components, network electronics and system requirements. All design specifications and installation of network infrastructure shall be based on materials and equipment as specified in the “Parts and Materials” list noted in the appendix. The Parts and Materials list should not be considered a complete list as additional parts may be required to provide complete solutions. Contact MSU/ University ITS for an updated list of materials or for additional materials if required. All materials, equipment, hardware, and components shall be new and free from defects in materials, composition, and installed workmanship. Materials and equipment shall be installed, placed, terminated, tested, handled, and processed in a manner consistent with manufacturer’s instructions, prevailing codes, ordinances, regulations, standards or MSU specific requirements, whichever is more stringent.
SECTION 27 00 02 REGULATORY REQUIREMENTS, CODES AND STANDARDS

All work on MSU campuses by cabling/electrical contractors shall be in compliance with the following industry codes, standards, and practices, as well as, MSU specific requirements. It is the responsibility of all trades to know and comply with the most current revisions of all codes, standards, and practices set forth by the following agencies:

- ANSI - American National Standards Institute
- ASME - American Society of Mechanical Engineers
- ASTM - American Society for Testing and Materials
- BICSI - Business Industry Consulting Services International
- EIA - Electronic Industries Alliance
- FCC- Federal Communications Commission
- IEEE - Institute of Electrical and Electronics Engineers
- NEC - National Electrical Code
- NEMA - National Electrical Manufactures Association
- NFPA - National Fire Protection
- OSHA - Occupational Safety and Health Administration
- SCTE - Society of Cable Television Engineers
- State of Mississippi and Local Building Codes
- TIA - Telecommunications Industry Association
- UL - Underwriters Laboratories
SECTION 27 00 03 TELECOMMUNICATIONS ROOMS AND PATHWAYS

Telecommunication Rooms / Equipment Rooms

Flame retardant plywood backboards shall be provided from floor to ceiling on at least two walls in each telecommunications room for equipment termination blocks and racks.

All TRs shall have ladder rack/cable tray around the perimeter and over the equipment racks to provide a cable pathway from where the cable enters the room. The width of the ladder rack shall be designed to accommodate and support the volume of the cables including service loops. The ladder rack and support system shall be sufficiently strong and well secured to the building structure to bear the weight of the cables and any splice enclosures.

All TRs shall have a minimum of three 20-amp, dedicated, dual-gang power outlets, one for each area of voice, LAN and CATV. One dual-gang power outlet box should be placed in close proximity to the voice termination field and one for the CATV field. One dual-gang power outlet box should be mounted on the wall near the location of the active LAN rack, or if the racks are located in the center of the room, the outlet box should be mounted on the ladder rack or active rack.

Telecommunication Pathways

Design considerations for pathways shall include, but are not limited to, conduits, cable trays, sleeves, ducts, pull boxes, conduit fill, building layout, and other utilities. Due to University and/or building specific needs, modifications may be necessary. All pathways shall be bonded and grounded as required by those agencies listed in section 1.4. Detailed layouts of pathways shall be shown and labeled on E-drawings. MSU/UNIVERSITY ITS shall approve design of all cable pathways before the release of the bid package. All pathway conduits, trays, sleeves, ducts, pull boxes, etc. shall be sized to accommodate proper cable bend radii, cable counts per conduit capacity, maintenance, future growth and adequate fire stopping where needed.

Backbone (Riser) Pathways

Backbone pathways shall have a minimum of three 4” trade size conduits or sleeves for cabling between TRs. The conduit shall terminate into a cable tray or ladder rack allowing a manageable path to the equipment racks. Upon completion, there shall be a minimum of one spare conduit between TRs for future use.
Horizontal Pathways

All wall/floor penetrations shall be sleeved with metallic conduit or equivalent. All sleeves shall be reamed, have a plastic bushing installed on each end, and extend 4” beyond the wall or ceiling on each side. Sleeves shall be of sufficient size to accommodate cabling and fire-stopping plus 40% spare capacity to allow for future cabling needs.

Cable pathways shall be accessible and follow the corridors of the building. Where cable tray or conduit is not specified, a continuous pathway of independent cable supports such as J-Hooks shall be provided. The distance between supports shall not exceed 48” and shall be fastened to the building structure. Conduits shall provide a pathway from each WAO box to an accessible common cable pathway.

Conduits shall be sized to accommodate the number of cables specified for installation with room for additional fill. Conduits shall be a minimum of ¾ in diameter. All conduits used for WAOs shall stub into an outlet box. Box-connectors and plastic bushings shall be installed on all conduits.

Outlet Boxes for LAN and voice

Each outlet box shall have a minimum of one ¾ in diameter conduit stubbed to an accessible cable pathway system.

Surface Mounted Raceway

Raceway shall be metallic or plastic and sized to accommodate the number of cables specified for installation with proper cable bend radii and room for additional fill. Split or dual channel raceway shall be specified for installations that require both power and telecommunication services to share raceway. All surface-mounted raceway shall be identified and labeled on the design prints with the contents and the from-to locations.
SECTION 27 00 04 MODULAR FURNITURE

Furniture shall accommodate MSU specific materials and shall be equipped with pathways necessary to accommodate power and telecommunication cable. MSU/UNIVERisty ITS shall be consulted to ensure compliance with University telecommunications needs.
SECTION 27 00 05 BACKBONE AND HORIZONTAL COPPER AND FIBER CABLE INSTALLATION

Labeling

The end of each copper/fiber data and voice cable shall be clearly marked with labels to uniquely identify them within the run. Magic marker and pen is not acceptable. Each unique cable identifier shall be clearly marked on a floorplan that will be delivered to MSU/University ITS once all the data and voice cable has been installed.

Inter-building Backbone Fiber-Optic Cabling

Backbone fiber shall be installed between the main cross-connect within the building to an existing cross-connect to be specified by MSU/University ITS. This installation shall consist of 24 strand MM (62.5) and 24 strand SM (8.3) fiber optic cable. (See Appendix “Parts and Materials” list.). A minimum of 25’ of excess shall be provided at each fiber termination point at the cross-connect locations.

Intra-building (Riser) Fiber-Optic Cabling Installation

The minimum strand count for fiber optic riser rated cable is 12 strands of SM (8.3) and 12 strands of MM (62.5) between TRs unless otherwise specified by MSU/UNIVERSITY ITS(see Appendix “Parts and Materials” list.). A minimum of 25’ of excess shall be provided at each fiber termination point at the cross-connect locations.

UTP Data and Voice Horizontal Cable Installation

All cables shall be continuous and without interruption from the WAO to the termination point in the TR. In-line splices, splits, taps or bridges are not acceptable in horizontal station cable runs. Unshielded twisted pair cable shall be 4-pair, Category 6, and blue in color (see Appendix “Parts and Materials” list.) Cable shall be plenum rated unless non-plenum is specified by the project Architect or Design Engineer. A minimum cable excess of 18 inches shall be provided at each wall outlet. A minimum excess of 15 feet will be provided at the TR termination point after cable routing within the TR has been determined.
SECTION 27 00 06 WORK AREA OUTLETS

Work area outlets (WAO) consist of voice, LAN and/or CATV services. MSU uses typical variations of WAOs. MSU has established minimum WAO requirements based on usage requirements. Work area outlets are typically 18” AFF unless otherwise specified by the project Architect/Engineer.
SECTION 27 00 07 WORK AREA OUTLET CONFIGURATIONS

The following descriptions are for typical WAO configurations. Other configurations may be needed to meet specific application requirements:

- Standard (Voice and Data): Two 4-pair cat6 LAN UTP cables terminated on 8-pin, 8-conductor, T568B modular connector jacks. One 4 pair cat5 UTP for a voice connection.
- Wall Phone Only: One 4-pair cat5 UTP cable terminated on 6-pin, 6-conductor, USOC modular connector jack for a voice connection, 48”AFF.
SECTION 27 00 08 RECORD DOCUMENTATION

UNIVERSITY ITS shall be provided with an electronic copy in AutoCAD of all documentation for as-built, installed telecommunications infrastructure. This package should include diagrams showing all risers, cable pathways, floor layouts, and TR diagrams.

Riser Diagrams

Riser diagrams shall include:
- One-line diagrams for UTP copper cabling with cable counts.
- One-line diagrams for optical fiber cabling with cable counts
- One-line diagrams for coaxial cabling with cable sizes.

Floor Diagrams

Floor diagrams shall include:
- TR locations and room numbers.
- WAO locations and faceplate labels
- TR wiring zones, which identify WAOs, served
- Horizontal cabling pathways including penetrations and fire stopping.

Riser Diagrams

TR diagrams shall include:
- TR room numbers.
SECTION 27 00 09 OUTSIDE PLANT

This section pertains to outside plant infrastructure facilitating the installation of telecommunication cable into the building. MSU/UNIVERSITY ITS shall be consulted regarding outside plant pathways. MSU uses an underground conduit system to provide pathways for telecommunications cabling. Contact MSU Facilities Management for specific guidelines and requirements for installation of maintenance holes and conduit. MSU Facilities Management and agencies such as “Call before You Dig” shall be contacted prior to breaking ground. Outside plant pathways include, but are not limited to, conduits, maintenance holes, hand-holes, and pull-boxes. All outside plant pathways will become property of MSU upon completion of the project. All projects shall be completed with infrastructure in place to connect to the existing outside plant allowing connectivity to the existing MSU telecommunication network.

Pathways, Entrance Duct and Ductbanks

MSU buildings are fed with a minimum of two (2) 4” conduits from a telecommunications maintenance hole. A minimum of one (1) 4” conduit shall be included in the design as a spare to accommodate future growth to the building. Duct between maintenance holes shall be designed to include a minimum of two (2) 4” conduits. A minimum of one (1) 4” conduit shall be noted in the design for spare to accommodate future growth. Conduits shall be encased in concrete where applicable. All joints shall be watertight. A positive drain slope shall be maintained and all unused conduits shall be capped to prevent water accumulation. Installation of conduits and duct banks shall include provisions of all necessary accessories including, but not limited to, couplings, bends, universal terminators at maintenance holes and each building, slip couplings, and adapters fitting PVC to rigid duct, pull strings, etc. Steel and PVC duct shall be encased in a concrete envelope with duct separators where applicable. All conduits shall have pull strings and tracer wire installed.

Communication Vaults

Communication vaults shall concrete composite type, molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two. Vaults shall have solid bottom. Vault shall have minimum interior dimensions of 36” x 36” x 36” deep, with heavy duty cover. Vault and vault cover shall be designed for driveways, parking lots and off road application subject to occasional non-deliberate traffic, ANSI Tier 22. Cover shall be weatherproof, single piece, gasketed, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure. Cover shall have non-skid finish and molded lettering legend “COMMUNICATIONS”. Box and cover color shall have natural gray finish.
Acceptable Manufacturers: Quazite Type “PG”; or equal.

Outside Plant As-Built Documentation

As-built drawings shall identify and label all conduits, duct banks, maintenance holes, pull-boxes, hand-holes and junction boxes. Documentation shall include cross sectional diagrams of duct banks and butterfly diagrams of all maintenance holes, pull-boxes, hand-holes, and junction boxes.
DIVISION 27 APPENDIX PARTS AND MATERIALS

Copper (Voice and Data) Cable and Component Standards

To ensure communication infrastructure compatibility, integrity and stability Mississippi State University has standardized on the following vendor specific components:

- Panduit CJ688TPxx MINI-COM Cat 6 module (data) (green)
- Panduit CJ66xx MINI-COM Cat 3 module (voice) (white)
- Panduit metal modular 24, 48, or 72 port patch panels. CPxxBL
- Panduit faceplates with labels, 2, 4, or 6 port openings, CFPLxxx (white)
- High grade Cat6 patch cables at work area outlets, cross connects and telecommunication room equipment.
- Data cable - Berk-Tek Lanmark 1000 Cat6 UTP, BLUE, plenum rated unless otherwise noted…..non-plenum is acceptable at the discretion of engineer or architect
- Voice cable - Berk-Tek Lanmark 350 Cat5e UTP, GRAY, plenum rated unless otherwise noted. Non-plenum is acceptable at the discretion of engineer or architect

Fiber Optic Cable and Component Standards

To ensure communication infrastructure compatibility, integrity and stability Mississippi State University has standardized on the following vendor specific components:

- Outdoor multimode fiber optic cable - Corning XXXKS4-14130A20, 62.5/125, LT Duct/Aerial, ALTOS/LST and dry water blocking or equivalent.
- Outdoor single mode fiber optic cable - Corning XXXRW4-14101A20, 8.3/125, LT Duct/Aerial, ALTOS/LST and dry water blocking or equivalent.
- Indoor multimode fiber optic cable - Lucent Accumex optical cable, 62.5/125, riser rated or equivalent.
- Corning/Avaya/Lucent enclosures and connectors.
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 31 00 FIRE ALARM AND DETECTION
DIVISION 28 ELECTRONIC SAFETY AND SECURITY

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.
SECTION 28 31 00 FIRE DETECTION AND ALARM

General

New facilities and facilities to be substantially renovated must include a fire alarm system. Exceptions include small buildings and temporary facilities where little value is added by provision of an alarm system. Discuss exceptions with MSU.

The design and installation of this fire alarm system will be in accordance with current editions of the following codes, standards and guidelines:

- NFPA 1 Uniform Fire Code
- NFPA 13 Standard for Installation of Sprinkler Systems
- NFPA 17 Standard for Dry Chemical Extinguishing Systems
- NFPA 17A Standard for Wet Chemical Extinguishing Systems
- NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 45 Standard on Fire Protection for Laboratories using Chemicals
- NFPA 70 National Electrical Code
- NFPA 72 National Fire Alarm Code
- NFPA 90A Standard for Installation of Air Conditioning and Ventilation Systems
- NFPA 92B Guide for Smoke Management Systems in Malls, Atria and Large Areas
- NFPA 241 Safeguarding Construction, Alteration, and Demolition Operations
- IFC International Fire Code
- IBC International Building Code
- ASME A17.1 Safety Code for Elevators and Escalators
- ADA Accessibility Guidelines (ADAAG)
- ANSI S3.2 Method for Measuring the Intelligibility of Speech over Communication Systems
- ANSI S3.41 American National Standard Audible Emergency Evacuation Signal

Quality Assurance

The fire alarm system shall be the product of a single manufacturer who has engaged in the production of this type of equipment for at least 10 years. Each and all items of the fire alarm system shall be products of a SINGLE fire alarm system manufacturer under the appropriate category by UL and FM bearing their respective labels. Control equipment shall be listed by UL as a single control unit. Interconnecting equipment that has not been listed for interconnection, or the creation of components or system into a nonstandard unit that is not normally available from the manufacturer, is not acceptable.
Further, the Engineer shall specify that:

- The authorized representative of the manufacturer of the fire alarm system equipment shall be responsible for satisfactory total system operation and its certification.
- The supplier shall employ factory trained and NICET certified personnel to terminate, program, test and commission the fire alarm system. These personnel must have been engaged in the installation of this type of equipment for a minimum of eight (8) years.
- The supplier shall have a fully equipped service organization within one hundred (125) miles of Mississippi State University.
- The supplier shall certify in writing to the Engineer with the Project submittals that the supplier has successfully completed projects of similar scope and nature, using the proposed product line, fire alarm and equipment, in other buildings over the past three years. The supplier shall also certify that they are an authorized State of Mississippi franchised representative, and have a fully equipped service organization that will respond with parts and service as required within a 48 hour time period.

