



Standards for Commissioned Architects and Engineers

The following set of standards and instructions are commonly referred to as the "Green Book" and intended for use by consulting engineers, architects, and other campus entities involved in new construction and renovation projects for Clemson University. These standards are intended to provide a level of consistency for future maintenance and repairs as well as a standard of quality for the various facilities and systems at Clemson University. These instructions are categorized in accordance with current Construction Specification Institute (CSI) formatting.

If project conditions warrant, any deviations from these standards shall be submitted by the Project Manager's Director, to the Chief Facilities Officer, through the University Building Official with a report from the contractor and/or design team outlining the change and substantiating the cost benefits approved.

These standards do not relieve the designer of any professional responsibility as their design relates to the applicable building codes and requirements. These documents are not intended to serve as technical specifications for any product or division.

Please contact [Andy Boyd](#) or [Channon Chambers](#) with any questions regarding these standards.



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DIVISION 00 – DESIGN STANDARDS

00 00 00 General Information

Foreword

The information contained in this document outlines the accepted procedures to be followed by consultants commissioned to provide professional service to Clemson University regarding the design of permanent improvements (both new construction and renovations) to the physical facilities at Clemson University (main campus and satellite properties).

It is hoped that the material in this document will facilitate the design process, as well as make the entire process more efficient in the use of both time and financial resources for the designer and Clemson University.

This information is not intended to be used as the actual specification of work to be included in the bidding documents, but as a guide to be used by the designer in the development of those documents. Differences in the scope of work that are covered in each of the divisions necessitate some of them to be more prescriptive in nature than others, i.e., the more technical divisions involving HVAC, Electrical, Plumbing, and Utilities.

Scope of Services and A/E Agreement

The contract between the Architect/Engineer and Clemson University specifies the scope of services to be provided and the procedures to be followed. This section of these instructions supplements those requirements and procedures and must be read in conjunction therewith. In the case of any conflict, the provisions of the contract shall prevail. The agreement with the Architect/Engineer utilizes AIA Document B101-2007.

Permitting

The consulting A/E shall give special attention to ensuring that all required permits for construction and/or operation of any component of this project are obtained from the appropriate regulating authority and that they are obtained within the prescribed time. It is the consultant's responsibility to ensure that these permits are obtained.

Communication with the Owner's Representative

Unless otherwise directed, the Project Manager will be the designated Owner's Representative and first Clemson University contact for all matters. The A/E shall maintain adequate communication with the Owner's Representative throughout the project. Do not take direct instruction from individual user groups unless authorized by the Owner's Representative.

Campus Master Plan

The information, instructions, and standards presented in this document shall be coordinated with the information contained in the most current edition of the [Long-Range Framework Plan](#) and Design Guidelines. These guidelines are available at the University Planning and Design office. Other publications concerning design principles and standards are also available through the University Planning and Design [website](#).

Design within the Historic District

Clemson University is committed to the preservation and protection of the historical aspects of its architecture and landscape. Information and guidelines to assist the designer in achieving this goal is available from the University Planning and Design office and specifically found in their publication [Clemson University Preservation Master Plan](#).

State Manual

Aspects of oversight by the [Office of State Engineer](#) for permanent improvement projects at Clemson University are found in the [Manual for Planning and Execution of State Permanent Improvements - Part II](#). This manual describes the requirements for procurement of all phases of the design and construction process. The designer shall be aware and cognizant of these requirements from the beginning of the design process and how these requirements affect the design and construction process.

00 01 00 Drawings

General

Drawing sheet size shall be no larger than 30" x 42". Half size drawings may also be requested for particular projects.

An index to all drawings shall be shown on either the cover sheet or the sheet immediately following the cover sheet.

Drawing scales shall be given by both listing the scale (i.e. 1:20 or 1"=10') and providing a scale ruler on each page of plans with scaled information.

In addition to the requirements in the [Manual for Planning and Execution of State Permanent Improvements - Part II](#), the first informational sheet shall show the gross and net assignable square footage of the building components. This information shall be shown on all three design submittal phases. The Construction Document set of drawings shall also indicate the design maximum live load per square foot for each area (floor and roof loading).

Accurate life safety drawings shall be submitted with construction documents to ensure the project can be properly reviewed for compliance with applicable building codes, environmental standards and University standards.

CAD Formatting and Modeling Requirements

Adhere to the requirements concerning submission of drawings in CAD format as indicated in Article 13 and subparagraph 13.2 of the A/E Agreement. All record documents shall include building information models capable of describing the project in two and three dimensions.

These models shall adhere to the following standards:

- BIM models for new construction shall have a minimum of LOD 400.
- BIM models for renovations shall have a minimum of LOD 300.
- Existing BIM models effected by new construction or renovation shall be updated to the LOD of the existing model or LOD 300, whichever is greater, as part of the A/E's scope of work.
- These minimums and any additional requirements deemed necessary will become part

of the A/E Agreement with the Owner via AIA Document E202-2008.

All O&M and specification manuals shall be in .pdf format.

All civil designs are to be produced in Auto CAD Civil 3D (version within one edition of current). All C3D designs to include: Existing, proposed, and as-built 3D surface model and, all existing, proposed and as-built storm drainage and sanitary sewer systems to be in C3D pipe network.

Code Footprint

A Code Footprint is required for facility designs that are classified as capital improvements by the State of South Carolina and the [Office of the State Engineer](#), and is also required on architectural projects that are managed by University Facilities.

00 02 00 Technical Specifications

The technical specifications shall be developed in a form consistent with the most recent numbering system of the Construction Specification Institute (CSI). Page numbering shall be consistent throughout the specification booklet, including specifications prepared by design consultants to the lead design group.

Specifications shall be produced on 8-1/2" x 11" size media. Adhere to the requirements of the A/E Agreement for submission of specifications in the appropriate electronic media.

00 03 00 Design Parameters

Materials

Hazardous materials, (asbestos, PCB's, lead, etc.), even products with trace amounts, shall not be specified or allowed to be incorporated into the work. It is incumbent upon the design professional and selected contractor to ensure that hazardous materials are not incorporated into the project. Additional links for Existing Conditions may be found in Division 02.

Regulations contained in the Safe Drinking Water Act concerning lead and copper concentrations shall be complied with in the selection of piping materials to insure this compliance.

Project Site

The design of permanent improvement projects shall strive for a plan that will allow for efficient movement of labor and material to and around the project site. The A/E shall make every effort to minimize the risk of injury to students and personnel and the consequent liability to the University and their agents. The designer shall also specify that all site work shall be done in strict compliance with the University's [Main Campus Urban Forest and Landscape Management Policy](#).

Show all necessary requirements regarding access routes, parking, construction fences, temporary utilities, etc.

Clearly specify any construction job signage, including the project identification sign, as well as other information that may be unique to a particular project.

Room Numbering

All room numbering is to follow the [Clemson Room and Door Numbering Standards](#) and is subject to the approval of the [Office of Space Management](#).

Space and Access Requirements

Provide ample head room at all points where people stand or walk, including over and under stairways and landings. The minimum ceiling heights must be 9'-0" for classrooms, 9'-6" for labs, 8'-0" for corridors, but in no case less than applicable code requirements.

When sleeping accommodations are included in the project, all accommodations shall be designed for occupancy by either male or female.

Provide separate space for departmental program equipment. Do not locate program equipment in the building mechanical room.

Provide access to the roof and any roof mounted equipment from the inside of the building via stairs. Ladders mounted to the building exterior are strictly prohibited.

Specify that a minimum 6' x 8' Lactation/Medical Privacy room with at least one outlet, a sink with counterspace, paper towel dispenser, soap dispenser, waste receptacle, and seating be included in new construction and major renovations.

At a minimum, provide one 8'x12' custodial closet per floor. Each custodial closet shall have a floor mop basin and wall hung lavatory with eye wash basin and handheld drench hose.

In addition to the above custodial closet, provide a minimum 8' x 12' recycling/storage room near the loading dock or service entrance.

Attic spaces containing mechanical, electrical and/or plumbing equipment shall have access via stairs and shall be considered an equipment room. All applicable codes and relevant sections of this document shall be enforced regarding these spaces.

Testing

Provide for a testing laboratory to perform any testing for individual material installation deemed necessary by the designer.

Specify that copies of all subsequent test reports be provided to the Owner, the A/E, and the Contractor in a timely manner. Specify that the scheduling of these tests shall be the responsibility of the Contractor and that any requirements for the storing of test cylinders or other applicable test samples shall be the responsibility of the Contractor.

Specify that the cost associated with the retesting of any material shall be borne by the Contractor.

00 04 00 General Information

Existing Drawings and Reports

The Owner has available a limited number of "as-built" drawings and surveys for many of the existing facilities on the main campus. The A/E is responsible for the review of the available documents determining their possible benefit to them in the design of the project.

Reproduction of said documents shall be coordinated with the Project Manager.

The Owner has an active survey of asbestos containing materials (ACM) in facilities on the main campus. It shall be the responsibility of the A/E to review the material contained in these surveys and incorporate any effect that it could have on the design of a particular project. It is of utmost importance that the A/E and the Owner comply with South Carolina asbestos regulations. Additional surveys or tests for ACM can be coordinated with the Project Manager in accordance with the A/E Agreement.

The Owner maintains a utility and site map of the main campus that is available for use by the A/E. Critical location and type of utility or other improvement shall be confirmed by additional survey as deemed appropriate by the A/E. Coordinate with the Project Manager and Clemson University Surveyor prior to the start of any survey.

00 05 00 Sustainable Design

Statement of Intent

The responsible use of all forms of energy and the good health of the community are high priorities of Clemson University. Consistent with its mission of teaching, research and service, Clemson University intends to be a leader and champion of sustainable design as a tool to help educate the Clemson community. At the same time, energy consumption and the "ecological footprint" of the University will be reduced, while the productivity and health of the community will be improved.

Sustainable principles that promote these objectives shall be incorporated into all building and infrastructure projects in accordance with the University's [Sustainable Building Policy](#), the Energy Code and satisfy the requirements for either the Silver Level of [LEED v4 for BD+C: New Construction and Major Renovation](#) or two [Green Globes](#) from the Green Building Initiative.

Project planning will anticipate initial capital costs and life cycle costs/savings will be anticipated early in the development process and will be a portion of the budget discussions. Two Green Globes or Silver Level LEED certification are a part of fundamental building design and construction – it is not considered to be an add-on. This is the policy of Clemson University and is non-negotiable.

00 06 00 Commissioning

Statement of Intent

For most major construction and renovation projects, the University utilizes both Fundamental and Enhanced Commissioning on the total building. The University usually contracts for this service directly with a commissioning agent or firm.

00 62 39 Minority Business Enterprise Certification Form

Specify that Clemson has established a goal of 10 percent of the value of procurement contracts and construction contracts or any portion of the awarded contract to be subcontracted to other suppliers. The Contractor is encouraged to offer such business to minority and/or women-owned businesses (MBE's). The Contractor shall submit a report along with each payment invoice to the Project Manager indicating the actual dollars spent with MBE's during the performance of this contract. At a minimum, this report shall include for each MBE firm contracted with, a comparison of the total actual dollars spent and the

actual total contract value. A sample form is available upon request. The Contractor agrees to furnish the Project Manager the following information: name of firm, type of product/service provided, and total dollar amount subcontracted, prior to payment being dispersed by Clemson University.

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00 Summary of Work

01 11 13 Work Covered by Contract Documents

Adequately describe the extent and scope of the work covered by the design documents for the project. Describe any extraordinary conditions that exist for the project. Confirm that the description of the scope of work listed here agrees with the description that might be listed in other areas of the documents.