Acceptable Manufacturers

SimplexGrinnell; EST; Bosch; or equal.

Submittals

Prior to bidding and project construction the design professional shall receive approval from the State Fire Marshal of all fire alarm plans. Prior to project construction, the professional shall ensure that a set of shop drawings have been submitted by the installing contractor and approved by the State Fire Marshal.

At project closeout, the contractor shall furnish PDCA one electronic and two (2) complete hard copies of “as-built” drawings. The contractor shall also provide two (2) sets of CD discs containing software back up and CAD based drawings in latest version of AutoCAD of as-built drawings and schematics. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings.

The installing contractor shall provide MSU a complete smoke sensitivity report at system installation and a second smoke sensitivity report at the end of the 1 year warranty period.

Appropriate manufacturer’s software shall be provided to MSU. Software shall be provided to
upload/download programs and analog data results.

General Guidelines

At a minimum, the fire alarm system shall include a fire alarm control panel (FACP), remote annunciator, digital alarm communicator transmitter (DACT) and initiation and notification appliances as required by applicable Codes and proscribed in this Section. For most buildings, the fire alarm system should include voice system regardless of applicable Code requirements. This significantly improves maintenance as it allows FM personnel to announce tests. Consult with MSU before beginning design to verify requirements.

Fire alarm control and voice evacuation panels shall be located in communication or electrical rooms. A remote annunciator must be installed at the building entrance where the fire department is expected to enter the building in the event of a fire alarm or fire. Additionally a remote annunciator shall be installed in the fire pump room when a fire pump is installed as part of the fire suppression system. Consult with MSU for exact location of annunciator.

MSU personnel must be able to perform comprehensive tests on the system with minimum disruption to occupants. Fire alarm system control must originate from the control panel and/or programmable field devices. Individual bypass switches located at the main control panel must provide system wide bypass for each type of output to accommodate testing with minimal disruption.

For building renovations, it is not acceptable to provide a new panel that serves a portion of a building unless the new panel is compatible with the existing system and listed to function as a single networked system. When older systems cannot be expanded to serve a renovated space, a new fire alarm panel should be provided for the entire building.

Where existing fire alarm systems are upgraded or replaced, the existing system shall remain in service until the new system is operational and satisfactorily tested by the University. Include procedures for identifying all devices, wires, and connection of old devices to new (as appropriate) and transfer of service between old system and new. If service is anticipated to be out beyond a single workday, an approved fire watch will be necessary. Consult with MSU for specifics regarding fire watch requirements.

System Requirements

Manual fire alarm initiation shall be provided using addressable, double action, manual pull stations at exits and other required locations. Automatic fire alarm initiation shall be provided using addressable and intelligent fire detection devices consisting of smoke and heat detectors, duct-mounted smoke
detectors, and sprinkler flow and tamper switch monitors.

Smoke detectors shall be installed in common areas, corridors, lobbies, libraries, communication rooms, storage rooms, custodial rooms and elevator lobbies. Smoke detectors shall be installed in each elevator lobby to provide selective elevator recall and protection. Heat detectors shall be installed in laboratories, hazardous locations and other normally unoccupied locations (electrical rooms, elevator rooms, mechanical rooms and facilities shops). Heat detectors shall be installed in each elevator equipment room as required by the elevator safety code. Duct-mounted smoke detectors shall be installed in each air-handling unit (AHU) and each make-up air-handling unit (MAHU).

As required by code, alarm notification shall be provided using a voice evacuation system and visual alarm indicators. Notification speakers and visual signal appliances shall be installed in corridors, lobbies, auditoriums, large rooms (exceeding 1000 square feet), restrooms, and other common use areas.

Coordinate auxiliary controls for fans, smoke dampers, fire suppression systems, elevator and door control. Include all necessary components and relays to make an operational system.

Include interface with all necessary fire sprinkler components, water flow devices and valve supervision. Include connection to exterior control valve and exterior bell if provided. Provide fire alarm circuits to elevator controller. Provide four supervised relays in the elevator machine room. Coordinate door hold open requirements with the Architect.

Fire Alarm System Reporting

The University has a Digital Alarm Communication Receiver (DACR) located at the University Police Department capable of supervising fire, security, equipment or other system signals from any campus location. All fire, security, equipment signals shall transmit an alarm signal to this location by means of a digital communicator. Prior to system testing and interconnection, notify MSU FM to program the central receiver and perform a joint acceptance test to ensure proper system operation and reporting. 

Spare Capacity

Design the entire fire alarm system so that the system can be expanded in the future without disruption or replacement of the existing control unit and secondary power supply. Fire alarm control panels shall be provided with 25% spare capacity installed on the following components:

- Audio & visual circuits
- Addressable detection points
- Auxiliary control circuits
• Annunciator control switches and LEDs

Provide 25% spare capacity on all circuits, considering both circuit and panel limitations. This includes device count, circuit length and voltage drop.

**Fire Alarm Control Panel**

The fire alarm system shall utilize a fully addressable, microprocessor based, power limited fire alarm control panel (FACP). The FACP shall be programmed to provide control and monitoring functions as described in this Section. The fire alarm control panel shall support independent addressable circuits, originating from the fire alarm control panel mounted hardware, for each floor and zone. The FACP shall be equipped with a NIC for transmitting signals to MSU PD over the university network.

Each initiating device shall annunciate at the fire alarm control panel as a discrete point on an alphanumeric display. Provide descriptive alphanumeric program labels for each system device with the following format: Device Address, Device Type, Floor, Specific Location (i.e. N1-108, Thermal, First Floor, Mechanical Room 0108).

The FACP shall be provided with control point switches capable of providing the following functions:

- Audio Bypass with LED “on-off” indication
- Visual Bypass with LED “on-off” indication
- Elevator Bypass with LED “on-off” indication
- Door Release Bypass with LED “on-off” indication
- Air System Shutdown Bypass with LED “on-off” indication
- Fire Sprinkler System Water Flow Bypass with LED “on-off” indication

**Digital Alarm Communication Transmitter**

The FACP shall be provided with a digital alarm communication transmitter (DACT) that automatically transmits all fire alarm system alarm, trouble and supervisory signals to the University’s Police Department via two (2) University furnished leased telephone lines. DACT shall be integrated to the FACP or shall be equipped in a separate locking cabinet with battery back-up. A network interface (NIC) shall be provided for transmitting signals over the university network. Reporting format shall be CONTACT ID and shall be compatible with the University’s DACR system.

Wire the communicator to the nearest building telephone closet using a four wire cable (2 pair, 22 gauge) in 3/4” conduit with ten feet (10’) of excess at the closet end, terminated in the communicator, and identified at both ends. The University shall connect to telephone lines.
Voice Evacuation System

Fire alarm audibility and visual notification is required throughout the building with speaker strobe devices positioned in corridors. Typically fire alarm speaker audibility can only be achieved through a single door. Therefore an office inside a suite would require an audible device within the suite to ensure sufficient audibility in the office. Avoid speaker placement in individual offices.

Visual notification must be in compliance with NFPA 72, including minimum candela intensity throughout all public spaces including but not limited to corridors, classrooms, conference rooms, common areas and restrooms. Strobe design must include candela rating on the individual device and a template should be used to ensure sufficient intensity to provide coverage to all required areas. Synchronize visual notification devices when more than two devices are in the line of sight. The preferred method is to synchronize the circuit at the individual floor fire alarm terminal cabinet. All new systems shall be synchronized.

Voice evacuation system shall provide audible alarm notification by voice evacuation and tone signals on loudspeakers. System shall utilize a Digital Voice Module (DWM) and audio amplifiers. The voice evacuation system shall be capable of providing user defined automatic “voice evacuation”, “all-clear”, and “weather alert” messages. The voice evacuation system shall also be capable of public address at the FACP.

The voice alarm system shall be provided with control point switches capable of providing the following functions:

- “Weather Alert” voice message switch with LED “on-off” indication
- “All Clear” voice message switch with LED “on-off” indication
- “All Speaker Talk” voice message switch with LED “on-off” indication

The DVM shall be provided with four (4) prerecorded digitized evacuation and instructional messages, one each for “alarm”, “all clear”, “test” and “weather alert”. All messages shall be professionally recorded and approved by MSU. The DVM shall be configured to automatically output to the desired circuits following a programmed slow whoop alert tone. The DVM memory shall have a minimum 50% spare capacity after those messages identified in this section are recorded. All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

Audio amplifiers shall be sized to provide a minimum of 50% spare capacity when attached to the speakers tapped at the wattage required to meet audio requirements. Voice evacuation panel shall
incorporate a spare automatic backup audio amplifier equal in size to the largest individual amplifier. Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to the backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, appropriate logging of the condition on the system printer, and other actions for trouble conditions as specified.

Remote Annunciator

A remote annunciator shall be installed at the lobby entrance and in the fire pump room. Lobby entrance annunciator location shall be coordinated with the City of Starkville Fire Department and the AHJ. The fire pump room annunciator location shall be coordinated with MSU FM. Remote annunciator panels shall provide textual annunciation and LED status indicators of alarm by function (fire zones, manuals alarms and water flow alarms) and control by function (AHU and MAHU shutdown, elevator recall and door release). Remote annunciator panels will also provide key-switch controlled remote command center functions (LCD display, alarm/trouble/supervisory trouble display, acknowledgement and reset) for maintenance personnel. Annunciator shall be a supervised, LCD display displaying a minimum of 80 characters for alarm annunciation in clear English text.

Power Supplies

The fire alarm system circuit shall be supplied from a dedicated branch circuit from the emergency power system. The dedicated branch circuit shall be arranged and protected with a disconnecting means, red in color, accessible only to authorized personnel, identified “FIRE ALARM CONTROL CIRCUIT”, to prevent inadvertent disconnection.

The FACP and voice evacuation system will also have a secondary power supply consisting of rechargeable storage batteries. Batteries shall be housed in separate cabinets from fire alarm control panels. Each battery cabinet shall be separate locking cabinet listed for that purpose. Cabinet shall match fire alarm control panel in appearance and finish. Primary and secondary power supplies will be monitored by the FACP.

Surge Protection

All equipment connected to alternating current circuits shall be protected from surges. Fuses shall not be used for surge protection. Install UL-listed surge suppression devices on the incoming 120 VAC supply to each fire alarm control panel. Install surge suppression device in separate lockable metal enclosure located adjacent to fire alarm control panel. The enclosure shall match the fire alarm control panel in appearance and style. The surge protector/isolator shall be rated to protect the equipment. All SLC circuits shall have UL-listed surge protection provided at the fire alarm control panel. All
SLC, NAC or control circuit cables/conductors that exit the building shall have surge protection installed at each point where it exits or enters a building. Any communication (telephone) circuit cables/conductors shall have surge protection installed at the fire alarm control panel. The surge protector/isolator shall be rated to protect the equipment. All surge protectors shall be installed in a separate cabinet from the fire alarm cabinet.

**Raceways, Terminal Cabinets & Fire Alarm Wiring**

Fire alarm system wire and cable shall be located in metal conduit or wire mold regardless of Code exceptions. Raceways in finished areas shall be concealed in finished areas. Location and routing shall take advantage of areas easily accessed by University Operations personnel (hallways/corridors) and shall consider future modification and/or extension wherever practical. Raceway layout shall consist of a vertical riser of fire alarm terminal cabinets located on each floor. Larger buildings and buildings with two or more wings may require multiple risers and terminal cabinets per floor. Engineer is encouraged to show at least two lateral branch lines per floor originating from each terminal cabinet. Circuits shall be laid out to serve a specific geographical area (zone) per floor. Good access must be provided for testing and maintenance requirements.

Notification and initiating appliance circuits shall not be loaded greater than 75% of capacity. Style 4 (Class B) supervision of all initiation devices shall be required. Style Y (Class B) supervision of all notification appliances shall be required. All field wiring shall be continuous from fire alarm terminal cabinets to others fire alarm terminal cabinets, field devices and the fire alarm control panel. All field wiring and fire alarm control panel wiring shall terminate in fire alarm control panels, fire alarm terminal cabinets or field devices. “Pig tailing” and/or “Tee tapping” of initiating and notification device circuits is strictly prohibited. All device connections shall be made using device terminals or in terminal blocks in fire alarm terminal cabinets. Splicing or tapping in any other locations is not acceptable.

Do not use a single circuit for multiple floors or zones; however, multiple circuits may be required for a single zone. Visual notification appliances shall not be placed on the same circuit as audible notification appliances. No speaker or strobe circuit shall exceed 10% voltage loss measured at the end-of-line device. All end-of-line devices shall be located in the terminal cabinet or the end of the corridor for the zone served. Install end-of-line device in box with text labeled “End-of-Line” or “E.O.L.”.

All fire alarm wiring shall be manufactured by West Penn, Belden, or as accepted. Use solid color compound or solid color coating on all conductors. Identify with colored tape wire sizes for which colored insulation is not available. Outside jacket of all fire alarm wiring shall be RED. No other wiring (i.e. HVAC control wiring, elevator control wiring, etc.) shall have a RED outside jacket. Wire insulation shall indicate polarity of wire by the color of the conductor insulation (red – positive, black –
negative). Shielded wiring shall be utilized where recommended by the manufacturer and installed in accordance with the manufacturer’s recommendations. Care shall be taken to properly make up, terminate and bond all shielded wire drain wires in accordance with the manufacturer’s recommendations.