01 11 16 Work by Owner

Clearly describe any work that is planned to be done by the Owner's forces or by other contractor's that the Owner has retained. If any work on adjacent facilities by the Owner is ongoing that could affect the work of this contractor, indicate such.

01 11 19 Purchase Contracts

The Owner may choose to pre-purchase certain pieces of equipment for the contractor to install. Itemize all such purchases and specify how they are to be handled, including unloading and storage responsibilities.

01 14 00 Work Restrictions

01 14 13 Access to Site

Many projects at Clemson University have restrictions that will affect construction operations. These include limited physical access to the project site; partial occupation of buildings under construction; surrounding buildings that are in use; pedestrian and vehicle traffic near the project site; and other restrictions due to the nature of construction on a university campus. No construction activity shall take place on football game days without special permission from the Project Manager.

Clearly specify any restrictions of access to site, restrictions on use of the site, restrictions on work hours, etc. that may affect the prosecution of the work under this contract. If special conditions exist concerning actual routing of traffic and delivery to site, please indicate such here and on the drawings.

If fencing, whether temporary or permanent, is used, ensure that sight distances for intersections and driveways are not impeded and that any banners or screening used for the display of company logos or for privacy will not cause fencing to topple due to increased wind loading. Stanchions with sandbags will not be allowed as anchors for any fencing with banners or screens installed.

01 14 16 Use of Site

This site is intended for use by the contractor for the construction of the facility. If special conditions of its use and the necessity for off-site storage and parking, indicate these conditions.

Specify that any use of the site will comply with the "[Urban Forest and Landscape Management Policy](#)."

All construction operations shall be in compliance with all applicable OSHA regulations for operations involving respirable silica dust.

All construction operations shall be in compliance with all OSHA regulations for operations involving asbestos.

Verify with the Project Manager that noisy construction work near occupied dormitories cannot start before 10:00am. Noisy construction operations on campus during exam week are prohibited. Noisy operations are generally defined as over 60 dba in the adjacent space on interior projects and 90 dba at 120 foot distance on exterior. The playing of radios, audio devices shall be strictly prohibited.

Specify that Clemson University is a tobacco-free institution. No smoking or other use of Tobacco Products is permitted on University Property pursuant to [Clemson's Tobacco-Free Policy](#).

01 20 00 Price and Payment Procedures

Price and payment procedures are covered in the requirements as itemized in the [Manual for Planning and Execution of State Permanent Improvements – Part II](#). The portions of the contract that are specified by this manual address these procedures including contract modification procedures (change orders and change directives, substitution procedures, etc.

01 31 00 Project Management and Coordination

The project management and coordination procedures and responsibilities of the contractor are addressed in the contract documents prescribed by the [Manual for Planning and Execution of State Permanent Improvements – Part II](#). Specify that the successful contractor will be required to submit a listing of both their Project Manager and their Field Superintendent to the Owner for approval. This submittal must be in the form of the attached Superintendent Listing.

01 32 00 Construction Progress Documentation

01 32 16 Construction Progress Schedule

Clemson University has developed a detailed requirement for construction scheduling on major projects. The specification for this requirement must be included as written in the project specification booklet. The designer must make themselves familiar with these requirements and its possible effects on the project. Consult with the Project Manager to determine if this project will include this scheduling requirement.

If this specification is used on this project, clearly indicate as such in the Pre-Bid Conference and in the minutes of the Pre-Bid Conference that are usually included in an Addendum prior

to receipt of bids.

01 32 33 Photographic Documentation

For major construction and renovation projects, the owner requests that photographic documentation of the construction process be a part of the construction contract.

01 35 00 Special Procedures

01 35 53 Security Procedures

Specify the following worksite decorum and background check policy: All companies, including but not limited to, design professionals, vendors, suppliers, consultants, general contractors of any trade, and their subcontractors, (Contractor) that bring one or more of its employees on to the Clemson University campus or other University property in order to fulfill the terms of this agreement, must conduct a criminal background check on said employee(s) prior to bringing or sending the employee(s) to the Clemson University campus or other University property. Contractor agrees that any employee with a criminal history that the contractor reasonably believes poses a threat to property or persons will not be brought or sent to the Clemson University campus or other University property. The Contractor agrees to impose this same criminal background check requirement on all subcontractors, vendors, suppliers, or consultants, used to fulfill its responsibilities under this agreement. The Contractor shall be responsible for all costs associated with these requirements. Clemson University reserves the right to verify compliance by contractor upon request. Information collected for verification is controlled by the federal Fair Credit Reporting Act. Individuals believed by Clemson University to pose a threat must leave the campus or University property immediately and the Contractor may be prohibited from future awards without permission of the Procurement Officer.

All workers shall, at all times, wear a visible identification badge with photo ID that contains their name and/or the name of their employer.

Possession of alcohol or controlled substances, or presence onsite of personnel who are under the influence of alcohol or controlled substances, is forbidden.

Workers' conduct shall be controlled to prevent unwanted interaction such as whistling, profanity, and initiating conversations with passersby, by the Contractor with students, staff, or other individuals, adjacent to the Project site.

01 40 00 Quality Requirements

Specify the appropriate instructions regarding Special Inspections and Tests that are required during the construction of the project. These instructions must be consistent with the requirements indicated in the OSE manual, building code, and approved by the Authority Having Jurisdiction (either OSE or CU building official depending upon scope).

01 50 00 New Utility Locations

Specify that the contractor be required to notify the Survey Group at University Facilities at least 24 hours prior to covering or backfilling any underground utility so that they can record the location and other information on their mapping data base. This requirement is in addition to any other requirement for special code inspections or testing. Specify the

Clemson University Surveyor will not mark any existing utility in the field because State law requires Contractor to call PUPS (811) for all existing underground utility locates. Failure to comply with survey notification will require uncovering.

05 51 00 Temporary Utilities

Contract documents shall indicate whether temporary utilities for the project during construction are to be furnished by the University at no cost to the contractor, or to be furnished by the contractor as part of his cost. If temporary utilities are to be furnished by the contractor, the project drawings shall indicate the points of delivery of these utilities to the project where the University will install the appropriate service. Utilities that may be charged to the contractor include electricity, steam, chilled water, potable water, and sewer. Charge rates for these utilities at the time of the project can be obtained from the Project Manager.

01 55 00 Vehicular Access and Parking

Review with Project Manager parking locations for Contractor's vehicles. Comply with University Parking and Transportation Services traffic and parking regulations, including permitting requirements. Cost for construction related parking is to be included in the Contract Sum. To minimize impact within work areas, off-site parking will be provided for ancillary workers and materials. Fenced or barricaded on-site parking spaces must be designated on drawings when appropriate. On-site parking must comply with emergency vehicle access and with minimum impact on Owner operations.

01 55 29 Staging Areas

Indicate exterior staging area or point of access to building on drawings. Provide fencing around staging areas and dumpsters when appropriate. Indicate location of dumpster and route for debris removal through occupied buildings. Review vertical access within building, including use of stairs and elevator with the Project Manager.

01 56 00 Temporary Barriers and Enclosures

All construction activities within public areas are required to be secured with an approved barrier. Provide a barricade plan as part of the site and life safety drawings. Specify contractor is responsible for maintaining barriers throughout the project.

Entrances and exits for public use must be provided to meet code requirements for buildings occupied during construction. At least one path of travel that is accessible to individuals with disabilities must be maintained to all user occupied portions of the building. Signage must meet all applicable ADA requirements.

Noise, vibration, and dust shall be minimized in and around buildings that are occupied during construction. Indicate areas for which noise and dust control must be provided and specify methods of control. If details of installations are involved, specify these in the applicable sections of the technical specifications and the drawings.

DIVISION 02 - EXISTING CONDITIONS

02 00 00 Existing Information

Information Availability

The Owner has archived varying amounts of information concerning sites and locations on the campus that are available for use by the consulting professional. The amount of information available at a particular site varies at the different locations on campus.

02 21 00 Surveys

Boundary, Topographic, and Utility Survey

If the project requires a current boundary, topographic or utility survey, the A/E shall coordinate the procurement of this service with the Project Manager. Depending on the project and scope of the information needed, this service may be procured either directly by the Owner or by the A/E.

The survey shall be tied to a minimum of two University benchmarks and, upon completion be delivered to the Clemson University Surveyor as well as raw point file in PNEZD format (point #, northing, easting, elevation, description).

The design team shall geo-reference the South Carolina State Plane Coordinate System Single Zone 3900 and utilize North American Horizontal Datum (NAD83) and North American Vertical Datum 1988 (NAVD88).

02 26 00 Hazardous Materials Assessment

Before a facility or a portion of a facility is renovated or demolished, the facility or portion of the facility being renovated must be thoroughly inspected for the presence of asbestos. The inspection must be performed by a person who has been trained and licensed as an Asbestos Building Inspector or management planner in accordance with State training and licensing requirements. Other hazardous materials such as lead and PCB's may also exist. Coordinate with the project manager to determine if an inspection has been performed within in the last three years or if a new inspection is required.

02 32 00 Geotechnical Investigation

If the project requires a geotechnical survey or subsurface drilling, the A/E shall coordinate the procurement of this service with the Project Manager. Depending on the project and scope of the work, this service may be procured directly by the Owner or by the A/E. Any subsurface investigation must include a utility location prior to any drilling or excavation. Both the Facilities Survey group and local commercial utility locating services PUPS (811) must be contacted prior to any subsurface investigation.

02 84 00 Polychlorinate Biphenyl Remediation

Decommissioning and Disposal of Equipment Containing Hazardous Materials:

The University's electrical systems currently employs equipment containing potentially hazardous materials. Common items include oil filled transformers & switches, fluorescent lamps, and ballasts containing Polychlorinated biphenyl (PCB) and other classified hazardous materials. Projects involving decommissioning and demolition plans for these electrical components shall be planned and coordinated with Research Safety and Campus Recycling.

Project construction plans and specifications involving oil containing electrical components shall be identified on the project plans with note(s) requiring advance scheduling through the assigned University project manager for initial survey and testing by Research Safety when the equipment is properly de-energized. If the PCB levels are within acceptable limits, the equipment will be cleared and released to the contractor or University Facilities for disposition or salvage. If PCB levels are above acceptable limits, Research Safety will manage on-site oil removal activities when it is possible. Research Safety will be responsible for the disposal of the PCB containing oil, and the drained equipment will be released to the contractor or University Facilities for disposal or salvage. In the event that the equipment cannot be drained of PCB containing oils, Research Safety will be responsible for equipment disposal.

Removal of fluorescent lamps shall be identified on project demolition plans and coordinated with Campus Recycling for intact bulbs and Research Safety for broken bulbs.

DIVISION 03 - CONCRETE

03 05 00 Common Work Results for Concrete

Design Standards

A concrete design shall comply in entirety with the most restrictive interpretation of applicable codes, including the seismic requirements for this seismic zone. In addition, numerous ASTM Standards and Specifications also apply to many aspects of concrete construction. Specify that all applicable standards are incorporated in the project design and in the preparation of the design documents and will be enforced.

Site Use Standards

Specify the restrictions on rinsing and washing out of truck mounted rotating drum concrete mixers on the site or on any University property. The Project Manager can coordinate these restrictions as it pertains to a particular project or site. The documents must clearly indicate the contractor's responsibility of cleaning up any wash out site before the end of the project.

03 20 00 Concrete Reinforcing

Specify that the contractor shall properly store and protect reinforcing steel to minimize contamination (mud, grease, corrosion) on the construction site prior to its placement.

Specify that all American Concrete Institute (ACI) and the Concrete Reinforcing Steel Institute (CRSI) recommendations involving the placement of and field cutting or bending of concrete reinforcing will be strictly enforced.