Color-coding is required for circuits and shall be maintained throughout the circuit. Color coding follows:

<table>
<thead>
<tr>
<th>Circuit Type</th>
<th>Color Code</th>
<th>Wire Size/Type</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Flow Switch</td>
<td>Purple</td>
<td>#14 AWG THHN</td>
<td>W</td>
</tr>
<tr>
<td>Valve Tamper Switch</td>
<td>Purple</td>
<td>#14 AWG THHN</td>
<td>T</td>
</tr>
<tr>
<td>Addressable Circuit</td>
<td>Red / Black</td>
<td>#18 AWG TP/STP</td>
<td>N</td>
</tr>
<tr>
<td>Suppression Systems</td>
<td>Purple</td>
<td>#14 AWG THHN</td>
<td>S</td>
</tr>
<tr>
<td>Elevator Recall</td>
<td>Pink</td>
<td>#18 AWG THHN</td>
<td>E</td>
</tr>
<tr>
<td>Door Holders</td>
<td>Red / Black</td>
<td>#12 AWG THHN</td>
<td>D</td>
</tr>
<tr>
<td>AHU/VFD Shutdown</td>
<td>Pink</td>
<td>#12 AWG THHN</td>
<td>H</td>
</tr>
<tr>
<td>Audio Alarm (Speakers)</td>
<td>Red / Black</td>
<td>#14 AWG STP</td>
<td>A</td>
</tr>
<tr>
<td>Visual Alarm (Strobes)</td>
<td>Red / Black</td>
<td>#14 AWG TP</td>
<td>V</td>
</tr>
<tr>
<td>Ground/Bond</td>
<td>Green</td>
<td>#14 AWG THHN</td>
<td>--</td>
</tr>
</tbody>
</table>

STP – Shielded, twisted pair cable; TP – Twisted pair cable

Terminal cabinet enclosures shall be NEMA Type 1. Cabinet shall be sized to provide 40% spare capacity. Panels shall be flush mounted. All cabinets shall be hinged door type with latch and lock. Box and front shall be steel, finished to match adjacent surfaces as approved by the Architect. Terminal cabinets shall be Hoffman type ATC, or as accepted. Terminal cabinet shall be labeled with a riveted or screwed laminated plastic nameplate indicating “FIRE ALARM TERMINAL CABINET” in ¼” white letters on a red background. Provide backboard in each terminal cabinet. Backboard shall be constructed of fire retardant treated ¾” exterior grade plywood, painted white. Provide terminal blocks in all terminal cabinets. These blocks shall be sized to accommodate wire from 18 gauge to 10 gauge. Terminal blocks shall be General Electric Type EB-25, or as accepted.
Manual Pull Stations

Manual pull stations shall be installed at each floor’s stairway enclosure exit, all doors opening to the exterior of the building and exits from assembly occupancy areas. Additional manual pull stations shall be located so that the travel distance to any manual pull station from any part of the building does not exceed 200’. Manual pull stations shall be mounted not more than 5’ horizontally from the entrance to each exit. Manual pull stations will be installed 48” above floor level, and shall be readily accessible, unobstructed and visible.

Activation of any manual pull station shall automatically operate an emergency voice communication system and visual alarm indicators, produce an alarm at the fire alarm control panel and remote annunciators and release magnetically held doors. All manual pull station alarm signals shall be automatically transmitted to the University Police Department as a “FIRE” signal.

All manual pull stations shall be addressable, double-action, break-glass type, red in color, non-coded, mounted in a listed manual back box. Manual pull stations shall be hinged and secured with a lockset. The manual pull station shall be able to communicate the pull station status (normal, alarm, trouble) to the FACP.

Smoke Detectors

Addressable, photoelectric type smoke detectors shall be installed in common areas, corridors, lobbies, libraries, communication rooms, storage rooms, custodial rooms, and elevator lobbies (note: open air elevator lobbies shall require a heat detector in place of a smoke detector). A smoke detector shall also be installed above the FACP. Smoke detectors shall be installed a minimum of 4’ from ceiling supply and return air diffusers.

Activation of any smoke detector shall automatically operate an emergency voice communication system and visual alarm indicators, produce an alarm at the fire alarm control panel and remote annunciators, release magnetically held doors and initiate air handler unit shutdown. All smoke detector alarm signals shall be automatically transmitted to the University Police Department as a “FIRE” signal.

Smoke detectors at elevator landings and in elevator machine rooms shall also recall the elevator to the designated floor or to the designated alternate floor as required by the elevator safety code. Smoke detectors shall be photoelectric type. Detectors shall be addressable, plug-in units that mount to a twist lock base. The detector base shall be able to communicate the detector status (normal, alarm, trouble) to the FACP. The detector base shall have base-mounted address dip-switches. Ionization
Detectors shall not be used unless specifically approved by MSU.

Heat Detectors

Heat detectors shall be installed in laboratories, hazardous locations and other normally unoccupied locations that are not suitable for smoke detectors (electrical rooms, elevator rooms, elevator pit, open-air elevator lobbies, mechanical rooms, facilities shops, etc.). Elevator pits require a fixed temperature and a rate-of-rise heat detector. All signals from the heat detectors in the elevator pit shall be automatically transmitted to the University Police Department as a “SUPERVISORY” signal.

Activation of any heat detector shall automatically operate an emergency voice communication system and visual alarm indicators, produce an alarm at the fire alarm control panel and remote annunciators and release magnetically held doors. All heat detector alarm signals shall be automatically transmitted to the University Police Department as a “FIRE” signal.

Heat detectors installed in elevator equipment rooms shall be capable of operating the shunt trip breaker (future) for the elevator main line power in accordance with the elevator safety code.

All heat detectors shall be addressable, plug-in units that mount to a twist lock base. Heat detectors shall be a combination rate-of-rise and fixed temperature (135 or 200 F) type, automatically restorable. The detector base shall be able to communicate the detector status (normal, alarm, trouble) to the FACP. The detector base shall have base mounted address dip-switches.

Duct Smoke Detectors

Environmental fans requiring automatic shutdown (excess of 2000 CFM) shall include duct detectors and a fire alarm system relay within 3’ of the MCC. For campus consistency the preferred method of fan control is from the FACP via relay at the fan’s MCC. This method offers proven reliability, simplicity and is best suited for minimizing maintenance complications with FM personnel. The fire alarm control shall have priority control over fan’s MCC “HOA” position. Consider practicality of installation, Code-required laminar flow and maintenance access. Provide multiple duct detectors if necessary. Duct detectors shall be installed in readily accessible locations in accordance with the manufacturer’s specifications. Each duct detector shall be installed with a remote alarm lamp and keyed test switch located in a visible and accessible location.

Activation of a duct smoke detector shall initiate a supervisory alarm at the fire alarm control panel and remote annunciators. Duct smoke detector activation shall also initiate an air handler unit shutdown as required by NFPA 90A. All duct detector alarms shall be automatically transmitted to the University Police Department as a “SUPERVISORY” signal.
All duct-mounted smoke detectors will be addressable, photoelectric type housed installed in duct detector housings with sampling tubes. Duct-mounted smoke detectors will have photoelectric sensitivity that can be set to the proper obscuration for the site-specific area.

All retractable smoke curtains shall be manufactured and installed in a manner that does not hinder the egress of occupants.

**Speakers & Strobes**

Speakers shall conform to the applicable requirements of UL 1480. Speakers shall be connected into notification appliance circuits. Speakers shall have their sound output level selected or be sound damper attenuated as required to ensure sound level compliance with NFPA 72 *National Fire Alarm Code* and ANSI S3.2 *Method for Measuring the Intelligibility of Speech over Communication Systems* for audible notification appliances. Surface mounted speakers shall be painted white. Recessed speakers shall be installed with grill that is painted white.

Visual notification appliances (strobos) shall conform to the applicable requirements of UL 1971 and shall conform to the Americans with Disabilities Act. Appliances shall operate at 24 volts DC and shall have a selectable intensity of 15, 30, 75 or 110 candela. Visual notification appliances shall have their strobe intensity selected to ensure compliance with NFPA 72 *National Fire Alarm Code* requirements for visual notification appliances. Strobes shall be synchronized on each floor and wing. Appliances shall be semi-flush mounted.

**Water Flow Alarms**

Water flow detectors shall installed at each sprinkler or standpipe riser and at each sprinkler system zone to provide water flow alarms to the FACP upon water flow activation. Activation of a water flow alarm shall automatically operate an emergency voice communication system and visual alarm indicators, produce an alarm at the fire alarm control panel and remote annunciators and release magnetically held doors. All water flow alarm signals shall be automatically transmitted to the University Police Department as a “FIRE” signal. Water flow alarm switches shall be vane type and all water flow alarms shall be electrically supervised. Each water flow alarm shall connect to the fire alarm system using an addressable interface module. Each water flow alarm shall have a unique address point.

**Valve Tamper Switches**

Activation of a valve tamper switch on the fire sprinkler system shall initiate a supervisory alarm at the fire alarm control panel and remote annunciators. All valve tamper switch alarm signals shall be
automatically transmitted to the University Police Department as a “SUPERVISORY” signal. Valve tamper switches shall be electrically supervised. Each tamper switch shall connect to the fire alarm system using an addressable monitor module. Each valve tamper switch shall have a unique address point.

Fire Pump Supervision

Individual supervisory signals shall be provided for the following conditions:

- Fire pump running
- Fire pump loss of power in any phase
- Fire pump phase reversal

Activation of a fire pump supervisory signal shall initiate a supervisory alarm at the fire alarm control panel and remote annunciators. All fire pump supervisory signals shall be transmitted to the University Police Department as a “SUPERVISORY” signal.

Automatic Fire Suppression Systems (Other than Water Flow)

Activation of an automatic fire suppression system shall automatically operate an emergency voice communication system and visual alarm indicators, produce an alarm at the fire alarm control panel and remote annunciators and release magnetically held doors. All automatic fire suppression system alarm signals shall be automatically transmitted to the University Police Department as a “FIRE” signal.

Any off-normal condition of an automatic fire suppression system shall initiate a supervisory alarm at the fire alarm control panel and remote annunciators. All automatic fire suppression system supervisory signals shall be transmitted to the University Police Department as a “SUPERVISORY” signal.

Magnetic Door Holders

Install magnetic door holders at fire rated doors. Coordinate installation with the Architect. Magnetic door holders shall be designed for semi-flush wall mounting. Magnetic door holders shall be designed to operate at 24 VDC. Each magnetic door holder shall be connected to the new fire alarm system using an addressable control module. Each magnetic door holder shall have a unique address point. Ensure smoke detector placement is in accordance with code.

Elevator Recall

Provide elevator recall and elevator shunt tripping in accordance with NFPA 72 National Fire Alarm and Signaling Code.
Electronic Safety and Security

**Code** and ASME A17.1 *Safety Code for Elevators and Escalators*. Provide a minimum of four addressable control modules with 24 volt DC relays (with red LED when in alarm) for elevator primary recall, alternate recall, elevator threatened and elevator shunt trip.

**Labeling**

Label each device with its SLC (IDNET) circuit and device number (i.e. N5-145) with self-adhesive tape. Lettering shall be a minimum of 3/16” height black characters.

- Smoke and Thermal Sensors: Locate device identification on detector base on the side nearest a wall.
- Addressable Modules: Label device with its SLC (IDNET) circuit and device number and function (N1-154, Return Fan RE/1 Shutdown). Locate device identification label on the module body or the cover of the module box in ready view.
- Duct Detectors: Locate device identification on detector base on the duct detector housing in ready view.

All fire alarm pull and junction boxes and associated covers that will be located in concealed spaces shall be painted red prior to their installation. All conduit and raceways that will be located in concealed spaces shall be color coded by a ¾” red tape band at 10’ intervals. Use Scotch Brand #35 tape or as accepted.

All circuits shall be labeled at each end and in fire alarm control panels, terminal cabinets, enclosures, and junction boxes using a typewritten shrink-wrap label to provide a unique and specific designation in the following format:

```
ID - Z - W - F - C
```

- **Circuit (ID)** = per Wire Table (i.e. for V - visual, A - audio, etc.)
- **Zone (Z)** = Software Zone (1, 2, 3, etc.)
- **Wing (W)** = Building Wing (N-North, S-South, etc.)
- **Floor Level (F)** = Floor Level (B, 1, 2, etc.)
- **Circuit No. (C)** = Circuit No. (01, 02, 03, etc.)

**Testing**

Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
Conduct preliminary tests to ensure that devices and circuits are functioning properly. Test the system in accordance with the procedures outlined in NFPA 72. After testing is complete, provide MSU a letter certifying that the installation is complete and fully operable. The letter shall state that the entire fire alarm system, including each initiating and indicating device and other auxiliary devices were tested in accordance with NFPA 72 *National Fire Alarm Code* and functioned properly. The letter shall include the names and titles of the witnesses to the tests.

**Spare Components**

Contractor shall supply spare components to MSU as listed below:

- Ten (10) smoke detectors or 5% of total installation, whichever is greater
- Five (5) heat detectors or 5% of total installation, whichever is greater
- Three (3) relays or 5% of total installation, whichever is greater
- Three of each type of A/V notification device or 5% of total installation, whichever is greater
Div. 32 Exterior Improvements

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and/or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.

Section 32 12 16: Asphalt Paving

Section 32 13 01: Concrete Sidewalks

1. Concrete Sidewalks: Concrete Sidewalks shall have a 28 day compressive strength of 3500 psi. Concrete shall be placed with a maximum slump of 3 inches. Expansion Joints shall be placed not to exceed 40 feet. All sidewalks shall have continuous steel reinforcing #4 or better at 24\" on center each way. Steel rebar shall run continuous thru expansion Joints. See attached photo of sidewalk detailing. All sidewalks that abut a street or other pedestrian walkway shall have handicap curb cuts to allow for handicap access.

Section 32 16 00: Curb and Gutter

1. Concrete curb and Gutters shall have a 28 day compressive strength of 3,500 psi. Concrete shall be placed with a maximum slump of 3 inches. Expansion Joints shall be placed not to exceed 40 feet. All curbs and gutters shall have continuous steel reinforcing #4 or better, 3 linear pieces per cross section of curb. Curb cuts shall be made to allow for Handicap per American Disability Act, at all street and sidewalk connections.

Section 32 17 23: Pavement Marking

1. All pavement markings shall be typical 4 inch wide stripes and shall be equal to Sherwin Williams “Pro-Mar” B29W1 (white) or B29Y2 (yellow). White stripes shall be for parking and Yellow for caution and no parking.
2. All markings on pavement for Handicap parking shall be heat applied rubberize laminate.
3. All required signage shall be installed per the ADA Regulations.