03 30 00 Cast-in-Place Concrete

Provide for a testing laboratory to be engaged by either the Owner or the A/E, to perform any testing deemed necessary by the designer.

Specify that copies of all subsequent test reports be provided to the Owner, the A/E, and the Contractor. Specify that the scheduling of these tests shall be the responsibility of the Contractor and that any requirements for the storing of test cylinders are the responsibility of the Contractor.

Specify that any cost associated with retesting of concrete shall be borne by the Contractor.

Coordinate the use of any additives of admixtures with the Project Manager.

Specify that all form work must comply with current ACI recommendations and safety codes.

03 35 00 Concrete Finishing

Clean and rub all exposed surfaces of concrete walls, columns, ceilings, and parapets to remove stains, foreign matter, burrs, fins, and any other surface irregularities after removal of form ties and after any repairs and patching work is completed.

Exposed surfaces shall be left true to line and plane, and free from form marks and other imperfections. Cosmetic coatings used to disguise underlying defects are unacceptable.

Provide all exterior concrete ramps, walks, loading docks, and other such surfaces subject to wetting with a non-slip broom finish.

The use of any specialty finishes on exposed concrete surfaces including colored concrete, exposed aggregate concrete, stamped concrete and grooving or tooling requirements must be coordinated and approved with the Project Manager.

03 45 00 Precast Concrete

Specify that any precast architectural concrete shall be properly handled and stored to prevent physical damage to the precast units and to prevent staining and discoloring of the precast units. Clearly state that the contractor will be responsible for replacing any damage precast units.

DIVISION 04 – MASONRY

04 05 00 Common Work Results for Masonry

Design Guidelines

The Clemson University Site Design Guidelines outline the design principles and design guidelines that must be followed regarding the exterior appearance qualities of facilities at Clemson, and how these qualities reinforce the unity and identity of individual districts and nodes of the campus. Exceptions to these guidelines must be approved by the Director of University Planning.

Historic Buildings and Structures

For renovations and additions to historic structures, mortar materials, colors, and joint profiles are critical and careful attention must be given to their effects on the construction and renovation of these facilities. Hence, for repairs to the existing masonry on some historic structures, it is important to pay special attention to the selection of mortar materials, since the use of some mortars presently available may result in the strength of the mortar exceeding the strength of the brick.

04 21 00 Clay Unit Masonry

04 21 13 Brick Selection and Sample Panels

To assure the best possible selection of brick, mortar, and proposed jointing for the project, specify that the Contractor shall prepare sample panels (from samples recommended by the A/E) of all proposed exterior materials from which a selection can be made. Coordinate the size, form and location of these sample panels with the Project Manager. Coordinate the selection of masonry with the selection of other exterior materials at the same time, i.e., roofing, metal work, other building trim.

After the selection has been made, coordinate the construction of an additional sample panel of the approved material to show in detail the variety of shapes, coursing, etc. that will be used in the facility. Maintain this enhanced sample panel until completion of the facility for comparison and standard of quality for the building.

For most projects, specify a cash allowance for the purchase of brick for the project. Specify that all exterior face brick is to be purchased at one time and delivered in sufficient quantity to complete the installation. This shall be done to ensure a uniform color throughout the building. Indicate a brick storage area on the documents.

The University prefers that masonry joints be of the type that will inhibit the entrance of water into the building. This makes "tooled" joints the joint of preference. Some design conditions may dictate departure from this preference, i.e., additions to existing buildings and project location. Any departure from the use of "tooled" joints shall have prior approval, in writing, from the Project Manager. The use of colored mortar is strongly discouraged on the campus and its use also requires approval, in writing, from the Project Manager.

Adequately specify methods for cleaning the various types of masonry used in the facility and any extraordinary conditions that may affect the use of masonry cleaning materials and equipment. Prohibit the use of sandblasting as a method for cleaning masonry.

Because of long term maintenance requirements, the widespread use of water-repellent masonry coatings are generally discouraged. The effective use of design detail must be utilized to minimize and/or inhibit the entrance of water into the structure.

04 22 00 Concrete Masonry Units

All masonry design shall comply in entirety to the most restrictive interpretation of applicable codes. Special attention must be given to all seismic requirements for construction in this seismic zone.

04 43 00 Stone Masonry

The use of stone masonry may be acceptable as a construction material on some exterior walls or other site installations. Its use is generally discouraged as a building material on the facility proper. Consult with the Project Manager for the possible use of stone masonry on campus.

DIVISION 05 – METALS

05 05 00 Common Work Results for Metals

Design Standards

The International Building Code (IBC) addresses design, fabrication, erection, and other construction practices for structural steel and related members and incorporates by reference the requirements of several industry publications, including AISC, AISI, SJI, AWS, ASTM, and ASCE. All design must be in accordance with all applicable provisions of these codes and guides.

For projects using a large quantity of structural steel, a site storage area must be identified on the documents.

When applicable, specify appropriate testing of connections and certification by approved testing agency.

DIVISION 06 - WOOD, PLASTIC AND COMPOSITES

06 05 00 Common Work Results for Wood, Plastics, and Composites

Design Standards

Use of structural fire-retardant wood is not allowed. However, all walls of telecommunications closets shall be covered with three-quarter inch A-C grade fire retardant plywood, painted with two coats light colored, non-conductive fire-retardant paint. The plywood shall extend from the floor to eight (8) feet above the finished floor and shall be mounted with the "A" side exposed.

Use pressure treated wood for blocking where moisture may be encountered, such as below grade locations and roof locations.

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 05 00 Common Work Results for Thermal and Moisture Protection

Design Standards

Clemson University has various types of roofing on its different facilities. Replacement of an existing roof or the design of a roofing system on a new facility may require different design parameters. In general, an existing roofing system will be replaced with a like system. Overall design will determine the type of roofing system used on a new facility. Some projects require roofing systems that are unique to the facility.

The Owner has an inventory of asbestos containing materials (ACM) in existing roofing and interiors of buildings.

Roof design shall meet all applicable code requirements. The IBC has made some significant changes regarding minimum requirements of codes based on replacement, recover, retrofit or percentages to be included. The designer shall be familiar with these requirements.

Standards published by the National Roofing Contractors Association (NRCA), Asphalt Roofing Manufacturers Association (ARMA), Single Ply Roofing Institute (SPRI), and the Sheet Metal & Air Conditioning Contractors National Association, Inc. (SMACNA) contain general construction and detail recommendations.

The [NRCA Roofing and Waterproofing Manual, 5th Edition](#) and the [SMACNA Architectural Sheet Metal Manual, 7th Edition](#) are excellent sources of details and criteria for roofing and roof accessory design.

Do not write specifications that allow an undetermined roofing manufacturer to determine the acceptability of a condition or detail to be used.

Provide an existing roofing plan showing actual field dimensions, actual conditions, penetrations, roof mounted equipment, and any core sample information or summaries. Indicate any equipment or penetrations that are to be abandoned.

Consult with the Project Manager to determine what equipment and/or penetrations can be abandoned.

Provide a new roofing plan, identifying slopes, penetrations, equipment, and any other details necessary to provide adequate information to the contractor. The use of isometric details is preferred where applicable.

On new multi-story buildings, roof access shall be via interior stairs. When roof hatches are used on existing buildings, they shall be designed such that opening, and closing can be done with three points of contact at all times. Installation of exterior ladders are strictly prohibited.

Protective mats or pads shall be strategically placed at exit/entry points and anticipated heavy travel areas on the roof.

Fall Protection: All areas that expose workers to a fall into hazardous equipment or material or a fall of 4 feet or greater shall be protected by parapet walls or permanent guardrails. When guardrails or parapets are not feasible, provide horizontal lifelines and anchorages as a part of a complete OSHA compliant fall arrest system.

Coordinate the installation of any required lightning arrestor system and adequately address the need for certification or recertification of the system. Specify that the system be made operational at the end of the work day.

Use crickets, saddles, and edge strips to direct water way from penetrations and parapet walls to ensure positive drainage to scuppers, drains, and gutters. Provide twice the primary slope to ensure proper drainage from penetrations and parapets. A minimum distance of twelve (12) inches between roof penetrations shall be maintained to allow for proper flashing details.

Whenever possible, avoid the use of pitch pans. When existing pitch pans cannot be eliminated, specify a preformed pan with a minimum height of four (4) inches, four (4) inch flange, and a minimum clearance of two (2) inches on all sides of the penetration. The pitch pan shall also include the appropriate hood or umbrella.

Use round shapes for equipment supports. These supports shall be a minimum of fourteen (14) inches high, with higher supports necessary for larger pieces of equipment.

Locate interior roof drains at mid spans and low points of the roof deck. Do not locate drains at columns. When flashing drains, taper insulation twenty-four (24) inches around drain. Extend membrane, lead flashings, and strip flashing under drain bowl clamping ring. Do not use exposed lead sump pans.

The designer shall specify that the contractor will confirm, prior to commencement of roofing activity or demolition, in the presence of the appropriate Facilities personnel, that existing roof drains are open and functioning properly. The method of protection of roof drains during construction shall also be specified.

07 32 00 Tile Roofing

Clemson University has a number of facilities with tile roof systems. Many of these facilities are considered to be part of the historic resources of the University. The replacement of roof systems on these facilities shall be coordinated with the design information and guidelines available in the [Planning and Design](#) office.

07 50 00 Membrane Roofing

Clemson University has utilized built-up bituminous roofing, modified bituminous membrane roofing, and elastomeric membrane roofing systems on its facilities. Each facility shall be analyzed with the Project Manager to determine the type of roofing in this category to be used.

A minimum slope of ½" per foot is required on these types of roofs. In the case of some large roof areas, if this slope cannot feasibly be attained without excessive parapet wall heights, a slope of ¼" per foot may be acceptable with an approved deviation.

07 51 00 Built-Up Bituminous Roofing

The designer shall take special care in reviewing possible acceptable locations of hot asphalt kettles. Any location specified shall be in accordance with applicable fire codes, and in no instance, be allowed on the roof itself. The Project Manager can coordinate possible locations with the Clemson University Fire Marshal. Due to objectionable odors created by asphalt kettles, the use of low emission kettles shall be specified and required, as well as the actual

location of the kettle to minimize infiltration of odors into the building or surrounding buildings.

The actual design of the type of built-up roofing may depend on the several factors concerning the facility. The standard of design for built-up roofing systems consists of a 3-ply built-up system with a cold applied modified bitumen cap sheet.

07 53 00 Elastomeric Roof Membranes

Due to the large number of elastomeric membrane roofing systems on the market, if one of these systems is to be utilized on a project, thorough research and investigation of the approved system shall be done. Most single ply systems at Clemson University have been some type of Ethylene-Propylene-Diene-Monomer (EPDM). An elastomeric membrane system shall not be specified without written deviation approval.

07 60 00 Flashing and Sheet Metal

Clemson University has employed different types of sheet metal roofing systems on its facilities. Location, use of the facility, expected life of the system, and architectural considerations can be factors in determining the type of metal roofing system that may be used on a facility.

Sheet metals incorporated into roof systems shall have the equivalent life expectancies of the adjoining roofing system and be compatible with the architectural intent of the facility.

07 71 00 Roof Specialties

Do not specify interior or built-in gutters, and built-in downspout systems unless unavoidable or their use is of primary architectural importance in the historical district (see [Long-Range Framework Plan](#) and [Clemson University Preservation Master Plan](#)). Material selection for gutter and downspout systems shall use the same standards as indicated for other sheet metal flashing and trim (see Section 07 60 00 above).

07 76 00 Roof Pavers

Clemson University has limited installations of roof deck paver systems on their facilities. Specify that all future dead and live loading is accounted for. This includes that from construction activities, maximum occupancy, change of furnishings, green roof irrigation, etc.

07 80 00 Fire and Smoke Protection

07 81 23 Intumescent Fireproofing

Specify that all Fire Caulking adhere to ASTM E814 standards, and that products shall not be mixed in sealing a single penetration.

07 81 23 Penetration Firestopping

Specify that all penetrations shall be sealed in accordance with fire caulking or firestopping assemblies tested to ATSM E814/UL1479, or ASTM E119/UL263 as applicable, Also, specify

that for every type and application of firestopping, a label shall be placed in the proximity of the work stating the type of material, when placed, responsible contractor, and installer name.

PRODUCTS AND MATERIALS- DIVISION 07 – THERMAL AND MOISTURE PROTECTION

Fiberglass Roofing Felts

Tamko, Johns-Manville, or GAF **Modified Bitumen Base Flashing** DynaFlex by Johns-Manville Awaplan Premium by Tamko Ruberoid by GAF SOPREMA

Modified Bitumen Cap Sheet

DynaGlas by Johns-Manville Awaplan Premium FR by Tamko Ruberoid Mop FR by GAF SOPREMA

Roof Drains

Smith Series 1010 –Y-R-C-G
Wade Series W-3000-NH-40-52-53

Sealants

Exposed Joints: Dow Corning 790, SikaFlex 1A, or Tremco Mono Interior Joints: Dow Corning 790 or Tremco Caulking Compound

Fire Caulking

3m, Hilti, Tremco and STI Fire Caulking Products can be used as long as they comply with ASTM E814 standards.

DIVISION 08 - OPENINGS

08 05 00 Common Work Results for Openings

Areaways and other accesses to mechanical rooms, electrical vaults, and other areas containing equipment, including departmental research and teaching equipment, shall be large enough to pass the largest piece of equipment without undue disassembly. The design shall place doors and frames in positions that discourage and minimize the entrance of water without the dependence on caulking and sealants.

All openings will be given unique ID numbers in accordance with [Clemson Room and Door Numbering Standards](#).

08 10 00 Doors and Frames

Doors

Personnel doors are to be 7'-0" in height, minimum. The preferred size for single doors, and for each leaf of pairs of doors, is 3'-0" x 7'-0". The preferred door thickness is 1-3/4", as a

standard. The 7'-0" height shall be maintained even where narrower doors may be necessary. The use of doors less than 7'-0" in height for access to plumbing chases and mechanical equipment spaces is prohibited.

Exit doors are to be designed to receive the appropriate panic hardware. The building plan must locate exit doors so that the stresses are minimized by the impact of hurried egress from the building by its occupants.

Exterior hollow metal doors shall be 14-gauge steel; others may be 16-gauge.

Heavy doors, fire doors, and doors wider than 3'-0" must be installed using four heavy duty ball bearing butts.

All storefront type doors must be designed with the following minimum dimensions: 5" vertical stiles, 8" top rail, and 10" bottom rail. Those receiving panic hardware must also have at least an 8" mid rail. All rails and styles are to be constructed of aluminum.

Frames

Steel door frames for openings wider than 3'-0", and all steel frames for exterior doors shall be constructed of 14-gauge material. Interior frames for doors narrower than 3'-0" may be constructed of 16-gauge material. All frames are to be fully welded and shall have double rabbeted profiles with equal sized rabbets.

"Wrap around" steel frames shall be used in masonry walls so that the masonry wall fits into the frame. The use of "inset" type frames or "knock-down" type frames are prohibited.

08 50 00 Windows

The design and selection of window types and materials is dependent on the facility design, the location of the facility within the campus, and any specialty use of the facility.

The use of window wells is discouraged.

08 60 00 Roof Windows and Skylights

The use of roof windows and skylights is discouraged.

08 71 00 Door Hardware

Design Standards

The Building Code deals with the type of hardware required for doors of certain types and uses. It mandates specific requirements concerning hardware for egress doors, doors in smoke barriers, stairway enclosures, and other doors between rooms and fire-rated exit corridors. Selection of hardware is also influenced by the requirements and recommendations of ANSI A117.1 for access by the persons with disabilities. The design documents must clearly indicate the specific hardware intended for each door.

Exterior pairs shall have trim/pull/lever on one leaf only. If access controlled, it shall be the active leaf. The secondary or "inactive" leaf shall be exit only and less trim/pull/lever. Every

effort shall be made to ensure that free egress cannot be hindered by means of chaining, barring or otherwise disabling trim/pull/levers from the exterior of the building.

Interior pairs of doors shall have trim/pull/lever on the active leaf only which shall be the right side as views from the exterior, "Right Hand Reverse Active". The secondary or "inactive" leaf shall be exit only and less trim/pull/lever. Every effort shall be made to ensure that free egress cannot be hindered by means of chaining, barring or otherwise disabling trim/pull/levers from the exterior of the building. Pairs of doors shall have keyed removable mullions.

Locksets and panic hardware for classrooms, offices and other spaces that would be appropriate for occupants to secure in place shall have locksets equipped with interior thumb latch such that the door can be secured from the interior of the room. The thumb latch must be part of the hardware and overridden by the normal function required to exit the space. Rooms such as storage rooms and mechanical rooms shall have storage function locks that always remain locked.

For assembly spaces with panic hardware, provide panic hardware with double cylinders. Provide a thumb turn in the cylinder on the inside of the room.

Finish Hardware

Finish hardware must normally be bid as an allowance item to the construction contract unless it includes access control hardware. The A/E must prepare an adequate hardware schedule for review by the Owners' locksmith prior to bidding the project. If the project is to include access control; the Division 28 Access Control vendor shall furnish and install all electrified door hardware and accessories. The Division 8 vendor shall furnish and install all non-electrified components. For new construction, all door and frame preparation shall be performed by the Division 8 vendor. The designer shall coordinate with the Division 28 Access Control vendor and the Owner's locksmith to develop appropriate hardware schedule compliant with Division 28 specifications. Every effort shall be made to ensure consistency in manufacturer, aesthetic and functionality across all door hardware provided by Division 8 and Division 28.

The materials, design, and finish of the specified hardware must be consistent with those currently in use at Clemson University. Consult with the Project Manager for specific requirements concerning these selections in order to allow proper review of the selected hardware. Please review the PRODUCTS AND MATERIALS section at the end of this Division for selection of the approved hardware devices.

All lock sets, exit devices, removable mullions and keyed exit alarms shall be provided with appropriate housings to accept the Clemson standard Best 7-pin interchangeable core including cylinder

The following products must not be used on University facilities:

- Pivot hinges on both interior and exterior doors
- Bottom rail locking devices
- Concealed or flush mounted head and foot bolts with the exception of head bolts for fire hold open hallway doors
- Concealed closers of any kind.
- Electrified strike plates or strike plates on mullions.

All locksets shall be equipped with housings to accept interchangeable cores as manufactured

by the Stanley Security Solutions (formerly Best Universal Lock Company) of Indianapolis, Indiana. The project must specify the use of temporary or "construction" cores during the construction phase of the project.

Specify the contractor to begin coordinating the installation of permanent cores with the Clemson University lock shop a minimum of 90 days prior to substantial completion.

08 71 13 Automatic Door Openers

Every new building must have mechanically assisted door operators at primary entrances. The mechanical mechanisms must be activated by push-plate actuators protected with an all-weather seal. Where automatic door openers are specified on access controlled openings; the Division 28 Access Control vendor shall furnish and install the ADA operator system. The A/E shall coordinate with the Division 28 Access Control vendor to ensure that all required pathways, cabling, installation methods and testing procedures are specified for proper integration with the access control system.

Power for automatic door openers to be provided by Division 26.

Door hardware will require door preparation to be defined under project hardware schedule.

Conduit and/or pathways from accessible ceiling space and/or head-end equipment to all door devices shall be provided by Division 26.

All Card reader equipment and installation, including the Door Hardware, shall be provided by the University.

Where an automatic door operator is coordinated with and magnetic lock, system design must provide mortise cylinder type key switch for two-position (on/off) operation.

All card reader and/or electrically unlocked or monitored doors shall be equipped with door position switches and request-to-exit functions integral to the door hardware.

Card reader and/or electrically unlocked doors shall be operated as pairs where applicable.

All access control power supplies and control panels shall be integrated into the emergency fire alarm panel in instances where an electronically locked door does not allow for a mechanical means of free egress.

08 80 00 Glazing

The Building Code addresses the use of glass in buildings. It incorporates, by reference, the provisions of ANSI Z97.1 concerning wire glass for use in fire rated doors, windows and view panels in rated walls as well as those of CPSC 16-CFR, Part 1201, relating to the use of glass in hazardous locations. The designer shall be aware of these code requirements and restrictions and incorporate them in the design.

The selection of glazing material (i.e., tinted glass, etc.) may also be influenced by the type of facility and its location within the campus and its relationship with surrounding facilities.

Glazing shall also be selected paying careful consideration to the impact of daylighting,

thermal comfort, glare, and solar heat gain.

PRODUCTS AND MATERIALS- DIVISION 08 – OPENINGS

All hardware removed must be returned to Clemson University lock shop.

All lock sets, exit devices, removable mullions and keyed exit alarms shall be provided with appropriate housings to accept the Clemson standard Best 7-pin interchangeable core including cylinder.

Electrified door hardware is specified in Division 28.

Mortise Locksets

Stanley Security Solutions: Best Hardware/45H Series, 7 Core Housing, "AT" Function for classrooms and offices spaces. "D" Function Code for mechanical rooms and storage rooms. 15 Lever/Knob Style, "J" Trim Style with Full Escutcheon, 626 Finish, Door Hand - RH, LH, RHR, LHR.

Sargent: 8200 series mortise lock, 7 core housing. Classrooms and office spaces shall have "05" Function. Storage rooms and mechanical rooms shall have "04" Function Code, 'L' lever, LW1 Escutcheon; RH, LH, RHR, LHR

Cylindrical Locksets

Stanley Security Solutions: Best 93K Series Cylindrical Lock. Office Spaces and Classrooms shall have Office Function. Storage rooms and mechanical rooms shall have Storage Function.

Sargent: 10 Line Cylindrical Lock. Office spaces and classrooms shall have Function 05 Office or Office. Storage rooms and mechanical rooms shall have function 04 Storage or closet Function.

Panic Hardware

Von Duprin 98/99 series - exterior and interior doors

Sargent 8000 series- exterior and interior doors

Detex / Advantex 10/40 series – exterior and interior doors

Removable Keyed Mullions

Von Duprin KR54 series

Automatic Door Opener

Record 8000/8100 Series ADA Low Energy Operator

Closers

LCN, 40 Series and/or 41 Series.

Hinges

Select Hinges (Select Products Limited) - full mortise - specify continuous hinges on exterior doors.

Pemko – continuous hinges

McKinney – full mortise hinges

Cores

Interchangeable (7-pin) cores as manufactured by Stanley Security Solutions (Best Universal). Cores shall be provided by University. Cylinders/housings shall be provided by vendor.

Doors

Exterior doors with wide stile profile only.

DIVISION 09 - FINISHES

09 05 00 Common Work Results for Finishes

Clemson University maintains a sole source contract to provide installation of approved flooring materials for all installations. The contractor must review and submit to Clemson for evaluation of the pricing received in accordance with the terms and conditions of that contract. Specific details of each contract will be provided upon request. At a minimum, the following must be included for the flooring provider in the project specifications; name, contact information, solicitation number, and expiration date. Documentation of the evaluation of this pricing information must be kept in each procurement file for review by Audit and Certification.