Section 32 35 01: Screening

1. Exterior locations shall be screened by architectural and landscape design considerations. All architectural screening considerations shall be in keeping with the design of the facility and context of the campus. Screening shall meet the following requirements.
   a. Elements such as parking, loading areas, dumpsters, outdoor storage, and electrical boxes shall be obscured by screening and painted.
   b. Specific screening needs shall dictate the required materials and amounts. Evergreen trees provide the greatest year-round screening, materials such as deciduous trees and shrubs, fences, and walls may be used. The materials and colors of fencing and walls shall be compatible with the architecture of the associated building.
   c. Screening areas shall have a minimum width of five (5) feet when vegetative materials are used. There is no minimum width for walls or fencing.
   d. Loading areas shall not front any streets unless screened from the public right of way.
   e. Outdoor storage is prohibited in any front building, and shall not be visible from the public right of way.
   f. Dumpsters, trash refuse, and recyclable containers shall be set on concrete pads and located to the rear of sites. They shall be screened on all four (4) sides by a masonry wall and gate with materials and colors that match the associated building.
   g. Electrical boxes and similar utilities shall be screened with evergreen hedges at least twenty-four inches tall upon installation.
   h. Utility and mechanical equipment on roofs or on site shall be totally screened.
   i. Screened utilities shall still be accessible to the utility personnel for maintenance. Manholes should not be covered up by mulch nor should plants be planted too close to utilities.
Section 32 35 02: Streetscape treatment

1. Streetscape consists of construction and materials adjacent to streets located on the campus of Mississippi State University. The following requirements shall be adhered to.
   a. Sidewalks shall be set back a minimum of six (6) feet behind the street curbs. This area shall be reserved for street trees. Sidewalks shall be a minimum of eight (8) feet wide.
   b. Sidewalks shall be constructed of concrete, brick, textured pavers or a combination of these materials, and shall be raised above the adjacent street level. Pedestrian street crossings at all intersections may be raised above the adjacent street level as a traffic-calming measure.
   c. As with streets, all sidewalks shall connect with adjacent buildings to reinforce pedestrian interconnection. Sidewalks shall connect building entries within and between developments where possible. (See Appendix x).
   d. Street trees shall be planted along both sides of all streets, street trees shall be installed in a planting zone, minimum six (6) feet wide and located between the back of the street curb and the sidewalk described above.
   e. In the paved areas and other similar areas where a generous sidewalk width is required or desired, street trees shall be installed in “plant wells” replete with brick pavers on sand and properly designed drainage and irrigation systems.
   f. Street trees shall be large maturing canopy species, such as oak, maple, elm and poplar. They shall be planted a forty (40) to fifty (50) feet on center and shall be a minimum of two and half (2 1/2”) inches in caliper and twelve (12) feet in height at time of installation.
   g. Under story trees, such as hornbeam, Redbud, crape myrtle, yellowwood, dogwood and Honey locust, planted twenty-five (25) feet on center may be used to meet street tree requirements only where pre-existing overhead utility lines exist and would prevent the installation of canopy species. Small trees may be multi-trunked and shall be a minimum of eight (8) feet in height at installation.
h. Under story trees, such as hornbeam, Redbud, crape myrtle, yellowwood, dogwood and Honey locust, planted twenty-five (25) feet on center may be used to meet street tree requirements only where pre-existing overhead utility lines exist and would prevent the installation of canopy species. Small trees may be multi-trunked and shall be a minimum of eight (8) feet in height at installation.

i. When incorporated into the site, streetscape furnishings such as benches, trash receptacles, light fixtures, bollards, fountains, sculpture, etc. shall create a unifying theme throughout the site. This entails the selection and specification of products based on harmonious design and compatibility with the architecture of the site or area.

Section 32 84 00: Irrigation

1. All areas to be landscaped shall have irrigation installed as part of the project. All irrigation shall meet the following requirements.
   a. Irrigation systems shall be subject to construction and completion inspections as specified by system designer prior to turnover to owner.
   b. Irrigation drawings shall include but not limited to zone size, operating pressure and scheduled flow rates.
   c. A complete scaled as-built drawing of irrigation design shall be provided upon project completion.

Section 32 90 01: Landscaping

1. The landscape of Mississippi State University mirrors the predominant landscape of the surrounding region, with informal groupings of plants amidst green lawns. Landscape design should complement this image. All landscaped areas either new or existing shall meet the following:
   a. All damage of turf and ornamental areas shall be restored to their original state, at the contractor’s expense, following completion of a project.
   b. Wherever possible, healthy existing trees should be retained, as they are an amenity requiring many years to replace. Grading and construction should avoid disturbance of such trees.
c. The preferred street trees are 2 inch - 2 ½ inch caliper oak, planted on average 50 foot on center.
d. To provide a more immediate effect for larger scale structures, the preferred street trees are 3 inch - 3 ½ inch caliper oak, planted no further apart than 50 feet on center.
e. Evergreen species are desirable for screening views, such as views into parking or service areas.
f. As an extension of the surrounding natural landscape, plant species should be native or well adapted to the region.
g. Suggested shade tree species include: Willow Oak, Pin Oak, Nuttall Oak, Bald Cypress, Tulip Poplar, Honey locust, Red Maple, Ginkgo (Male Only), and Green Ash.
h. Suggested shrub species at 18 inches-36 inches height include: Wax Leaf Lugustrum, Dwarf Japanese Holy, Dwarf Chinese Holly, Manhattan Euonymous Abelia, Dwarf Wax Myrtle, Loropetalum, and Florida Jasmine.
i. Suggested screening plants include: Mary Nell Holly, Eleagnus, Easter Red Cedar, Savannah Holly, and Foster Holly.
j. On site areas adjacent to streets, lawn areas must be established or be sodded with Tifway Bermuda grass prior to occupancy of the project.
k. Irrigation systems must be provided to ensure robust planting areas (including within parking islands and medians, if applicable).
l. To prevent accidents, irrigation systems must be installed below ground, with spray heads flush with the ground surface.
m. Where site run-off requires detention/retention areas, the area should be designed as a public amenity and landscaped accordingly.

Section 32 90 02: Plant Establishment Period Maintenance

1. Contractor shall provide care for site elements during plant establishment for a period twelve (12) months from date of substantial completion or acceptance of the work. Site elements include the following:
a. Turf
b. Trees
c. Shrub & Groundcover
d. Grasses and Perennials

e. Edging and Trimming

f. Debris Removal

g. Irrigation System Operation and Maintenance Coordination

Section 32 91 19: Topsoil

1. Use only topsoil meeting specified requirements. Samples of topsoil shall be taken using Unified Soil Classification System designation for each sample tested and complete horticulture suitability analysis including percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and ph value.

Section 32 93 00: Trees Plants and Groundcover

1. All new plant material shall be warranted for the entire plant establishment period, beginning at the time of final acceptance of the complete project. Final acceptance of the landscaping will coincide with that of other components of the project. All plant material shall be alive and in a satisfactory condition and growth for each specified species of plant at the end of the warranty period.

2. If any of the plant material is damaged directly or indirectly as a result of the work prior to final acceptance of the complete project, including work other than landscaping, said material shall be replaced.

Section 32 92 19: Seeding

Section 32 92 23: Sodding

Section 32 94 01: Staking

1. Before the planting trees the Contractor shall contact Campus Landscaping. Depending on the size of the trees to be planted, the Campus Landscape Department shall designate if staking is required. Generally if plant stock is delivered with well-developed root balls, and if properly planted, it will not require staking. Any required staking shall be done at the Contractor’s expense
## DIVISION 33 - UTILITIES

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### APPENDIX A

**APP A** ELECTRICAL INSTALLTION DETAIL DRAWINGS (TYPICAL)
DIVISION 33 UTILITIES

Professionals shall verify that all applicable portions of these standards are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or contractor during the planning, design and construction of the project shall be submitted to the Office of Planning Design and Construction Administration for approval. All requests for variances shall be submitted on the Office of Planning Design and Construction Administration’s standard Request for Variance form.
SECTION 33 70 00 GUIDE FOR ELECTRICAL UTILITY SYSTEMS

General

Use ductbank/manhole systems for all underground primary utility systems. Direct buried cable is not acceptable. Installation of electrical duct in bored hole or in trench may be approved in special circumstances with written permission of FM. All underground duct bank systems shall be marked by installing an electronic conduit marker above duct bank. Cable splices shall be made only when identified as necessary by the Engineer in the construction plans. All splices shall be made in manholes or vaults. All underground cables shall be tagged in all accessible locations such as in manholes, transformers, switches and switchgear. Outdoor, oil-filled, loop-fed, pad-mount transformers are the preferred method for supplying power to new or remodeled buildings. Pad-mount transformers and switchgear units must be accessible by vehicular crane and shall have sufficient working space in accordance with the NESC.

Demolition & Continuity of Electrical Service

In general, remove abandoned equipment, cables, etc. Items which have value for reuse on the University’s electric distribution system, or which have salvage value as scrap material, shall be returned to FM; all other items shall be disposed of by the Contractor in accordance with applicable laws. Contact FM for disposition of salvaged materials.

Existing electrical utility service shall be maintained at all times as required by FM. Contractor shall coordinate any service interruptions required with FM to facilitate the installation, renovation or removal of electric distribution facilities. FM will shift normal open points on loop-fed lines and cables, where feasible, to allow the Contractor to cut, splice, relocate and/or retire cables during regular business hours. The Contractor shall provide FM with adequate notice when the shifting of normal open points is required. The Contractor shall make every effort to keep underground cables and circuits available for service as much as is practicable. The Contractor shall arrange all work with the least possible interruption in electrical service. The Contractor shall not interrupt electrical service at any time without FM’s prior approval. On radial taps and locations where shifting normal open points in not feasible, FM requires that the Contractor schedule service interruptions after normal working hours or on weekends at the convenience of the University. FM also requires the Contractor to staff each service interruption in a manner as to minimize the duration of the service interruption as deemed appropriate by FM.

Connection to Existing Electric Utility Facilities

Contractor shall verify phase connection and rotation when connecting to the University’s electric utility system. Contractor shall use an approved live-line phasing meter. Contractor shall not rely on color markings for assurance of proper phase connection. All phasing and rotation tests shall be witnessed by a FM representative. Contact FM at least 48 hours in advance to arrange FM witnessing.
Electrical Duct

Ducts shall be not installed direct buried in trench or bored hole without the permission of FM. Minimum duct sizes follow:

- Backbone 600-ampere feeder circuits: 2-6” ducts (1-spare)
- Loop feeder circuits: 2-4” ducts (1-spare)
- Radial or lateral taps: 2-4” ducts (1-spare)

Concrete encased ductbanks shall utilize Type EB Schedule 20 PVC conduits with a minimum of 3” of concrete encasement. Utilize interlocking plastic duct spacers that provide 3” of clearance between ducts. Support ducts with duct spacers placed at intervals not exceeding 5’. All PVC duct shall have solvent-weld joints and all joints shall be watertight. Ducts shall be tied down using rebar reinforcement to prevent “floating” of ducts. Concrete shall be minimum 3000 psi and shall be placed with the aid of a mechanical vibrator. The top of concrete encasement shall be a minimum of 42” below finished grade.

Ducts installed using horizontal directional drilling methods shall be HDPE type, SDR-13.5 minimum, installed so that the minimum cover is 60” below finished grade. HDPE duct larger than 4” nominal shall be continuous length type. Fittings for HDPE duct shall be of a type as recommended by the manufacturer of the conduit.

Ducts installed direct buried shall utilize Schedule 40 PVC conduits. Install PVC duct as recommended by the manufacturer using approved couplings, fittings and cement. All PVC duct shall have solvent-weld joints and all joints shall be watertight. Ducts buried in trench shall be installed so that the minimum cover to top of duct is 60” below finished grade.

All underground ducts shall be designed, configured and installed to eliminate standing water. Make changes in direction of duct run using long sweep bends with a minimum radius of 25’. Where ducts turn up into the surface, use long radius (36” minimum), rigid galvanized steel (RGS) or fiberglass reinforced epoxy (FRE) elbows. Two coats of asphaltum or bitumastic paint shall be applied to all underground metallic conduit and ells to provide corrosion protection. Unused spare ducts shall be sealed using rubber duct plugs compressed with galvanized steel plates, Condux or equal.

Ducts installed for future use by the University shall be installed such that ducts are easily located and accessible for future extension. Concrete encasement in future use ductbanks shall be stopped approximately 2’ from the end of the duct. Ducts shall be sealed watertight using end caps solvent cemented to the PVC duct.

All ductbank and direct buried duct runs shall be permanently marked using passive electronic markers placed approximately 6” above the ductbank envelope.

All spare ducts shall have a waterproof locatable pull tape installed in all spare (empty) ducts.

Refer to attached Section 33 71 19 -Electrical Ducts, Manholes & Vaults for specific electrical duct
requirements.

**Manholes**

Manholes shall be used in 200-ampere loop feeder circuits and radial/lateral taps. Switchgear vaults shall be utilized for 600-ampere backbone feeder circuits. Engineer shall verify allowable cable pulling tensions and place manholes accordingly. At a minimum, provide manholes where splices are required, where duct lines change direction and within 50’ of every riser pole. Manhole separation on straight duct runs shall not exceed 500’.

Avoid use of combination power and communication manholes; however, when power and communication duct lines follow the same route, use a common trench and locate power and communication manholes in close proximity to one another. Manholes shall be constructed of reinforced concrete and may be either pre-cast or cast-in-place. Manholes and covers shall be specified for AASHTO H20 highway loading.

Determine the size of manholes by the number of circuits and splicing requirements of the cables within; minimum interior size is 6’ by 8’ with a depth of 6’ for 200-ampere loop feeder circuits and radial or lateral taps. Switchgear vaults shall be utilized for 600-ampere backbone feeder circuits. Manholes shall accommodate racking of splice closure of largest set of primary cables while keeping cable-bending radii greater than 12 times cable diameter. Conduit entry into the manholes shall be located as close to possible to end walls to facilitate cable routing along the walls and optimize interior manhole space.

Refer to attached *Section 33 71 19 -Electrical Ducts, Manholes & Vaults* for specific manhole requirements.

Refer to attached *Section 33 79 19 -Medium Voltage Grounding & Bonding* for specific grounding and bonding requirements.

**Switchgear Vaults**

Switchgear vaults shall be utilized for 600-ampere backbone feeder circuits. Engineer shall verify allowable cable pulling tensions and place vaults accordingly. At a minimum, provide vaults where splices are required, where duct lines change direction and within 50’ of every riser pole. Vault separation on straight runs shall not exceed 500’.