All interior finishes shall meet the Volatile Organic Compound limits given in the [Green Globes Design Guide for New Construction](#).

09 50 00 Acoustical Ceilings

All suspended tile ceilings are to be constructed with 2'x2' tiles.

09 60 00 Flooring

Due to both the environmental impact and lifelong maintenance costs of certain types of resilient flooring, the use of flooring requiring continued "waxing" and other labor and material intensive maintenance, the use of these types of flooring (VCT or other similar products) is not allowed without approval of the Chief Facilities Officer.

Neutral colors are preferred. Avoid specifying novel or unique materials. Specify that the contractor is to be responsible for the initial cleaning of any flooring product and responsible for its protection until completion and final acceptance of the facility.

Specify that the agreed upon amount of attic stock be provided to the Owner upon completion of the project.

The Designer shall specify flooring material that is uniform throughout areas that are subject to space reconfiguration via relocation of partitions and/or cubicles. This shall be done to ensure consistent aesthetics and account for program requirements within the facility that necessitate frequent space reconfiguration.

The use of vinyl laminate, marmoleum (MCT), terrazzo and other low maintenance flooring, with a focus on the life cycle environment impact, must be used.

“Wet” laboratories shall be finished with heavy duty, chemically resistant, impermeable, slip resistant seamless flooring with integral base. Tiles and wooden planks are not acceptable in these areas.

Rooms called laboratories that do not use chemicals, radiation, genetic materials or biological materials may use other appropriate flooring materials. Examples of these rooms would be Speech Labs, Computer Labs, Language Labs, etc.

Floors in storage areas for corrosive liquids shall be of liquid tight construction.

09 66 00 Terrazzo

Terrazzo floors are to be sand cushion type, installed over a depressed slab. Bonded terrazzo (terrazzo surfacing installed integrally with a structural concrete slab) is not to be specified.

09 68 00 Carpeting

The designer shall be aware of the restrictions on interior finishes as mandated by the Building Code, and all materials specified shall meet these code restrictions and any references therein to applicable fire codes.

The proposal of the color and type of carpet must be included with the presentation of other interior finishes for the facility.

Carpet may be bid as an allowance item or bid through the Owner as a separate contract.

09 90 00 Painting and Coating

Paint colors must be presented to the University Project Manager for approval in conjunction with the presentation of other finishes to be used within the facility.

Specify that all exposed piping, ductwork, etc. is to be painted by the contractor. Prohibit spray painting in the vicinity of machinery and equipment unless adequate masking and protection of the equipment and associated valves, gauges, etc. is in place.

PRODUCTS AND MATERIALS- DIVISION 9 – FINISHES

Interior Paints

Select from the [Clemson Facilities Interior Design Paint Standard Program](#).

Flooring

Select from the [Carpet/Flooring Price Spreadsheet](#).

DIVISION 10 - SPECIALTIES

10 11 00 Visual Display Surfaces

The University primarily utilizes dust free marker boards in lieu of traditional chalkboards.

The designer shall be aware of the program requirements for the spaces within the facility and specify the appropriate application of any visual display surfaces.

In classroom buildings, teaching laboratories, and other similar facilities, provide for each faculty member a personal bulletin board, located at each faculty door, for posting faculty hours, class grades, etc. Bulletin boards 18" x 18" in size are recommended.

10 13 00 Directories

The procurement and installation of facility directories must be included in the bid documents as a Signage Allowance.

10 14 00 Signage

The procurement and installation of signage (both interior and exterior) must be included in the bid documents as a Signage Allowance.

All signage shall comply, as applicable, with the [Exterior Signage Guidelines](#) and [Interior Signage Guidelines](#) published by the University Planning and Design Office. The letter style is to be consistent with existing University graphics.

Room name and number signs are located on the wall adjacent to the lock side of the door rather than on the door itself and centered 48-60 inches above the floor.

In addition to the room number, residence hall signs shall have a built-in card holder under the room number.

Signage that provides emergency information or general circulation directions or identifies rooms or spaces must conform to requirements of ANSI A117.1 and ADA, as to character proportion and color contrast. Signage identifying rooms and spaces must also meet ANSI and ADA requirements for tactile characters and/or symbols.

10 21 00 Compartments and Cubicles

10 21 13 Toilet Compartments

All toilet partitions are to be the ceiling hung type. Clemson prefers polymer based solid surfacing, solid core phenolic, and solid plastic toilet compartments and screen systems designed for long term durability. Laminate, powder coated steel, and stainless steel are discouraged.

Compartments for the accommodation of the physically handicapped are to be sized, arranged, and equipped to meet current requirements of ANSI A117.1 and ADA requirements. When space allows, additional ambulatory accessible stalls are encouraged.

Each toilet compartment is to be equipped with a coat hook, and with a double roll toilet tissue holder. Compartments in women's toilets are to be equipped with sanitary napkin disposal receptacles.

10 28 00 Toilet and Bath Accessories

Soap dispensers, paper towel dispensers, toilet paper dispensers, tampon/sanitary napkin receptacles and trash receptacles will be provided by the owner.

Do not construct openings in countertops to receive trash.

Accessible reach heights are to be maintained on all mirrors, shelves, coat hooks, dispensers, grab bars, etc.

Mirrors must be located such that reflected images will not be presented to adjacent rooms.

All permanent accessories must be surface mounted. As with toilet partitions, Clemson prefers solid surface countertops and shelves in bath locations.

Design space to accommodate one 23-gallon waste receptacle (owner provided) near the door and show correct accessible locations for all other owner provided accessories. Refer to Products and Materials section below for models of Owner supplied units.

10 41 00 Emergency Access and Information Cabinets

10 41 16 Emergency Access Key Cabinets

Specify that all new facilities and facilities undergoing significant exterior renovation shall have a Series 3200 Knox-Box emergency access high security key box. Location of this key box will be determined by the CU Fire Code Official.

PRODUCTS AND MATERIALS- DIVISION 10 – SPECIALTIES

Emergency Access Key Cabinets

Series 3200 Knox Box

Paper Towel Dispensers

Do not place Paper Towel Dispensers in University restrooms. Owner will provide Georgia Pacific enMotion Automated Touchless Towel Dispenser. Model #: 59462

Seat Cover Dispensers

Do not place Seat Cover Dispensers in University restrooms.

Soap Dispensers

Do not place Soap Dispensers in University restrooms. Owner will provide Gojo FMX-12 Clean Gene Dispenser-Black with Tiger Logo.

Tampon Dispensers

Do not place tampon dispensers in University restrooms

Tampon/Sanitary Napkin Receptacles

Do not place Tampon/Sanitary Napkin Receptacles in University restrooms. Owner will provide Tough Guy 2NXW1: 10" Polypropylene, surface mounted, self-closing door with removable rigid liner.

Toilet Paper Dispensers

Do not place Toilet Paper Dispensers in University restrooms. Owner will provide Georgia Pacific Compact Side-by-Side Double Roll Coreless Bathroom Tissue Dispenser. Model #: 56784

DIVISION 11 – EQUIPMENT

11 05 00 Common Work Results for Equipment

Installation

The installation of equipment on a project will usually fall under one or more of the following conditions:

- **Contractor Furnished – Contractor Installed**
Installation shall conform to the provisions of the Contract Documents and be coordinated by the general contractor. Specify that the installation shall be performed by competent and trained workmen in accordance with all applicable codes and governing regulations. Specify that installation shall comply with manufacturer's instructions. Where appropriate, the installation by the manufacturer shall be specified. Documents must specify any necessary inspection by the installer that may affect installation. Specify that the installer shall not proceed until any unsatisfactory conditions are corrected. Specify that any defects caused by unsatisfactory conditions or untimely installation shall be corrected at no cost to the Owner.
- **Owner Furnished – Contractor Installed**
Same requirements as Contractor Furnished – Contractor Installed
- **Owner Furnished – Owner Installed**
Contract Documents for the general construction contract shall identify equipment,

any space requirements, and any utility connections required. Specify that installation must be coordinated with the Project Manager.

- **Contractor Furnished – Owner Installed**
Same requirements as Owner Furnished – Owner Installed

Delivery

Specify that coordination of delivery shall be the responsibility of the general contractor. The contractor shall have a representative on site to receive the shipment. The Owner will not coordinate this work.

Specify that all debris and crating material shall be removed from the site and properly disposed.

Testing and Operation

Specify that any equipment requiring testing of its operation is to be accomplished and properly documented, including any safety devices. When appropriate, operation and maintenance instruction shall be provided to the Owner's personnel. This instruction shall include demonstration of proper use, maintenance, safety features, cleaning procedures, and proper storage and handling. Provide operation and maintenance manuals as appropriate in accordance with applicable sections of this manual.

11 08 00 Commissioning Equipment

When equipment is to be provided within the scope of the project and the design/selection is included as part of the A/E agreement, the services provided will include the identification of user needs, formulation of budgets, development of design documents for the purchase and installation of the equipment. Identification of user needs, and formulation of budgets shall be accomplished during the programming and design development phases of the project. The entire process shall be closely coordinated with the user group with the Project Manager involved. The result of this process must ensure compatibility with user requirements, current University standards, as well as compliance with governing codes and regulations.

Plans and specifications shall be prepared that adequately supply information necessary to purchase and install the equipment as approved by the University. Any applicable warranty or guarantee on material, installation, and/or manufacturing workmanship must be coordinated with the Project Manager. Approval of acceptable manufacturers shall be obtained from the Project Manager prior to the release of documents.

Purchasing

The University prefers that equipment be furnished and installed under the provisions of the general construction contract. When this method of procurement is not possible or practical, it may become necessary to specify and purchase this equipment through the University Purchasing Division. This method also requires complete bid documents including instructions to bidders which will detail provisions from related documents that may apply. on current state procurement regulations and procedures. When this method of procurement is used, the documents for the general construction contract must contain any necessary coordination requirements for this separate delivery and installation.

11 21 00 Retail and Service Equipment

11 21 23 Vending Machines

The location, type, and number of vending machines will be determined in conjunction with University Housing and Dining. Allocate suitable electrical and data ports in accordance with Divisions 26 and 27.

11 82 00 Solid Waste Handling Equipment

11 82 13 Solid Waste Bins

The University uses an 8 cubic yard, front load dumpster method of refuse disposal. These are to be enclosed in an approved screening device and located in a service area where they are accessible to a front-loading truck, but not be objectionably visible to the general public. Site location and enclosure is to be coordinated with University Planning and Design, and the Director of Custodial, Recycling and Solid Waste.

Pay special attention to designing adequate structural integrity of pavement, etc. around the dumpster container to minimize wear by repeated service. Concrete pavement has performed best in the area occupied by the truck during the actual lift operation of the container.

Allocate space for one 23-gallon waste receptacle located near the door of each restroom.

Dormitory area waste receptacles and recycling containers shall be limited to 16 gallons or be fire rated with a lid.

11 82 23 Recycling Equipment

It is standard practice for recycling bins to be located in alcoves adjacent to vending machines and break rooms, except in Dormitories which are in enclosures.

Specify that a minimum of an 8'x12' recycling/storage room be provided in each building near the loading dock or service entrance.

DIVISION 12 - FURNISHINGS

12 05 00 Common Work Results of Furnishings

Installation

The installation of equipment on a project will usually fall under one or more of the following conditions:

- **Contractor Furnished – Contractor Installed**

Installation shall conform to the provisions of the Contract Documents and be coordinated by the general contractor. Specify that the installation shall be performed by competent and trained workmen in accordance with all applicable codes and governing regulations. Specify that installation shall comply with manufacturer's

instructions. Where appropriate, the installation by the manufacturer shall be specified. Documents must specify any necessary inspection by the installer that may affect installation. Specify that the installer shall not proceed until any unsatisfactory conditions are corrected. Specify that any defects caused by unsatisfactory conditions or untimely installation shall be corrected at no cost to the Owner.