Switchgear vault details are available from FM upon request. Minimum switchgear vault interior dimensions are 9’ by 9’, with a minimum interior depth of 6’. Switchgear vault shall be provided with hinged, spring assisted aluminum double-doors situated to allow operator access to switchgear controls from ground level. Vault doors shall be specified for AASHTO H20 highway loading. Covers shall be pad-lockable and marked “ELECTRIC”. Conduit entry into the vaults shall be located as close to possible to end walls to facilitate cable routing along the walls and optimize interior vault space.

Refer to attached *Section 33 71 19 -Electrical Ducts, Manholes & Vaults* for specific switchgear vault requirements.
Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Medium Voltage Cable

All medium voltage cable shall be rated for use on 15 kV systems and shall have 133% (220-mil) ethylene propylene rubber (EPR) insulation with concentric neutral and polyethylene jacket. Copper tape or shielded power cable is not acceptable. Mississippi State University utilizes three standard size cables: 750-kCMIL aluminum for backbone 600-ampere feeder circuits; #2/0 copper for 200-ampere looped circuits in the interior of campus; and #2 copper for 200-ampere laterals to individual loads.

Underground conductors shall match existing circuits so as to not degrade the load carrying capacity of the existing distribution system. Ensure that new cables and specified splicing methods are compatible with existing cables. Provide the same information (e.g., insulation type, insulation rating, conductor type, and number of conductors) for existing cables as required for new cables. The designer shall confer with FM to verify required circuit capacity, connection and routing.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific requirements for medium voltage cables.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Cable Splices, Terminations & Testing

Cable shall not be spliced without approval from FM. Cables shall be spliced only where necessary and indicated on the construction plans by the Engineer. All splices shall be made in manholes or vaults using straight splices. Other splicing methods are not acceptable.

Cable terminations on 750-kCMIL aluminum backbone feeder circuits shall be made using 600-ampere, 15 kV, deadbreak elbows conforming to IEEE 386. Cable terminations made on #2 and #2/0 copper shall be made using 200-ampere, 15 kV, loadbreak elbows conforming to IEEE 386.

Cable splicing shall only be performed by certified journeyman lineman or cable splicers. Cable splicing qualifications shall be required by the engineer in the contract documents. All cable, terminations and splices shall be acceptance tested as a system. Acceptance testing shall be performed by a third party testing firm in accordance with NETA requirements.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific requirements for medium voltage cables.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Refer to attached Section 33 71 83 -Medium Voltage Testing Requirements for specific testing requirements.
Medium Voltage Switchgear

In the design of extensions to the underground medium voltage electrical distribution system, provisions should be made for sectionalizing the system using pad-mounted or vault-mounted switchgear units. Placement of aboveground switches is limited to locations where aesthetics allow. Confer with FM for approval of pad-mounted switchgear units and verify configurations, styles (vault or pad-mounted) and location. Confirm system characteristics with FM for present and future use.

Where new switchgear is required, provide SF-6 insulated, vacuum-break, single-sided, three-position (close-open-ground) dead-front switchgear. Standard switchgear configuration shall include two 600-ampere loop switches and two 200-ampere tap interrupters. Other switchgear configurations may be accepted depending on the particular requirements of the project and the University’s future-use plans. Confirm system characteristics with FM for present and future use. Tap interrupters shall utilize SF-6 insulated-vacuum re-settable circuit breakers with electronic trip controls. Do not use air-or oil-insulated switchgear or switchgear utilizing fused switches.

Pad-mounted switchgear units shall be placed on polymer concrete box pads sized for the switchgear unit, minimum 36” depth. Box pads shall be placed on well-compacted 12” bed of limestone aggregate. Ensure a minimum of 10’ clear workspace in front of pad-mounted switches for stick work. Switchgear units shall be labeled in accordance with ANSI Z535 and NESC.

Install elbow type arresters on one set of three-phase 200-ampere loadbreak bushings of medium voltage switchgear units (when available). Install insulated caps on all unoccupied (spare) 600-ampere deadbreak and all 200-ampere loadbreak bushings.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific medium voltage cable termination requirements.

Refer to attached Section 33 77 19 -Medium Voltage Switchgear for specific pad-mounted switchgear requirements.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Refer to attached Section 33 77 39 -Medium Voltage Surge Suppression for specific surge protection requirements.

Pad-Mounted Transformers

The use of pad-mounted transformers with secondary currents exceeding 2000 amperes is discouraged due to the size and quantity of secondary conductors; transformers 750 kVA and larger serving 208Y/120 volt loads and transformers 1500 kVA and larger serving 480Y/277 volt loads shall be served using two pad-mounted transformers. Do not size transformer more than 25% larger than the expected diversified load unless approved by FM.
Pad-mount transformer voltage rating shall be 13,200Δ-480Y/277 or 13,200Δ-208Y/120, as specified by the Engineer. Transformers shall utilize deadfront, loop-feed construction using high voltage bushing wells and 200-ampere loadbreak bushing inserts conforming to IEEE 386. Transformers shall be U.L. or F.M. listed and shall utilize less-flammable FR3 fluid. Transformers shall be labeled in accordance with ANSI Z535 and NESC.

Provide two (2) 4” future-use conduits in the high voltage section to a point 5’ out from the transformer pad. Configure secondary conduits and conductors to ensure that oil-drain gate valve is accessible. All primary, secondary, and metering ducts and conduits shall be arranged in a manner to allow the installation of grounding bushings.

Transformer location with respect to buildings shall meet requirements of NESC. Provide cast-in-place transformer foundation minimum 8” thick placed on well-compacted 6” bed of limestone aggregate. Pad shall provide minimum 3” clear space from edge of pad to transformer tank on all sides. Ensure a minimum of 10’ clear workspace in front of pad-mounted transformers for stick work.

Install elbow type arresters on set of three-phase 200-ampere loadbreak bushings when used in a radial configuration.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific medium voltage cable termination requirements.

Refer to attached Section 33 73 00 -Three Phase Pad-Mounted Transformers for specific pad-mounted transformer requirements.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Refer to attached Section 33 77 39 -Medium Voltage Surge Suppression for specific surge protection requirements.

Pad-Mounted Termination Cabinet

When medium voltage cables are required to be accessible or tapped, and switching is not required, pad-mounted termination cabinets may be used when aesthetically acceptable and approved by FM.

Termination cabinets utilize deadfront construction using high voltage bushing wells and 200-ampere loadbreak bushing inserts conforming to IEEE 386. Termination cabinets shall be labeled in accordance with ANSI Z535 and NESC.

Pad-mounted termination cabinets shall be furnished with the manufacturer’s matching ground sleeve sized for the switchgear unit, minimum 18” depth. Ground sleeve shall be placed on well-compacted 6” bed of limestone aggregate. Ensure a minimum of 10’ clear workspace in front of pad-mounted termination cabinet for energized hot-stick work.
Install elbow type surge arresters on set of three-phase 200-ampere load break bushings in accordance. Install insulated caps on all unoccupied (spare) 200-ampere loadbreak bushings.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific cable termination requirements.

Refer to attached Section 33 77 29 -Medium Voltage Termination Cabinets for specific pad-mounted termination cabinet requirements.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Refer to attached Section 33 77 39 -Medium Voltage Surge Suppression for specific surge protection requirements.

Riser Poles

All primary overhead to underground transitions shall be made at locations approved by FM. All primary risers shall be made in galvanized rigid steel (GRS) or fiberglass reinforced epoxy (FRE) conduit. Riser conduits shall be installed to a point within 12” of the University’s neutral conductor. Riser conduits shall attached to the University’s distribution pole using conduit standoff brackets and conduit straps. GRS conduit shall be properly grounded in accordance with NESC. Engineer shall direct Contractor to complete termination and testing of primary cables. FM shall make final connections to the University’s electric distribution system.

Refer to attached Section 33 71 19 -Electrical Ducts, Manholes & Vaults for specific riser conduit requirements.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific cable termination requirements.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Refer to attached Section 33 71 83 -Medium Voltage Testing Requirements for specific testing requirements.

System Grounding

All power distribution shall be grounded in accordance with NESC. All grounding and bonding connections shall be made using thermal weld or compression-type grounding connectors. All connectors shall meet the requirements of UL467 and IEEE 837. Split-bolt or pressure-type mechanical connectors are not acceptable.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.
Surge Protection

Install elbow arresters at the ends of all radials and in normally open locations in loops at pad-mounted
transformers, switchgear units and sectionalizing cabinets. Install elbow type arresters on one set of spare
200-ampere bushings (when available) in each pad and vault-mounted switchgear unit.
Refer to attached Section 33 77 39 -Medium Voltage Surge Suppression for specific surge protection
requirements.

Identification & Labeling

Cables shall be identified at their point of termination in each switchgear unit, termination cabinet and pad-
mounted transformer and entrance and exits of manholes, switch vaults, etc.

Refer to attached Section 33 71 49 -Medium Voltage Cables, Splices & Terminations for specific
requirements for medium voltage cables.

Landscaping

After installation of electrical work and backfilling, all landscaping shall be restored them to at least the
conditions that existed prior to the commencement of work.
SECTION 33 71 19 ELECTRICAL DUCTS, MANHOLES & VAULTS

General

Rigid galvanized steel conduit shall meet the requirements of UL6. Concrete encased and direct buried electrical duct shall meet the requirements of NEMA TC6. Bored HDPE duct shall conform to Underwriters Laboratories standard UL-651A (Rigid PVC Conduit and HDPE Conduit) or UL 651B (Continuous Length HDPE Conduit). Electrical duct fittings shall meet the requirements of NEMA TC9. Precast manholes and vaults shall conform to ASTM C478. Reinforcing bars shall conform to ASTM A615, Grade 60. Concrete shall conform to ACI-318. Manhole frame and cover shall conform to ASTM A48. Manhole and manhole frame and cover shall be suitable for AASHTO H20 wheel loads.

Electrical Duct

Ducts shall be not installed direct buried in trench or bored hole without the permission of FM Department. Minimum duct sizes follow:

- Backbone 600-ampere feeder circuits: 2-6” ducts (1-spare)
- Loop feeder circuits: 2-4” ducts (1-spare)
- Radial or lateral taps: 2-4” ducts (1-spare)

Concrete encased ductbanks shall utilize Type EB Schedule 20 PVC conduits with a minimum of 3” of concrete encasement. Install PVC duct as recommended by the manufacturer using approved couplings, fittings and cement. All PVC duct shall have solvent-weld joints and all joints shall be watertight. Utilize interlocking plastic duct spacers that provide 3” of clearance between ducts. Support ducts with duct spacers placed at intervals not exceeding 5’. Duct spacers shall be staggered by rows and layers to provide a duct line of maximum strength. Anchor duct to bottom of trench using rebar reinforcement at intervals not more than 10’ to prevent “floating” of ducts. Concrete shall be minimum 3000 psi and shall be placed with the aid of a mechanical vibrator. The top of concrete encasement shall be a minimum of 42” below finished grade.

Ducts installed using horizontal directional drilling methods shall be HDPE type, SDR-13.5 minimum, installed so that the minimum cover is 60” below finished grade. HDPE duct larger than 4” nominal shall be continuous length type. Fittings for HDPE duct shall be of a type as recommended by the manufacturer of the duct. Contain excess drilling fluids at entry and exit points until recycled or removed from site. Provide recovery system to remove drilling spoils from access pits.

Ducts installed direct buried in trench shall utilize Schedule 40 PVC conduits. Install PVC duct as recommended by the manufacturer using approved couplings, fittings and cement. All PVC duct shall have solvent-weld joints and all joints shall be watertight. Ducts buried in trench shall be installed so that the minimum cover to top of duct is 60” below finished grade.

All underground ducts shall be designed, configured and installed to eliminate standing water. Make changes in direction of duct run using long sweep bends with a minimum radius of 25’. Where ducts turn up into the
surface, use long radius, rigid galvanized steel (RGS) or fiberglass reinforced epoxy (FRE) elbows. Two coats of asphaltum or bitumastic paint shall be applied to all underground metallic conduit and ells to provide corrosion protection. Unused spare ducts shall be sealed using rubber duct plugs compressed with galvanized steel plates, Condux or equal.

Terminate ducts in manholes and vaults using bell end fittings. For concrete-encased ducts installed in new manholes through a knockout panel, after removing forms from ductbank, rub the exposed concrete surface smooth. Feather the edge of the concrete around each bell and conform to the curvature of the bell end.

Ducts installed for future use by the University shall be installed such that ducts are easily located and accessible for future extension. Concrete encasement in future use ductbanks shall be stopped approximately 2’ from the end of the duct. Ducts shall be sealed watertight using end caps solvent cemented to the PVC duct.

Care shall be taken during installation to ensure no debris enters the duct system. After installation of the duct system is complete, a steel sectional mandrel shall be pulled through the conduit. The mandrel diameter shall be ½” less than the inside diameter of the ducts. Replace any duct section blocked. Mandrel pulls shall be witnessed by a FM representative. Contact FM at least 48 hours in advance to arrange FM witnessing.

**Ductbank Markers**

All ductbanks shall be permanently marked using passive electronic markers placed on top of the ductbank concrete envelope. Markers shall be placed on 100’ intervals along straight duct bank runs, at each point the ductbank changes direction and at transition points between concrete encased and bored ducts runs. Markers shall also be placed within 5’ of all pad-mounted transformers, pad-mounted switch cabinets, manholes and switchgear vaults and at the terminus of future use ducts. Markers shall be installed approximately 6” above the top of the duct concrete encasement in select backfill.

Acceptable manufacturer: 3M “Type 1422-XR/ID”.

**Spare Ducts**

Install waterproof locatable pull tape in all spare (empty) ducts after thoroughly rodding, clearing and swabbing all lines free of any obstructions. Do not splice, tie or otherwise join shorter lengths together. Only a whole, unbroken length of tape is to be installed in each duct. Locatable pull tape shall be aramid fiber with minimum tensile strength rating of 1,250 pounds and shall have sequential foot markings printed on tape.

Acceptable manufacturer: Arnco “Tone Tape”; NEPTCO Inc. MuleTape; or equal.

**Primary Risers**

All primary overhead to underground transitions shall be made at locations approved by FM. All primary risers shall be made in galvanized rigid steel (GRS) or fiberglass reinforced epoxy (FRE) conduit. Riser
conduits shall be installed to a point within 12” of the University’s neutral conductor. Riser conduits shall attached to the University’s distribution pole using conduit standoff brackets and conduit straps. GRS conduit shall be properly grounded in accordance with NESC. Engineer shall direct Contractor to complete termination and testing of primary cables. FM shall make final connections to the University’s electric distribution system.

Acceptable Manufacturers (RGS Conduit): Wheatland; Allied Tube; Republic Conduit; or equal.
Acceptable Manufacturers (FRE Conduit): Champion; United Fiberglass; or equal.
Acceptable manufacturers (Brackets): Alumaform Catalog # 6-CSO-24 (Standoff) & STK-* (Strap); Hubbell Catalog No. C6CSO24 (Standoff) & CSTK*(Strap); or equal.

Manholes
Determine the size of power manholes by the number of circuits and splicing requirements of the cables within; minimum interior size is 6’ by 8’ with a depth of 6’ for 200-ampere loop feeder circuits and radial or lateral taps. Switchgear vaults shall be utilized for 600-ampere trunk or backbone feeder circuits.

Manholes shall be constructed of reinforced concrete and may be either pre-cast or cast-in-place. Manholes and covers shall be specified for AASHTO H20 highway loading. Minimum thickness of manhole and vault floor, walls and cover shall be 6”. Manholes shall accommodate racking of splice closure of largest set of primary cables while keeping cable-bending radii greater than 12 times cable diameter. Provide duct terminations, size and quantity as required, with a minimum of two 6” spare duct terminations in each wall of the manhole. Conduit entry into the manholes shall be located as close to possible to end walls to facilitate cable routing along the walls and optimize interior vault space.

Manholes shall be equipped with cast-in-provisions for:
- Cable supports
- Ground rod sleeves
- 12” diameter sump
- Pulling eyes on all walls
- Lifting inserts in each manhole section for unloading and positioning

Manholes shall be fitted with non-locking frame and cover fabricated of heavy-duty cast iron. Provide manhole covers with MSU standard cover (37-1/4” diameter), marked “ELECTRIC” in 3” high letters. Manhole cover shall be equipped with two recessed lifting handles.

Manholes shall be placed on well-compacted 6” bed of limestone aggregate. Manhole shall be set at depth to provide one 12” manhole riser section. Utilize pre-cast concrete grade rings as required to place top of manhole rings and covers flush with paving or sidewalks and approximately 2” above finished grade in landscaped areas. For manholes in landscaped areas, provide a 6’ by 6’ concrete apron around manhole and frame. Concrete apron shall have 1” chamfer all sides.
All holes in structures for entering pipes or ducts shall be thoroughly plugged with concrete from electrical ductbank or non-shrinking mortar, applied so there will be zero leakage around pipes and ducts. Concrete or mortar will be finished smooth and flush with the ducts, pipes, etc. and the adjoining interior walls. Plastic bell-ends will be installed on each duct flush with inside walls. Unused spare ducts shall be sealed using rubber duct plugs compressed with galvanized steel plates, Condux or equal.

Ground/bond manhole and manhole appurtenances as required by NESC. Refer to attached Section 33 79 19 -Grounding & Bonding for specific manhole grounding requirements.

Provide cable racks in all new manholes. When reworking cables in existing manholes, provide racks for new cables. Cable racks shall be either 14” long arms or 3” saddle arms, Underground Devices CR36 or RA14, or equal. All cables shall be properly supported and secured to cable racks using tie wraps. The length of any cable in manhole shall be not less than half the circumference of the manhole.

Acceptable manufacturers: Lee’s Precast; Oldcastle Precast; Concast; or equal.

Switchgear Vaults

Switchgear vaults shall be utilized for 600-ampere trunk or backbone feeder circuits. Switchgear vault details are available from FM upon request. Minimum switchgear vault interior dimensions are 9’ by 9’, with a minimum interior depth of 6’.

Vaults shall be constructed of reinforced concrete and may be either pre-cast or cast-in-place. Vaults and vault access doors shall be specified for AASHTO H20 highway loading. Minimum thickness of manhole and vault floor, walls and cover shall be 6”. Vaults shall accommodate racking of splice closure of largest set of primary cables while keeping cable-bending radii greater than 12 times cable diameter. Provide duct terminations, size and quantity as required, with a minimum of two 6” spare duct terminations in each wall of the vault. Conduit entry into the vaults shall be located as close to possible to end walls to facilitate cable routing along the walls and optimize interior vault space. Vaults shall be equipped with cast-in-provisions for:

- Cable supports
- Ground rod sleeves
- 12” diameter sump
- Pulling eyes on all walls
- Lifting inserts in each manhole section for unloading and positioning

Switchgear vault shall be provided with hinged, spring assisted aluminum double-doors situated to allow operator access to switchgear controls from ground level. Vault-door riser section shall have 1” chamfer all sides. Vault doors shall be specified for AASHTO H20 highway loading. Covers shall be pad-lockable and marked “ELECTRIC”.

Vaults shall be placed on well-compacted 6” bed of limestone aggregate. Vault shall be set at depth as
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required to place top of vault access doors flush with paving or sidewalks and approximately 2” above finished grade in landscaped areas.

All holes in structures for entering pipes or ducts shall be thoroughly plugged with concrete from electrical ductbank or non-shrinking mortar, applied so there will be zero leakage around pipes and ducts. Concrete or mortar will be finished smooth and flush with the ducts, pipes, etc. and the adjoining interior walls. Plastic bell-ends will be installed on each duct flush with inside walls. Unused spare ducts shall be sealed using rubber duct plugs compressed with galvanized steel plates, Condux or equal.

Provide cable racks in all new future-use vaults. Cable racks shall be either 14” long arms or 3” saddle arms, Underground Devices CR36 or RA14, or equal. All cables shall be properly supported and secured to cable racks using tie wraps. The length of any cable in future-use vault shall be not less than half the circumference of the future-use vault. Ground/bond vault and vault appurtenances as required by NESC.

Refer to attached Section 33 77 19 -Medium Voltage Switchgear and Section 33 79 19 Grounding & Bonding for specific requirements.

Acceptable manufacturers: Lee’s Precast; Oldcastle Precast; Concast; or equal.
SECTION 33 71 49 MEDIUM VOLTAGE CABLE, SPLICES & TERMINATIONS

General

All medium voltage cable shall be rated for use on 15 kV systems and shall have 133% (220-mil) ethylene propylene rubber (EPR) insulation with concentric neutral and polyethylene jacket. Copper tape shielded power cable is not acceptable. Mississippi State University utilizes three standard size cables: 750-kCMIL aluminum for backbone 600-ampere feeder circuits; #2/0 copper for 200-ampere looped circuits in the interior of campus; and #2 copper for 200-ampere laterals to individual loads. Cable terminations on 750kCMIL aluminum backbone feeder circuits shall be made using 600 ampere, 15 kV, deadbreak elbows conforming to IEEE 386. Cable terminations made on #2 and #2/0 copper shall be made using 200-ampere, 15 kV, loadbreak elbows conforming to IEEE 386.

Special Requirements

Cable installation, termination, splicing, grounding and marking shall only be performed by certified journeyman lineman or cable splicers with a minimum of five years’ experience splicing and terminating medium voltage cables. Qualifications shall be required in the contract documents to be submitted for approval by the Engineer. A copy of approved qualifications shall be submitted to FM prior to initiation work under this section.

Cable installation, elbow terminations and cable splices shall be installed in strict accordance with the manufacturer’s installation instructions. All cables, splices and terminations shall be acceptance tested as a system. Acceptance testing shall be performed by a third party testing firm in accordance with NETA requirements. A copy of test results shall be provided to FM prior to these systems being connected to the University’s 13.2 kV electric distribution system.

Refer to Section 33 71 83 -Medium Voltage Electrical Testing Requirements for specific testing requirements for medium voltage electrical systems.

750-kCMIL Aluminum 15 KV Cable

Cable shall be 750-kCMIL aluminum 15 kV underground jacketed concentric neutral primary cable. Cable shall consist of a central strand filled 750-kCMIL aluminum conductor surrounded by an extruded semi-conducting ethylene-propylene rubber (EPR) strand screen, surrounded by 220-mil EPR insulation. An extruded semi-conducting EPR insulation screen shall be applied over the insulation. A 1/3 concentric copper neutral shall be wound on top of the insulation screen. The central 750-kCMIL aluminum conductor shall have a semi-conducting filler material designed to prevent water travel through the strands. The entire cable assembly shall be protected by an encapsulating polyethylene jacket. Cable shall be new and shall be manufactured in the United States of America.

Acceptable Manufacturers: Okonite Catalog No. 162-23-3096; Kerite Catalog No. 175A1533200; Prysmian Catalog No. QNX000A; or equal by Southwire.
#2/0 Copper 15 KV Cable

Cable shall be #2/0 copper 15 kV underground jacketed concentric neutral primary cable. Cable shall consist of a central strand filled #2/0 copper conductor surrounded by an extruded semi-conducting ethylene-propylene rubber (EPR) strand screen, surrounded by 220-mil EPR insulation. An extruded semi-conducting EPR insulation screen shall be applied over the insulation. A 1/3 concentric copper neutral shall be wound on top of the insulation screen. The entire cable assembly shall be protected by an encapsulating polyethylene jacket. Cable shall be new and shall be manufactured in the United States of America.

Acceptable Manufacturers: Okonite Catalog No. 140-23-9025 or 140-23-3075; Kerite Catalog No. 121C15-33200; Prysmian Catalog No. QN9000A; or equal by Southwire.

#2 Copper 15 KV Cable

Cable shall be #2 copper 15 kV underground jacketed concentric neutral primary cable. Cable shall consist of a central strand filled #2 copper conductor surrounded by an extruded semi-conducting ethylene-propylene rubber (EPR) strand screen, surrounded by 220-mil EPR insulation. An extruded semi-conducting EPR insulation screen shall be applied over the insulation. A full concentric copper neutral shall be wound on top of the insulation screen. The entire cable assembly shall be protected by an encapsulating polyethylene jacket. Cable shall be new and shall be manufactured in the United States of America.

Acceptable Manufacturers: Okonite Catalog No. 141-23-9460; Kerite Catalog No. 102C1531200 Prysmian Catalog No. QN4010A; or equal by Southwire.

Cable Installation

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables shall be installed in strict accordance with the manufacturer’s installation instructions. Pulling tension, sidewall pressure and minimum bending radius limitations as given by the cable manufacturer shall be observed. Pull cables in conduit run utilizing swivel pulling eyes attached directly to the conductor. Basket type grips shall not be used for cable pulling. In no case shall strands be removed to attach pulling eye. Utilize water based pulling lubricants to reduce friction in conduit. Cable shall be routed to pad and vault-mounted switchgear, pad-mounted termination cabinets, and pad-mounted transformers in such a manner as to minimize forces on the bushings from cable expansion or movement.

Cable Splices

Cable shall not be spliced without approval from FM. Cables shall be spliced only where necessary and indicated on the construction plans by the Engineer. All splices shall be made in manholes or vaults using straight splices. Other splicing methods are not acceptable. Cable splices shall be properly supported using cable racks in manholes and vaults. Cables shall be spliced in accordance with cable manufacturer’s recommendations. Cables splices and terminations shall be properly sealed using cold shrink jackets. Cable neutrals and splice bodies shall be properly grounded and bonded to the manhole or vault ground ring.
Backbone 600-ampere cables joined in manholes or vaults shall be spliced using pre-molded, 600-ampere, 15 kV, straight splices. Splices shall be supplied with connectors for University’s standard 750-kCMIL aluminum 15 kV concentric neutral cable, as specified in this section.

“Loop” 200-ampere cables joined in manholes or vaults shall be spliced using pre-molded, 200-ampere, 15 kV, straight splices. Splices shall be supplied with connectors for University’s standard #2/0 copper 15 kV concentric neutral cable, as specified in this section.

Acceptable Manufacturers: Elastimold “PCJ”; 3M “5400 Series”; Prysmian “Elaspeed”; or equal.

600-Ampere Cable Terminations

Install a 15 KV 600-ampere elbow termination on each incoming and outgoing 750-kCMIL 15 KV cable in vault and pad-mounted switchgear units. Elbow terminations shall be installed in strict accordance with elbow manufacturer's installation instructions. Connect elbow terminators to 600-ampere bushings in pad-mounted switchgear. The concentric neutral connections to the ground bus shall be long enough so that the elbows can be freely moved to and from the accessories bracket position.

Elbow connectors shall be pre-molded, 600-ampere, 15 kV, deadbreak type for terminating high voltage underground cable. Connectors shall be fully shielded for dead front operation and shall mate with a standard ANSI 386 interface. Elbow connectors shall be supplied with connectors for University’s standard 750-kCMIL aluminum 15 kV concentric neutral cable, as specified in this section.


200-Ampere Cable Terminations

Install a 15 KV 200-ampere elbow termination on each #2 and #2/0 copper 15 KV cable in vault and pad-mounted switchgear, termination cabinets, and pad-mounted transformers. Connect elbow terminators to 200-ampere bushings in vault and pad-mounted switchgear, termination cabinets and pad-mounted transformers. Elbow terminations shall be installed in strict accordance with elbow manufacturer’s installation instructions. The concentric neutral connections to the ground bus shall be long enough so that the elbows can be freely moved to and from the accessories bracket position.

Elbow connectors shall be pre-molded, 200-ampere, 15 kV, loadbreak type for terminating high voltage underground cable. Connectors shall be fully shielded for dead front operation and shall mate with a standard ANSI 386 interface. Elbow connectors shall be supplied with connectors for University’s standard #2 and #2/0 copper 15 KV concentric neutral cable, as specified in this section.

Cable Accessories

Install elbow arresters at the ends of all radials and in normally open locations in loops at pad-mounted transformers and switchgear units. Install elbow type arresters on one set of spare 200-ampere bushings (when available) in pad and vault mounted switchgear units. Install insulating receptacle on all other unoccupied 200-ampere loadbreak bushings of vault and pad-mounted switchgear units, pad-mounted termination cabinets and pad-mounted transformers. Connect the ground lead of the insulated cap to the ground loop using the proper compression connectors.


Faulted Circuit Indicators

Install faulted circuit indicators on each outgoing (e.g. load side) 15 kV cable exiting pad mounted switchgear units, cable junction enclosures and pad mounted transformer. Faulted circuit indicators shall be installed on 15 kV cables per faulted circuit indicator manufacturer’s written instructions. Install remote LED indicator lights for each faulted circuit indicator through switchgear cabinet so that LED indicators are readily visible.