- **Owner Furnished – Contractor Installed**

Same requirements as Contractor Furnished – Contractor Installed

- **Owner Furnished – Owner Installed**

Contract Documents for the general construction contract must identify furnishings, any space requirements, and any utility connections required. Specify that installation must be coordinated with the Project Manager.

- **Contractor Furnished – Owner Installed**

Same requirements as Owner Furnished – Owner Installed

Delivery

Specify that coordination of delivery shall be the responsibility of the general contractor. The contractor shall have a representative on site to receive the shipment. The Owner will not coordinate this work.

Specify that all debris and crating material shall be removed from the site and properly disposed of.

Testing and Operation

Specify that any furnishings requiring testing of its operation is to be accomplished and properly documented, including any safety devices. When appropriate, operation and maintenance instruction shall be provided to the Owner's personnel. This instruction shall include demonstration of proper use, maintenance, safety features, cleaning procedures, and proper storage and handling. Provide operation and maintenance manuals as appropriate in accordance with applicable sections of this manual.

12 08 00 Commissioning of Furnishings

When furnishings are to be provided within the scope of the project and the design/selection is included as part of the A/E agreement, the services provided will include the identification of user needs, formulation of budgets, development of design documents for the purchase and installation of the furnishings. Identification of user needs, and formulation of budgets shall be accomplished during the programming and design development phases of the project. The entire process shall be closely coordinated with the user group. The result of this process must ensure compatibility with user requirements, current University standards, as well as compliance with governing codes and regulations.

Plans and specifications shall be prepared that adequately supply information necessary to purchase and install the furnishings as approved by the University. Any applicable warranty or guarantee on material, installation, and/or manufacturing workmanship must be clearly communicated and documented. Approval of acceptable manufacturers shall be obtained from the Project Manager prior to the release of documents.

Purchasing Standards

The University prefers that furnishings be procured and installed under the provisions of the general construction contract. When this method of procurement is not possible or practical, it may become necessary to specify and purchase these furnishings through the University Purchasing Division. This method also requires complete bid documents including instructions to bidders which will detail provisions from related documents that may apply. Bid evaluations and recommendations shall be provided to the Project Manager for review and approval prior to award of a contract. When this method of procurement is used, the documents for the general construction contract must contain any necessary coordination requirements for this separate delivery and installation.

12 48 00 Rugs and Mats

12 48 13 Entrance Floor Mats and Frames

Campus buildings with heavy student or public traffic must incorporate walk-off mats, recessed in the floor, at building entries and vestibules. The preferred distance depth is at least six feet outside and twelve feet inside and must extend at least the full width of the doors. They must be easily removed for cleaning and the texture selected to clean shoes quickly. The type of walk-off mat is left to the discretion of the design team in collaboration with the Project Manager. Sections of the mat material must be run opposite to the flow of traffic and comply with ADA. Specify the agreed upon amount of attic stock to be turned over to the Owner at the end of the project.

12 50 00 Furniture

12 50 05 Furniture Warranty

Clemson University requires a warranty period for all furniture purchases of not less than ten years from date of acceptance of the products. If, during the warranty period, faults develop, they shall be repaired or replaced without any additional cost to the University including those associated with transportation and installation.

Exceptions to the Ten Year Warranty Requirement will be considered a deviation from these standards and will be evaluated on a case-by-case basis. Should the University agree to any exceptions from the Ten Year Warranty Requirement, the details of these exceptions will be included in the appropriate contract documents.

12 60 00 Multiple Seating

12 61 00 Fixed Audience Seating

All fixed seating for theatres, auditoriums, lecture halls, classrooms, etc. shall carry a minimum 10-year warranty on the seating from the manufacturer against poor workmanship, material defects, functional failure, etc.

DIVISION 13 - SPECIAL CONSTRUCTION

Clemson University often has special purpose needs in the academic and athletic

environment. Auditoriums and classrooms, laboratories, clean rooms, information technology, and instrumentation needs are often integral to the functionality the building. Designers shall consult with the Owner user groups early in the design development process and coordinate with the Project Manager any special construction needs while maintaining long term flexibility in building operations.

DIVISION 14 - CONVEYING EQUIPMENT

14 20 00 Elevators

The University utilizes both traction operated and hydraulic operated elevators, depending on the facility and the application. Traction elevators are preferred over two stories. If a hydraulic elevator is selected for use, the designer shall adequately cover subsurface information for the intended installation of the hydraulic jack.

All elevator designs and installations must comply with all applicable codes and regulations, including those of ADSI A17.1. The designer shall be especially aware of fire protection code requirements affecting the elevator installation. Specify that the contractor shall be required to obtain the necessary operating permits from the South Carolina Department of Labor and Licensing prior to Substantial Completion of the facility, and that warranties on the elevator installation shall commence at the date of Substantial Completion.

The design shall specify all necessary provisions to allow the installation of a telephone in each elevator cab, including all conduits and associated wiring devices required for the installation. The telephone instrument itself will be furnished and installed by the Owner's Telecommunications personnel.

All elevators shall be sized, at a minimum, according to Section 3002.4 of the 2015 IBC to accommodate a standard EMS Stretcher (24"x84" w/ 5" Corner Radii).

Specify that the contractor and/or the elevator manufacturer and installer shall furnish complete diagrams for both power and control wiring of the elevators installed and included in the bound set of Maintenance Manuals and posted in the elevator equipment room. Dedicated elevator equipment rooms are required.

DIVISION 21 - FIRE SUPPRESSION

21 05 00 Common Work Results for Fire Protection Systems

Scope

Fire Suppression Systems are required in all new Clemson University buildings or portions of buildings as designated by the currently adopted codes.

Existing buildings at Clemson University that undergo renovations that exceed 50% of the building size or value shall be required to have Fire Suppression Systems as if the building were new construction.

Design Standards

Designer qualifications: Fire Sprinkler System design shall be entrusted only to South Carolina Registered Professional Engineers with training and experience in fire sprinkler and fire alarm system designs and listed in the SC State Board of Registration for Professional Engineers

Provide a design for a complete system with specifications and drawings that show site plans, floor plans, riser diagrams, piping schedules, area hazard classification, building cross sections, device types and locations, wiring diagrams, power requirements, back-up power supplies, including any necessary details to accurately depict the scope of work included in the project. Design must include all nozzles, piping, bracing, hangers, valves, tanks, and components necessary to furnish a complete system for the facility.

The design shall include all Underground and Above Ground components of Fire Sprinkler, Standpipe, Hose Station, Fire Hydrant, and Fire Pump Systems.

For projects not on Clemson's main campus, consult with the responding Fire Department to coordinate the preferred type and location of hydrants and Fire Department Connections.

Design must specify the necessary testing of the system prior to the system being placed into service.

Provide engineer-sealed Fire Sprinkler System Specification Sheet, on the [form\(s\) provided by the SC Office of the State Fire Marshal](#).

When in receipt of an acceptable contractor submittal, provide engineer-sealed Certificate of Compliance, on the [form\(s\) provided by the SC Office of the State Fire Marshal](#).

See Division 28, Section 28 30 00, for information and instructions concerning the design and installation of Fire Detection and Alarm Systems

Submittals

Specify what submittals, if any, must be made to the various AHJ. Specify which approvals must be obtained before work may begin. Clemson University Fire Code Official must approve all plans that include or affect any Fire Protection System.

Materials and Components

Specify that all materials and components used in any newly installed, upgraded, or retrofitted Fire Protection System must be listed by an approved agency.

Specify that all materials and components used in any new Fire Protection system must be new. Reused and/or refurbished materials and/or components are not acceptable. For upgraded and up-fitted systems, reuse of existing materials and/or components is acceptable only with prior written approval of the Owner and the Engineer.

Acceptance Testing

Specify that all systems be tested according to the adopted Codes and Standards and that all required documentation of testing and test results be submitted to the Owner and Engineer of Record. Specify that the Contractor give the Owner and Engineer a minimum of two (2) working days' notice before conducting tests to allow the Owner and/or Engineer the

opportunity to witness the testing. The CU Fire Marshal, or his designee, shall be present to witness testing of all fire protection apparatus.

21 10 00 Water-Based Fire Suppression Systems

21 11 00 Fire Suppression Systems Water Piping

Specify that underground piping and fittings shall be Ductile Iron Minimum Pressure Class 51 with thrust resisting couplings at all fittings, and at least 10 linear feet beyond the fitting. Underground piping also must comply with Divisions 31 (Earthwork) and Division 33 (Utilities) and the [Urban Forest and Landscape Management Policy](#).

Specify that above ground piping be steel: Minimum Schedule 40 with threaded fittings and connections for piping of nominal diameters up to 3". Minimum Schedule 10 for piping of nominal diameters above 3" and joined with roll grooved, welded, or flanged connections. At no time shall segmented welding or plain-end mechanical couplings/fittings be used that employ steel gripping devices to bite into the pipe as a means of joining.

Specify that drainage piping and dry piping must be galvanized, of the same minimum schedule and joined with the methods as listed directly above.

Specify that all control valves supplying water to a Fire Sprinkler System be installed such that they are readily accessible. These valves shall also have a tamper switch that must be monitored when a Fire Alarm System is provided.

Specify that all hangers must conform to NFPA 13. Powder-actuated fasteners are not permitted.

Specify that all fire sprinkler systems be designed with seismic considerations. Specify that seismic bracing, clearances, appropriate couplings, restraining straps, and all other aspects of protecting fire suppression system components in areas subject to earthquakes be followed as outlined in adopted Codes and Standards.

The Reliable Automatic Sprinkler Company currently supplies most types of sprinkler heads and valves when available to Clemson University at no cost. It is intended that we utilize this asset on all projects. For specific technical questions please contact Reliable Sprinkler at: technicalservices@reliablesprinkler.com

Specify that fire sprinkler systems are to be protected from freezing and are not to be subjected to temperatures below 40°F.

Specify that all underground piping shall be flushed at a minimum of full system flow until the water runs clear before connecting the underground piping to the fire sprinkler system or fire pump, if a pump is required.

21 11 16 Fire Hydrants

Specify that fire hydrants are to be Mueller Centurion model or approved equal. Specify that placement of all fire hydrants, and fire department connections are to be pre-approved by the Fire Code Official.

21 11 19 Fire Department Connections

Fire Department Connections are to be sized and located as per the requirements of the

International Fire Code and NFPA Standards. Free standing FDC's are to be installed according to the [CUFD Free Standing FDC Standard](#). Both the location and orientation of the connection shall be reviewed and approved by the University Fire Code Official.

Specify that minimum Emergency Vehicle Turning Radius is to be per the International Fire Code and the Clemson University Fire Department. The Clemson University Fire Code Official is to review and pre-approve all proposed roadways, driveways, and parking lots to ensure adequate accessibility for firefighting apparatus.

[Access Design Requirements](#) are available on Clemson's website. Please contact Clemson University's [Building Official](#) for any questions regarding these requirements.

21 13 16 Dry-Pipe Sprinkler System

Specify UL listed or FM approved air compressors for fire service. Nitrogen generators shall be used on major construction and renovation projects unless otherwise approved by the owner.

21 20 00 Fire Extinguishing Systems

All new computer room and electronic systems fire protection shall be in compliance with NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems.