Faulted circuit indicator shall be load-tracking, time/manual reset, four-hour reset time, with remote LED indication. Faulted circuit indicator shall be designed for elbow or cable mounting.

Manufacturers: Power Delivery Products Catalog No. 29-6215-000-Automatic-4 Hour, LPC225, or equal.

Overhead (Riser) 600-Ampere Terminations

Install a 15 KV-600 ampere overhead terminator on each 750-kCMIL aluminum 15 KV cable on riser poles. Overhead terminations shall be installed in strict accordance with manufacturer’s installation instructions. The concentric neutral connections shall be bonded directly to the system neutral using compression type connectors. Terminators shall be mounted on three-phase fiberglass equipment mounting bracket, 48” minimum width.

Overhead terminators shall be porcelain, outdoor type for terminating 750-kCMIL aluminum 15 kV jacketed concentric neutral cable with 220-mil insulation. Connectors shall meet the requirements of IEEE 404. Outdoor terminators shall be supplied mounting casting with grounding assembly and flat bus tinned NEMA two-hole terminal pad sized for the 15 KV cable installed.


Acceptable Manufacturer (Equipment Mounting Bracket): Maclean Power Systems Catalog # G3MA014824DD1; or equal.
Overhead (Riser) 200-Ampere Terminations

Install a 15 KV-200 ampere overhead terminator on each #2 and #2/0 copper 15 KV cable on riser poles. Overhead terminations shall be installed in strict accordance with manufacturer’s installation instructions. The concentric neutral connections shall be bonded directly to the system neutral using compression type connectors. Terminators shall be mounted on three-phase fiberglass equipment mounting bracket, 48” minimum width.

Overhead terminators shall be pre-molded, silicon rubber, outdoor type for terminating #2 or #2/0 copper 15 kV jacketed concentric neutral cable with 220-mil insulation. Connectors shall meet the requirements of IEEE 404. Outdoor terminators shall be supplied with cable support brackets and stem type connectors for the 15 KV cable installed.

Acceptable Manufacturer: 3M Catalog “QT-III Series”; Elastimold “Ranger 2 Series”; Raychem “PICT Series”; or equal.

Identification & Labeling

Cable markers shall be installed on primary cables in each vault or pad-mounted switchgear, pad-mounted termination cabinet, and pad-mounted transformer. Minimum tag size is 1” x 2” with ¾” letters, yellow on black, identifying destination and phase (i.e. “TO SWITCH 634”, ØA). Tags shall be non-metallic, heat stabilized, attached to cables using nylon cable ties made for this purpose.

Acceptable Manufacturers: Tech Products “Everlast”, or equal.

Cable and Cable Termination Grounding

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements for medium voltage cable and cable accessories.

Surge Arresters

Refer to attached Section 33 77 39 -Medium Voltage Surge Suppression for specific grounding and bonding requirements for medium voltage cable and cable accessories.

Testing Requirements

Refer to attached Section 33 71 83 -Medium Voltage Testing Requirements for specific testing requirements for medium voltage cable and cable accessories.
SECTION 33 71 83 MEDIUM VOLTAGE TESTING REQUIREMENTS

General

All cables, splices and terminations shall be acceptance tested as a system. Acceptance testing shall be performed by a third party testing firm in accordance with latest NETA ATS requirements. A copy of test results shall be provided to FM prior to these systems being energized from the University’s 13.2 kV electric distribution system.

Should any cable fail due to weakness of conductor insulation or to defects or injuries incidental to the installation or because of improper installation of cable, cable splices, terminations, or other connections, the Contractor shall make necessary repairs of replace cable and retest.
SECTION 33 73 00 THREE PHASE PAD-MOUNTED TRANSFORMERS

General
Pad-mount transformers shall be in accordance with NEMA Publication No. TR 1 and ANSI Standards C57.12.00, C57.12.26, C57.12.28 and C57.12.34. Transformers shall be new.

Acceptable manufacturers: ABB; Cooper Power Systems; Howard Industries; Ermco.

Approval Listing:
Pad-mount transformers shall be FM Global Listed or U.L. Listed.

Ratings
Transformer supplied and installed on this project shall have the following ratings:

• Three phase
• Loop feed construction
• 150, 300, 500, 750, 1000 or 1500 kVA, as specified
• 95 kV BIL primary/30 kV BIL secondary
• 13,200 volts primary
• 208Y/120 or 480Y/277 volt secondary, as specified

All ratings specified shall be for continuous duty operation at rated kVA without exceeding either a 65°C average temperature rise or an 80°C hot spot temperature rise. Transformers shall be self-cooled by natural convection. Ratings specified are for continuous duty without the use of cooling fans. Fan cooled units are not acceptable.

Transformer Efficiencies & Losses
Transformers must comply with the latest DOE Energy Conservation Standards and Test Procedures, with the allowed tolerances as defined in the DOE Test Procedures.

Pressure Relief
All transformers shall be designed such that all excessive pressure build-ups are released without damage to the tank in accordance with ANSI C57.12.25. All transformers shall be equipped with a pressure relief device.

Transformer Core & Windings
The transformer coil construction shall be either triplex or five-legged construction. Transformer core and coil assemblies shall be rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment. Cores shall be gain-oriented, non-aging, silicon steel. Coils shall be continuous
windings without splices except for taps. Coil loss and core loss shall be optimum for efficient operation. Primary, secondary and tap connections shall be brazed type. Coil windings shall have end fillers or tie downs. Nominal impedance shall be in accordance with ANSI C57.12.00.

**Insulating Liquid**

Furnish with new less-flammable transformer liquids conforming to NFPA 70 and F.M. requirements for less-flammable liquids having a fire point not less than 300° C. The fluid shall be a biodegradable electrical insulating and cooling liquid classified by UL and approved by FM as "less flammable" fluids. The transformer nameplate shall indicate that the PCB content of said transformer is less than 1 part per million or at time of manufacture gas chromatograph analysis certified non-detectable PCB. The nameplate shall show the gallons of oil.

**Transformer Taps**

Transformers shall have two, 2-1/2 percent full capacity taps above, and two 2-1/2 percent full capacity taps below normal rated primary voltage. Taps shall be suitable for de-energized operation only. The tap changer switch shall be externally operable.

**High Voltage Bushings**

Transformers shall be equipped with high voltage bushing wells and corresponding load break inserts for dead front operation. The bushing wells shall be externally clamped, 15 kV, 200-ampere, separable, rated for primary switching per IEEE 386. The load break bushing inserts shall be Cooper Power Systems “LBI 215” or Elastimold Catalog “1601A4”. Inserts shall be shipped with physically wired down and secured dust caps.

**Secondary Bushings**

Transformers shall be equipped with fully insulated, epoxy low voltage bushings. Units 500 kVA and smaller shall have six-hole spade type terminals. Units 750 kVA and larger shall have ten-hole spade type terminals. Number and arrangement of low voltage bushings shall be in accordance with ANSI C57.12.26. Spade pads shall be furnished with additional support, as designed by the manufacturer. The supports shall be attached to the pads at the farthest point from the tank wall and attached in a manner so as to not interfere with any of the pad’s holes.

**Fusing**

Transformer shall be furnished with Cooper Power Systems Bay-O-Net fuse holders, dual sensing load break externally removable fuses, and internally mounted partial range current limiting fuses, type ELSP. The partial range current limiting fuses shall be placed in series with the Bay-O-Net fuse holder and be mounted internally under oil. Oil drip shields shall be provided with the Bay-O-Net fuse holder and shall be designed
to catch and hold oil. Bayonet and current limiting fuse sizing shall be in accordance with Cooper Power Systems recommendations for the transformer furnished.

**Transformer Tank**
Transformer tanks shall be constructed in accordance with IEEE C57.12.26. The maximum dimensions of three phase pad-mounted transformers shall be as shown below. These dimensions do not include cooling fins.

<table>
<thead>
<tr>
<th>Power Range</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 to 500 kVA</td>
<td>66” maximum</td>
<td>72” maximum</td>
<td>72” maximum</td>
</tr>
<tr>
<td>750 to 1500 kVA</td>
<td>73” maximum</td>
<td>90” maximum</td>
<td>90” maximum</td>
</tr>
</tbody>
</table>

The minimum depth of the apparatus compartment shall be 24”. Cooling fins shall not exceed further than 12” beyond the dimensions shown above.

**Oil Drain Valve**
Transformer shall come equipped with an oil drain valve installed at the bottom edge in the transformer secondary compartment, ¾” minimum diameter, gate or ball activated.

**Grounding Lugs**
Transformers shall be furnished with provisions for one ground pad installed in the transformer low-voltage compartment and one ground pad installed in the transformer high-voltage compartment. Ground pads shall be NEMA two-hole type.

**Compartmental Locking** All hinged or removable cabinet access lids or doors shall have a three-point latch and shall be provided with a 9/16” stainless steel or silicon bronze penta-head captive bolt locking device and provisions for padlocking. The penta-head bolt shall be coordinated so that it must be engaged before a padlock can be inserted into or removed from the hasp. All transformers shall meet the requirements from tamper resistance of NEMA TR-1.

**Labeling**
A danger label, complying with ANSI Z535, shall be located on the inside of the transformer and readily visible whenever the first equipment door is opened.
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Accessories
In addition to standard accessories, each transformer 1500 kVA or larger shall be equipped with oil level gauge, dial thermometer with maximum top oil temperature indicator and magnetic reset and tank pressure vacuum gauge.

Noise
Transformer sound levels shall not exceed the values specified in the latest revision of NEMA Publication TR-1.

Paint Finish
The transformer shall have a corrosion resistant finish that meets or exceeds paint requirements of ANSI C57.12.28. The outside shall be properly prepared, primed and painted with a highly weather resistant paint. All transformers to have the manufacturer’s premium paint system. Color of pad mounted transformer shall be Carboline F235 Dark Bronze, Valspar KMB0082 Dark Bronze or as accepted.

Installation
Transformer location with respect to buildings shall meet requirements of NESC. Ensure a minimum of 10’ clear workspace in front of pad-mounted transformers for stick work. Install pad-mounted transformer in accordance with manufacturers’ installation instructions.

Install pad-mounted transformer on cast-in-place transformer foundation minimum 8” thick placed on well-compacted 6” bed of limestone aggregate. Pre-cast or cast-in-place box pads are not acceptable. Pad shall provide minimum 3” clear space from edge of pad to transformer tank on all sides. Use ASTM A615 Grade 60 reinforcing steel bars and concrete with a minimum 3000-psi strength. Provide not less than 3” of concrete cover over reinforcing steel. Chamfer top edges and corners of pad foundation.

Terminate medium-voltage ducts in the primary compartment area of the transformer pad. Provide two (2) 4” future-use conduits in the primary compartment to a point at least 5’ out from the transformer pad. Terminate low-voltage conduits in the secondary compartment of the transformer. Configure secondary conduits and conductors to ensure that oil-drain gate valve is accessible. Terminate each primary conduit and secondary with a bell end fitting set 2” above the top of the concrete pad. All primary and secondary ducts and conduits shall be arranged in a manner to allow the installation of grounding bushings.

Refer to attached Section 33 71 19 -Electrical Ducts, Manholes & Vaults for specific duct requirements.

Connect all medium voltage primary cables. Refer to Section 33 71 49 -Medium Voltage Cable, Splices & Terminations for specific requirements.

Install driven ground rods in primary and secondary compartments of transformer. Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.
SECTION 33 77 19 MEDIUM VOLTAGE SWITCHGEAR

General

Medium voltage switchgear shall be in accordance with NEMA Publication No. 37.72 and ANSI Standard C57.12.28. All switchgear shall be new. In general, switchgear units shall consist of two (2) three-phase load-interrupter switches for switching two (2) 600-ampere main feeders and two (2) three phase fault interrupters for switching and protection of two (2) 200-ampere three phase taps. The two 600-ampere switches and the two 200-ampere fault interrupters shall be connected to a common 600-ampere bus when all switches/interrupters are closed. All switch and fault interrupter bushing terminals shall be arranged for single-sided front access. Other switchgear configurations (e.g. more or less switches and/or fault interrupters) may be accepted depending on the particular requirements of the project and the University’s future-use plans. Confirm system characteristics with FM for present and future use.

All components of vault-mounted switchgear units shall be elbow connected as specified herein and shall be enclosed in a submersible, SF6 insulated, welded stainless steel tank that is completely protected from the environment. All components of pad-mounted switchgear units shall be elbow connected as specified herein and shall be enclosed in an SF6 insulated, welded stainless steel tank and pad-mounted enclosure that is completely protected from the environment.


Ratings

Switchgear supplied and installed on this project shall have the following ratings:

- Voltage rating shall be 15.5 KV.
- Unit shall be rated for alternating current at a frequency of 60 Hertz.
- Switchgear shall have a BIL rating of 95 KV.
- The load interrupter switches shall have a continuous and loadbreak current rating of 600-amperes.
- Load interrupter switches shall have a one-second current rating of 12,500 amperes symmetrical.
- Fault interrupter switches on three-phase taps shall have a continuous current rating of 200-amperes.
- Fault interrupter switches shall have a one-second current rating of 12,500 amperes symmetrical.

Load Interrupter Switches

Load interrupter switches shall be three-position (closed-open-ground) type. The load interrupter switches shall provide three-pole live switching of 600-ampere three phase circuits. Load interrupter switches shall provide a visible gap when open. Operating shafts shall be pad lockable in any position. The operating shaft shall be capable of being locked to prevent operation to the ground position.
The load interrupter switches shall be furnished with a manual handle to charge the switch operating mechanism or to actuate the operating mechanism. Operating mechanism shall be capable of providing quick-make, quick break operation in either switching direction. The operating mechanism shall be designed to prevent inadvertent operation from the closed position directly to the ground position and vice versa.

Load interrupter switch terminals shall be equipped with three single pole 600-ampere bushings designed to ANSI/IEEE 386 Standards to accept all standard 600-ampere insulated deadbreak elbows.

For vault-mounted switchgear units, provide switch operating handles for operating the load and switch interrupter switches from a position outside of the vault and above the switchgear unit.

Fault Interrupters

Fault interrupters shall be three-position (closed-open-ground) type. Three-phase resettable fault interrupters shall be provided in the switchgear for live switching of tap circuits and for fault interruption of tap circuits. Fault interrupters shall be vacuum or arc spinning contact type. The fault interrupters shall be operated by a spring operating mechanism that is recharged with a manually operated handle. The operating mechanism shall operate independently of the speed of the manual handle. Trip indicators shall be provided on the fault interrupters that indicate the contact position is open. This indicator shall be fully visible through viewing windows in the switchgear tank. Fault interrupters shall provide three-pole fault interruption and three-pole load switching.