PRODUCTS AND MATERIALS- DIVISION 21 – FIRE SUPPRESSION

Fire Hydrants

- Mueller Centurion

Emergency Access Key Cabinets

- Series 3200 Knox Box

Underground Piping

- AWWA C150/C151 ductile iron, thickness class 51, bituminous coated, cement lined, per ANSI A21.4, with UL approved thrust-restraint type couplings.

Above Ground Piping

- ASTM A795; ANSI/ASTM A53; ASTM A135.
- Piping less than or equal to 3" diameter shall be Schedule 40 with threaded couplings.
- Piping greater than 3" diameter shall be minimum Schedule 10, with roll grooved or welded couplings.

DIVISION 22 - PLUMBING

22 05 00 Common Work Results for Plumbing

22 05 19 Meters and Gauges for Plumbing Piping

Pressure gauges shall have maximum readings approximately two times the expected working pressure. A gauge cock must be specified between each gauge and the main line.

22 05 23 Valves

Specify that valves be installed with stems horizontal or above except as required for accessibility. Arrange valve handles to be easily accessible.

All valves shall be identified with metal tags. In addition to permanent metal tags, valves that are obscured by drop ceilings, movable structures, etc. are to have their access points labeled with same nomenclature as the metal tag on drop ceiling/obscuring structure such that it is visible upon entry onto the space where the valve is located.

Specify that valves be installed at all locations requiring shut off during maintenance.

Require that hose bibcocks shall be freeze protected with an escutcheon plate on the wall. All hose bibcocks, including wall hydrants and sill cocks shall be equipped with a vacuum breaker as per instructions from the S.C. Department of Health and Environmental Control (DHEC).

22 05 23 Hangers and Supports for Plumbing Piping and Equipment

The design shall provide foundations, supports, and means of attachment to the structure for all equipment, fixtures, and piping under this Division.

Specify the use of the appropriate beam clamps, brackets, and expansion shields for supporting and securing equipment, fixtures, and piping.

Specify wall clamps and brackets used for support of piping and equipment from concrete or solid masonry shall be secured with self-drilling concrete fasteners.

Clamps and brackets on hollow masonry block construction shall be supported with toggle bolts.

Specify that horizontal, parallel, and adjacent piping shall be supported by gang hangers with appropriately sized hanger rods (3/8" minimum) and clamps to match the pipe.

Specify that hangers supporting insulated piping be sized to fit over the insulation and have an integral pipe saddle to prevent damage to insulation.

Specify that supports and clamps in contact with copper pipe shall be copper plated.

22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment

Shock absorbers for plumbing fixtures shall be the same size as the line on which they are installed, up to 1" pipe size. Pipes larger than 1" shall have one-inch shock absorbers installed. Shock absorbers must be installed at the end of all branch lines. No pipe extensions are to be used in place of shock absorbers.

22 05 53 Identification for Plumbing Piping and Equipment

Specify that all piping is to be marked and coded with color coded tape as follows, in a neat and uniform manner. Markings shall not exceed 20 feet apart in mechanical rooms. The

wording and color coding shall be coordinated with other mechanical, electrical, and other trades and suppliers.

See Utility Piping Identification for specific markings.

22 05 76 Facility Drainage Piping Cleanouts

The design shall include all necessary clean-outs for efficient maintenance of the waste piping system for the facility. Clean-outs located in exposed areas of the facility shall be equipped with a chrome plated cover plate terminated just inside finished walls. Provide clean-outs in each exposed P-Trap not integral with the fixture. Clean-outs shall be the same nominal size of the pipe for sizes 4" and smaller and 4" nominal size for larger pipe. Cleanouts shall be installed at the base of all stacks, not more than 50 horizontal feet apart, at every change of direction greater than 45 degrees, and be accessible with at least 12 inches of clearance to facilitate maintenance. (Housing: Independent or double Cleanout for servicing building within 5' of foundation/footing)

22 07 00 Plumbing Insulation

New insulation systems must conform to adopted energy code but in no case, will be less than listed in Products and Materials without permission from the Project Manager. Additions, Alterations, and Repairs will extend insulation the full length of the project scope as required by new construction.

All insulation must have composite (insulation jacket and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard ratings as tested under procedure ASTM E-84, NFPA 225 and UL 723 not exceeding a Flame Spread of 25 and a Smoke Development of 5.

All pipe insulation must be continuous through walls, partitions, ceiling openings and sleeves. Where pipes pass through fire-rated floors, walls, or partitions, the use of a UL approved system for through penetrations is required. The annular space around the pipes must be packed with mineral wool and sealed at each exposed edge to maintain the rating of the system.

Insulation on all cold surfaces must be applied with a continuous, unbroken vapor seal. Specify that hangers supporting insulated piping be sized to fit over the insulation or if anchors are secured directly to cold surfaces they must be adequately insulated, and vapor sealed to prevent condensation.

22 11 00 Facility Water Distribution

22 11 13 Piping

Specify that all piping be neatly arranged, running parallel with primary lines of building construction, and that right-of-way must be given to piping that requires gravity sloping for drainage. All domestic water piping shall be slope for drain down. All changes in pipe direction shall be made with appropriate fittings.

Where possible, all water piping shall be located in heated areas of the facility.

All domestic water supplies that require backflow prevention shall have a redundant backflow preventer of equal capacity plumbed in parallel with the primary unit as to negate the need to shut off water to an entire facility for service or repair.

Overhead piping shall be located below ceiling insulation to prevent freezing. Water, soil, or waste piping is not permitted on exposed parts of the building.

No pressure piping is allowed beneath the building slab unless associated with fire suppression systems.

Utility piping entering the facility from underground must always do so through a utility trench or areaway as to remain serviceable.

Regulations contained in the Safe Drinking Water Act concerning lead and copper concentrations shall be complied with, including the specification and the selection of piping materials to ensure this compliance.

Specify that unions or flanges be provided at all connections to each piece of equipment and on both sides of valves and other in-line devices that require removal for maintenance. Specify that cast bronze adaptors be used at all copper to flanged or IPS connections.

Specify that piping passing through or under corrosive fill be protected by appropriate coatings, wrapping, or galvanized sleeves. Sleeves shall be at least two pipe sizes larger than the pipe plus insulation.

Require all rough-in plumbing to be sealed off with test plugs, caps, etc., until fixtures are ready to be installed.

Specify that all openings between pipes and pipe sleeves shall be sealed with a flexible fire-retardant sealant at fire walls and where required to inhibit noise transmission.

Specify that there shall be no visible penetrations to the exterior envelope of building.

22 13 00 Facility Sanitary Sewerage

22 13 16 Piping

Specify that all piping be neatly arranged, running parallel with primary lines of building construction, and that right-of-way must be given to piping that requires gravity sloping for drainage. All changes in pipe direction shall be made with appropriate fittings.

Specify that traps be installed for each fixture and floor drain, with access to the traps on upper floors.

Require all rough-in plumbing to be sealed off with test plugs, caps, etc., until fixtures are ready to be installed.

Specify that all openings between pipes and pipe sleeves shall be sealed with a flexible fire-retardant sealant at fire walls and where required to inhibit noise transmission.

Utility piping entering the facility from underground must always do so through a utility trench or areaway as to remain serviceable.

Specify that there shall be no visible penetrations to the exterior envelope of building

Specify that cleanouts for sanitary sewer lines serving individual buildings be made using two 45 degree Y-fittings joined in opposing directions so that equipment can service either the building or the public utility without making a 90 degree turn within one fitting.

Specify that there shall be no visible penetrations to the exterior envelope of building.

22 13 19 Specialties

Floor drains shall be provided where required by the activity within the area. Provide floor drains in all public rest rooms. Floor Drains can be omitted in private restrooms such as those attached to individual offices with permission from the Project Manager.

Provide floor drains for all emergency showers.

All floor drains shall connect to sanitary sewer.

Floor drains shall be acid resisting, with grate and openings to restrict cigarettes, peanut hulls, etc.

Floor drain bodies shall be tapped for trap primers. Trap primers shall be installed in all floor drains.

Provide Petro Plugs for Mechanical Room floor drains when equipment with petroleum fuel and lubricants are present.

22 40 00 Plumbing Fixtures

22 42 13 Commercial Water Closets, Urinals, and Bidets

Specify that water closets are to be wall hung with plumbing chase of 1.5' min. clear width or other equivalent access with flush valve, vacuum breaker, top spud, elongated, vitreous china bowl, with white seat open front type. Water closets and seats used in apartment style residential units may differ from this.

Specify that urinals are to be wall hung with flush valve, vacuum breaker, and top spud. Fixture must be vitreous china. Mounting heights must comply with appropriate ADA requirements. No waterless fixtures allowed.

Specify that water closets, urinals, and bidets are to be wall hung with flush valve exposed on room side.

All fixtures shall be [WaterSense](#) complaint.

22 42 16 Commercial Lavatories and Sinks

Any wall hung lavatory must be either vitreous china or enameled cast iron, with 4" faucet centers, 3/8" angle supplies with stops and equipped with a 1-1/4" min. P-trap. Countertop lavatories shall be equipped like wall hung lavatories.

Laboratory sinks shall have 8" faucet centers and vacuum breakers

22 42 39 Commercial Faucets

Use remote sensor faucets with maximum continuous flow rate of 1/2 gallon per minute and a maximum metered flow rate of 1/4 gallon per 10 seconds.

All fixtures shall be [WaterSense](#) complaint.

22 45 00 Emergency Plumbing Fixtures

Emergency showers and eyewash stations will be placed in locations dictated by applicable OSHA 29 CFR 1910.151C and installed in accordance with ANSI/ISEA Z358.1-2014. All showers and eyewashes in locations meant for use by people other than custodial and service personnel shall be in accordance with [Clemson's Accessible Eyewash and Shower Standards](#).

22 47 00 Drinking Fountains and Water Coolers

Specify one bottle filling station/fountain combination unit. Install such that fountain meets with all applicable ADA requirements.

22 63 00 Gas Systems for Laboratory and Healthcare Facilities

22 63 19 Laboratory Gas Storage Tanks

Buildings with laboratories will require areas for handling the delivery and return of gas storage tanks (bottles). Specify separate empty and full container holding areas including chain restraints per applicable codes.

PRODUCTS AND MATERIALS-DIVISION 22 – PLUMBING

Back Flow Preventer

- Domestic Water: Watts, Apollo (Include protected test bypass and complete rubber parts repair kit)
- Fire Protection: Ames (Include protected test bypass and complete rubber parts repair kit)

Carriers

- Water Closets: Zurn Series Z-1025, Z-1206, or Z-1208 with cantilevered supports
- Urinals: Zurn Series Z-1221 with cantilevered supports

Clean-outs

- Smith, Zurn, Josam, Wade

Domestic Hot Water Heaters

- Steam: Leslie Constant Temp
- Gas: Rheem-Non-condensing preferred.
- Electric: Marathon Commercial metal free where demand factor and fixture unit values allow
- Instant Hot: Rinnai, AO Smith, Takagi

Domestic Water Piping

- 1" thru 3" Metal Piping – Copper Type L
- Greater than 3" Metal Piping – Carbon steel, Schedule 40 or Copper Type L
- PEX Piping - Shall comply with Table 605.4 of IPC

- PEX Fittings - Viega PEX Pro Press Fittings for hydronic piping. Type A or Viega PEX Pro Press fittings for domestic supply.