Fault interrupter switch terminals shall be equipped with three single-pole 200-ampere universal bushing wells and inserts designed to meet ANSI/IEEE 386 Standards.

For vault-mounted switchgear units, provide switch-operating handles for operating each of the fault interrupters from a position outside of the vault and above the switchgear tank. For pad-mounted switchgear units, provide parking stands for each of the outgoing 200-ampere elbow connectors on the front of the switchgear tank.

Controls:

Provide standard microprocessor-based overcurrent control for switchgear unit. Control shall incorporate ANSI C37.112 relay curves. Switchgear shall be capable of being programmed using a laptop computer. The control shall at a minimum feature the following time-current characteristic (TCC) curves:

- Standard “E” speed curves
- Standard “K” speed curves
- IEEE C37.112-1996 “U” relay curves
- IEEE C37.112-1996 “C” relay curves

Controls provided shall be manufacturer’s most advanced model (e.g. S&C Electric standard control, G&W Electric “Type 7.1” control, Cooper Power Systems “Type iTAP265” control).
Gas Fill Valve
Switchgear units shall come equipped with a pressure gauge and a gas fill valve.

Grounding Lugs
Vault-mounted switchgear units shall be furnished with provisions for two ground pads installed on the switchgear unit tank. Pad-mounted switchgear units shall be furnished with provisions for two ground pads installed on the switchgear unit tank and one ground pad on the switchgear cabinet enclosure. Ground pads shall be NEMA two-hole type.

Compartmental Locking
For pad-mounted switchgear units, all hinged or removable cabinet access lids or doors shall have a three-point latch and shall be provided with a 9/16” stainless steel or silicon bronze penta-head captive bolt locking device and provisions for padlocking. The penta-head bolt shall be coordinated so that it must be engaged before a padlock can be inserted into or removed from the hasp.

Labeling
For pad-mounted switchgear units, a danger label, complying with ANSI Z535, shall be located on the inside of the pad-mounted switchgear unit and readily visible whenever the first equipment door is opened.

Mounting Provisions for Fault Indicator:
Provide mounting provisions for fault indicators installed on each phase of load interrupter switches in pad-mounted switchgear unit. Provide viewing windows for fault LED indicating lights for each phase of all load interrupter switches (e.g. three per load interrupter switch) in pad-mounted switchgear unit cabinets.

Paint Finish
For pad-mounted switchgear units, the cabinet shall have a corrosion resistant finish that meets or exceeds paint requirements of ANSI C57.12.28. The outside shall be properly prepared, primed and painted with a highly weather resistant paint. All pad-mounted switchgear units shall have the manufacturer’s premium paint system. Color of pad-mounted switchgear unit shall be Carboline F235 Dark Bronze, Valspar KMB0082 Dark Bronze or as accepted.

Vault-Mounted Switchgear Installation
Vault mounted switchgear shall be installed in MSU standard precast concrete electrical vault in a manner to allow operation of the gear from grade level. Refer to attached Section 33 71 19 -Electrical Ducts, Manholes & Vaults for specific switchgear vault requirements.
Connect all medium voltage primary cables. Install insulated caps on all unoccupied (spare) 600-ampere deadbreak and all 200-ampere loadbreak bushings. Refer to Section 33 71 49 Medium Voltage Cable, Splices & Terminations for specific requirements.

Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.

Install elbow type arresters on one set of three-phase 200-ampere loadbreak bushings of medium voltage switchgear units (when available). Refer to attached Section 33 77 39 Medium Voltage Surge Suppression for specific requirements.

Pad-Mounted Switchgear Installation

Pad-mounted switchgear location with respect to buildings shall meet requirements of NESC. Ensure a minimum of 10’ clear workspace in front of pad-mounted switchgear units for stick work. Install pad-mounted switchgear units in accordance with manufacturers’ installation instructions.

Install pad-mounted switchgear on polymer concrete box pads sized for the switchgear unit, minimum 36” depth. Box pads shall be manufactured by Quazite or Concast. Box pads shall be placed on well-compacted 6” bed of limestone aggregate.

Terminate medium-voltage ducts in the switchgear box pad with a bell end fitting set 30” below the top of the box pad. Refer to attached Section 33 71 19 -Electrical Ducts, Manholes & Vaults for specific duct requirements.

System Coordination

Switchgear units shall have fault interrupters set for coordination with the University’s power distribution system. All fault interrupter settings shall conform to FM relaying standards and shall be approved by FM prior to the switchgear being energized. Coordination data and standard settings may be obtained from FM upon request.
SECTION 33 77 29 MEDIUM VOLTAGE TERMINATION CABINETS

General

Medium voltage terminating cabinet shall be in accordance with ANSI Standard C57.12.28 and IEEE 386. Terminating cabinet shall be new.

Acceptable Manufacturers: Howard Industries “4560 Series”; Hubbell “CW300 Series”; Cooper Power Systems “SecTER Series II”; or equal.

Design & Ratings

Sectionalizing cabinet shall be deadfront and shall be designed such that both line and load connections are made through 15 KV 200-ampere loadbreak separable connectors in accordance with ANSI/IEEE Standard 386, latest revision. Sectionalizing cabinet shall be equipped with three (3) three-way 200-ampere loadbreak junctions for three-phase operation. Loadbreak junction bushings shall be rated at 15 KV, 200-amperes continuous. Cable junction enclosure shall be furnished with integral or matching ground sleeve.

Cabinet

Sectionalizing cabinet enclosure shall be 12-gauge minimum sheet steel, all welded construction and shall be tamper resistant. Enclosure dimensions shall be approximately 60”W x 18”D x 30”H. Access door shall be equipped with door holders that will latch the door open to prevent accidental closing. Access door shall be provided with provisions for padlocking and a recessed penta-head security bolt. Security bolt shall be made captive to prevent removal. Switching cabinet shall be supplied complete with two ground lugs in the cable termination compartment. Ground lugs shall accept #2/0 copper ground conductors. Parking stands shall be provided in the cable termination compartment of switching cabinet. Parking stands shall be welded into place in positions that allow the use of hot line tools for switching operations. Enclosure shall be non-vented.

Labeling

A danger label, complying with ANSI Z535, shall be located on the inside of the pad-mounted termination cabinet and readily visible whenever the first equipment door is opened.

Paint Finish

Cabinet shall have a corrosion resistant finish that meets or exceeds paint requirements of ANSI C57.12.28. The outside shall be properly prepared, primed and painted with a highly weather resistant paint. All pad-mounted termination cabinets shall have the manufacturer’s premium paint system. Color of pad mounted termination cabinet shall be Carboline F235 Dark Bronze, Valspar KMB0082 Dark Bronze or as accepted.
Pad-Mounted Termination Cabinet Installation

Pad-mounted termination cabinet installation shall meet requirements of NESC. Ensure a minimum of 10’ clear workspace in front of pad-mounted switchgear units for stick work. Install pad-mounted termination cabinet in accordance with manufacturer’s installation instructions.

Pad-mounted termination cabinets shall be furnished with the manufacturer’s matching ground sleeve sized for the switchgear unit, minimum 18” depth. Ground sleeve shall be placed on well-compacted 6” bed of limestone aggregate.

Terminate medium-voltage ducts in the termination cabinet box pad with a bell end fitting set 18” below the top of the ground sleeve. Refer to attached Section 33 71 19 -Electrical Ducts, Manholes & Vaults for specific duct requirements.

Connect all medium voltage primary cables. Install insulated caps on all unoccupied (spare) 200-ampere loadbreak bushings. Refer to Section 33 71 49 -Medium Voltage Cable, Splices & Terminations for specific requirements.

Install driven ground rods in termination cabinet ground sleeve. Refer to attached Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding and bonding requirements.
SECTION 33 79 19 MEDIUM VOLTAGE GROUNDING & BONDING

General

All electrical utility system components shall be grounded in accordance with NESC. All grounding and bonding connectors shall be made using copper-to-copper compression or thermal weld grounding connectors. Grounding connectors shall be suitable for direct burial and shall conform to the requirements of UL 467 and IEEE 837. Split bolt or other mechanical type connectors are not acceptable.

Grounding conductors shall be bare, soft temper copper cable conforming to ASTM B8 or THWN/THHN insulated copper wire, as specified in this section. Ground rods shall be copper clad steel with diameter adequate to permit driving to full length of the rod, but not less ¾” diameter and 8’ long. Conduit grounding bushings shall be galvanized malleable iron insulated throat grounding bushings with lay-in type ground lugs. Use two-hole heavy-duty compression lugs for bolted connections to equipment ground pads. Match connectors and die sizes to the material shapes and conductor sizes to be joined.

Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Follow manufacturer’s installation instructions and use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code to make visible indication that a connector has been adequately compressed.

Pad-Mounted Transformers, Switchgear Units & Termination Cabinets

Install two (2) 3/4” x 8’ ground rods inside precast concrete pad. Install a #4/0 bare copper ground ring connecting each of the two ground rods and each of the two ground terminals of the pad-mounted transformer, switchgear unit, or switch cabinet in a continuous ring. Connect the concentric neutrals of each cable terminated in the pad-mounted transformer, switchgear unit, or termination cabinet to the #4/0 copper ground ring using the proper compression-type grounding connectors. Connect the grounding braid of any surge arresters to the #4/0 copper ground ring using the proper compression-type grounding connectors. Connect bushing insert and elbow drain wires to the ground ring using proper compression-type grounding connectors.

Manholes & Future-Use Switchgear Vaults

Install two (2) 3/4” x 8’ ground rods and a #4/0 THHN/THWN copper ground ring around the outside edge of the interior of the manhole or vault, connecting each of the two ground rods in a continuous ring. Connect the concentric neutrals of each cable spliced in the vault to the #4/0 copper ground ring using the proper compression-type grounding connectors. Connect splice body drain wires to the ground ring using proper compression-type grounding connectors.

Vault-Mounted Switchgear Units

Utilities
Install two (2) 3/4" x 8' ground rods and a #4/0 THHN/THWN copper ground ring around the outside edge of the interior of the vault, connecting each of the two ground rods and each of the two ground terminals of the vault-mounted switchgear unit in a continuous ring. Connect the concentric neutrals of each cable terminated in the vault to the #4/0 copper ground ring using the proper compression-type grounding connectors. Connect the grounding braid of any surge arresters to the #4/0 copper ground ring using the proper compression-type grounding connectors. Connect bushing insert and elbow drain wires to the ground ring using proper compression-type grounding connectors.
SECTION 33 77 39 MEDIUM VOLTAGE SURGE SUPPRESSION

General
Install elbow arresters at the ends of all radials and in normally open locations in loops at pad-mounted transformers, switchgear units and termination cabinets. Install elbow type arresters on one set of spare 200-ampere bushings (when available) in pad and vault mounted switchgear units. Elbow arrester grounding braid shall be connected to the equipment ground-bus ring using suitable compression connections.

Refer to Section 33 79 19 -Medium Voltage Grounding & Bonding for specific grounding requirements.

Elbow Arresters
Elbow surge arresters shall be designed for installation in pad and vault-mounted switchgear and pad-mounted transformers. Elbow arresters shall be designed for use with 200-ampere 15 KV loadbreak interfaces that conform to IEEE Standard 386. Elbow arresters shall be metal oxide varistor elbow (M.O.V.E.) type 15 KV class rated at 10 KV (8.4 KV MCOV) furnished complete with copper braid ground lead.

Acceptable Manufacturers: Cooper Power Systems “323 Series”; Elastimold “167ESA Series”; or equal.
SECTION 33 APPENDIX A
NOTES:

1. REFER TO SINGLE LINE DIAGRAM FOR SWITCHGEAR CONFIGURATION AND NUMBER AND TYPE OF WAYS.

PAD MOUNTED 15KV SWITCHGEAR DETAIL - TYPICAL

SCALE: NONE
NOTES:

1. VIEW WITH DOOR OPEN & ACCESS PANEL REMOVED.

2. INSTALL SWITCH IDENTIFICATION NO. (E.G. "501") ABOVE EACH RESPECTIVE SWITCH OPERATOR ON OPERATION SIDE OF SWITCHGEAR UNIT.

PAD MOUNTED SWITCHGEAR - INTERIOR LABELING

SCALE: NONE
NOTES:

1. USE 4,000 PSI CONCRETE AND 60,000 PSI REINFORCING STEEL.
2. USE LONG RADIUS FKE OR ASPHALTUM COATED RGS ELS FOR CONDUIT BENDS UNDER PAD FOUNDATION.
3. PAD SHOULD BE POURED AGAINST A 6" MINIMUM COMPACTED GRAVEL FILL THAT IS PLACED ON WELL COMPACTED EARTH.
4. VERIFY DIMENSIONS FOR TRANSFORMER PAD FOUNDATION WITH ENGINEER BEFORE INSTALLATION. DIMENSIONS OF PAD FOUNDATION MAY HAVE TO BE CHANGED FOR TRANSFORMER FURNISHED BY CONTRACTOR.
5. VERIFY PLACEMENT OF CONDUITS IN TRANSFORMER PAD FOUNDATION WITH UTILITY BEFORE INSTALLATION.
6. VERIFY METERING AND METERING CONDUIT REQUIREMENTS WITH UTILITY BEFORE INSTALLATION.

PAD MOUNT TRANSFORMER FOUNDATION DETAIL - TYPICAL

SCALE: NONE
NOTES:

1. SECONDARY CONDUCTORS AND CONNECTIONS OMITTED FOR CLARITY. REFER TO SINGLE LINE DIAGRAM FOR DETAILS.

THREE PHASE PAD MOUNTED TRANSFORMER DETAIL - TYPICAL

SCALE: NONE
THREE PHASE PAD MOUNTED TRANSFORMER - EXTERIOR LABELING

SCALE: NONE

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI

DRAWN: R.W. JOB NO: 617E3022
CHECKED: J.A. DATE: 04-13-10
APPROVED: J.A. SCALE: UN-DRAWN

THREE PHASE PAD MOUNTED TRANSFORMER EXTERIOR LABELING

DRAWING NO: 9

Revision 11-14-2017

Utilities
NOTES:

1. VIEW WITH DOORS OPEN.

THREE PHASE PAD MOUNTED TRANSFORMER - INTERIOR LABELING

SCALE: NONE
CABLE TAG DETAIL - TYPICAL

SCALE: NONE