Drinking Fountains

- Wall mounted, ADA approved-Oasis, Elkay

Emergency Shower, Eyewash, Facewash, and Combination Units

- Haws
- Encon Model #01050216 combination eye and safety shower, and universal emergency sign

Fittings for Copper Pipe

- Viega ProPress compression fittings ½" – 4";
- Wrought copper, solder joint type, conforming to ANSI B16.22

Hangers and Support Devices

- Grinnell, Unistrut, Fee & Mason, Elcene, Kindorf, Mueller, Auto-Grip

Hose Bibcocks

- Interior: Woodford Manufacturing with wheel handle that fits standard garden hose.
- Exterior: Woodford Manufacturing that is freeze-proof and tee key actuated and fits standard garden hose.

Insulation

- Domestic Hot Water Piping: 1" fiberglass
- Domestic Cold Water Piping: ½" fiberglass
- Soil and Waste Lines (above ceiling): ½" fiberglass or 1" foamed plastic

Lavatory Faucets

- [WaterSense](#) Complaint
- Remote sensor type
- T & S Model 5Ef-1D-DS
- Sloan Optima ETF-80
- Housing Facilities: Manually operated Moen and Delta

Nipples

- Brass when used with copper piping

Pressure Gauges

- Ashcroft, Dwyer

Process Hot and Chilled Water Piping

- *ViegaPEX Barrier tubing*
- All fittings shall be bronze lead free Viega PEX Pro press
- All valves to be lead free NPT

Service Sinks

- Kohler Model K-6718, with Kohler Model K-8907 faucet

Shock Absorbers

- Josam 1480/1481, Watts or Zurn with shut off valve

Shower Faucet

- Kohler Coralais, Moen
- Housing Facilities: Moen Single Handle

Shower Heads

- [WaterSense](#) Complaint

Strainers

- Watts

Toilet Seats

- Benis, Beneke, Sperzel. Usually open front type, although some residential apartment style housing may use closed front models.

Trim

- Kohler, Chicago Faucet, T & S Brass, Crane, Eljer, American Standard

Unions

- Copper to Steel: Insulating dielectric nipple and union with ball valve
- Copper to Copper: 200 lbs. SWP, brass ground joint
- Steel to Steel: 250 lbs. SWP, malleable iron with brass iron seat

Vacuum Breakers

- Domestic Water: Watts
- Fire protection: Ames

Valves

- Less than or equal to 2": 150 # minimum Ball valves with replaceable packing full port with stem extensions for insulation installations
- 2-1/2": or larger shall be 150# bronze flanged full port with packing gland and rising stem and flanged connections.

Chemical Drains

- Blue Orion
- Spears

Waste & Vent Piping

- Above slab: PVC, Schedule 40, cast iron or copper
- Below slab: PVC Schedule 40 or ductile iron - depending on location and use
- No hub couplings: 4 band stainless steel. Husky, Clamp-all, or equivalent. No "Fernco" all rubber fittings.

Deionized Water Piping

- HPDE

Water Meters

Octave Ultrasonic Master Meter capable of connecting with current campus-wide Metasys system.

DIVISION 23 - HVAC

23 05 00 Common Work Results for Heating, Ventilating, and Air Conditioning

Design Standards

Provide a design for a complete HVAC system with specifications and drawings that show floor plans, all associated mechanical piping and equipment, automatic temperature control system, equipment layout, and any necessary details. The designer shall address the importance of providing adequate space in all equipment rooms. The steam piping system shall meet ASME and ANSI B31 Pressure Piping Code and include a steam flow metering system with integrator. The CHW system shall show primary and secondary diagram, primary crossover bridge. The primary crossover bridge shall also have a check valve to allow for building flow to prevent campus chilled water loop short-cycling.

The HVAC system shall also be designed for installation of building automation and energy management systems.

Consult the [Manual for Planning and Execution of State Permanent Improvements](#) for information concerning requirements, codes, and standards that are applicable to this design. The design shall comply with all local codes having jurisdiction, OSHA regulations, ADA compliance, and any applicable seismic codes.

The designer shall pay particular attention to the coordination of installations under this division with those installations specified under Divisions 22, 26, and 33, including the provision for power to be supplied to any equipment by specification under Division 26.

The designer shall require submittal and product data on all equipment and products necessary to ensure compliance with the contract documents and for inclusion in required

maintenance manuals.

The designer shall include adequate climate control for all equipment rooms associated with elevators and account for the thermal load of all machinery, electrical and electronic devices installed.

The documents shall require the testing and balancing of any appropriate mechanical system by an independent testing firm. Adequate copies of this balance report shall be required and contain data considered necessary to properly document the results of this balancing. These reports shall be included in the final maintenance manual.

Specify that the contractor shall obtain and pay for all installation permits, certificates, and inspection fees relative to the work. The preparation of any specific plans or shop drawings necessary to obtain these permits shall also be the responsibility of the contractor.

The design shall not include any pressure piping beneath the building slab. Utilities shall enter the building through a utility trench or areaway.

The designer shall assure that any differences in required guarantees or warranties from those specified in the General Conditions are clearly noted and explained.

BAS Contractor Shall provide location of all remote control devices such as differential pressure transmitters, duct static pressure transmitters, etc. on control drawings and record drawings.

The documents shall specify that motor starters, controls, relays, contactors, and switches shall be provided under this division but installed under Division 26, except where they are specified under Division 26 or they are not part of any mechanical piece of equipment. Temperature and low voltage controls shall be installed under this division. Power wiring shall be furnished and installed under Division 26.

Clearly specify that the products to be provided for installation under this Division are in strict accordance with the Product and Material listing for this Division.

Equipment Sole-Source Suppliers

Clemson University has Johnson Controls, Inc. under contract to provide installation of approved building automation systems and components for all new construction. The contractor must review and submit to Clemson for evaluation of the pricing received in accordance with the terms and conditions of that contract. Specific details of each contract must be provided in the specifications; name, contact information, solicitation number, and expiration date. Documentation of the evaluation of this pricing information must be kept in each procurement file for review by Audit and Certification.

23 05 19 Meters and Gauges for HVAC Piping

Pressure gauges shall have maximum readings approximately two times the expected working pressure. A gauge cock shall be specified between each gauge and the main line.

Both steam meters and chilled water meters shall be specified to provide connectivity to campus Johnson Control Metasys.

23 05 23 Valves

Specify that valves be installed with stems horizontal or above except as required for accessibility. Arrange valve handles to be easily accessible.

All valves shall be identified with metal tags.

Specify that valves be installed at all locations requiring shut off during maintenance, component isolation and troubleshooting.

23 05 29 Hangers and Supports for HVAC Piping and Equipment

The design shall provide foundations, supports, and means of attachment to the structure for all equipment, fixtures, and piping under this Division.

Specify the use of the appropriate beam clamps, brackets, and expansion shields for supporting and securing equipment, fixtures, and piping.

Specify wall clamps and brackets used for support of piping and equipment from concrete or solid masonry shall be secured with self-drilling concrete fasteners. Clamps and brackets on hollow masonry block construction shall be supported with toggle bolts.

Specify that horizontal, parallel, and adjacent piping shall be supported by gang hangers with appropriately sized hanger rods (3/8" minimum) and clamps to match the pipe.

Specify that hangers supporting insulated piping be sized to fit over the insulation. Specify that supports and clamps in contact with copper pipe shall be copper plated.

23 05 53 Identification for HVAC Piping and Equipment

Specify that all piping is to be marked and coded with color coded tape as referenced, in a neat and uniform manner. Markings shall not exceed 20 feet apart in mechanical rooms. The wording and color coding shall be coordinated with other plumbing, electrical, and other trades and suppliers.

The wording on identification markers shall be descriptive of the item identified, as "H.W. Return", not "Pump 28."

23 05 93 Testing, Adjusting, and Balancing for HVAC

The documents shall specify any necessary tests that are to be conducted by a certified testing and balancing contractor (TAB) on any equipment or systems as appropriate for each specialty of the mechanical system. The documents shall require that all tests are to be made in the presence of the mechanical contractor or his designated representative, and that accurate records be kept of test readings and that the test results shall be incorporated in the maintenance manuals. The documents shall also specify that the TAB contractor is to furnish all labor and technical personnel, instruments, and appliances for these tests. If the gauges, thermometers, etc., that are used for these tests are to be left permanently installed, then they are not to be installed until just prior to the tests so that possible changes in calibration can be avoided. The documents shall also specify that any action necessary to protect components of the systems being tested from damage during these tests, i.e., pumps, seals, etc. These tests shall include, but are not limited to, the following:

Clemson University may contract directly with a Testing and Balancing contractor to perform all tests and adjustments to the mechanical systems in accordance with the design. Specify

that the HVAC contractor shall coordinate and cooperate with the TAB contractor to ensure that the testing and balancing work can be accomplished in an appropriate and timely manner. The consultant shall coordinate their design with the TAB contractor in order that the installation of effected equipment (fittings, connecting devices, etc.) will ensure an efficient method of accomplishing the testing and balancing. Upon completion of testing and balancing, all transfer grills shall be open and functioning, and all steam and chilled water supply and return valves shall be open and flowing.

23 07 00 HVAC Insulation

23 07 13 HVAC Duct Insulation

Specify that sheet metal duct insulation shall be glued with insulation bonding adhesive covering at least 50% of the surface. Mechanical fasteners shall be installed on not more than 18" centers on bottoms of ducts greater than 24" wide. Punctures shall be sealed with adhesive and foil reinforced tape. Lap longitudinal and traverse joints, 2" minimum, and wrap insulation with 18-gauge stainless steel wire, 18" maximum on centers. Insulation shall not be pulled overly tight around ducts when wrapping. Use 24" minimum length board type insulation on bottoms of ducts at trapeze hangers. Insulation shall be installed on exterior of duct only.

No duct liner is permitted. Outside air intake ducts shall be insulated. Return ducts and exhaust ducts shall not be insulated unless passing through unconditioned space. All exposed insulation in mechanical rooms shall be finished with canvas. All duct insulation shall have a UL flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as tested by ASTM E-84, and must meet the requirements of NFPA 90-A.

23 07 19 HVAC Piping Insulation

Specify that piping shall not be covered with insulation until all pressure testing has been completed.

Specify that pipe insulation shall be installed with staggered longitudinal joints.

Specify the use of vapor barriers for insulated pipes that may be subject to condensation on its exterior or on piping located in damp areas.

Specify that insulation on steam and condensate lines should be of a thickness to reduce surface temperature to 110 degrees Fahrenheit except in buildings where it is necessary meet SC Energy Code requirements for insulation value.

Steam, condensate, and vent piping shall have insulation applied with side and end joints butted tightly.

Specify that a factory applied 8 oz. canvas jacket be installed smoothly over longitudinal and circumferential joints.

Pipes fittings and valves on hot water lines shall be insulated with insulation equal in thickness with the associated piping.

Pipes fittings and valves on cold water and chilled water lines shall be insulated with fabricated or mitered sections of pipe insulation or pre-molded sections, vapor sealed with glass fabric embedded between two coats of Foster 60-30-N adhesive.

Pipe fittings and valves on steam, condensate, and vent lines shall be insulated with fabricated, mitered segments of pipe insulation. At screen strainers and other fittings requiring routine access for maintenance, fabricate the insulation so that it can be removed and replaced as necessary.

Specify that each pipe support on piping 2" and larger shall be provided with equal thickness 12" long sections of Foamglass with jacket carried continuously over Foamglass and vapor sealed as appropriate.

23 09 00 Instrumentation and Control for HVAC

The design of the HVAC system shall provide for a complete system of automatic temperature control of the direct digital type as manufactured by Johnson Control Company. No other control manufacturer will be allowed.

The system controls shall provide a distributed process network control system complete with all necessary hardware and software, including all required programming. The system shall be PC microprocessor based and monitored by connection to the existing University network to allow for alerts for leaks.

The Owner will provide a fiber optic data transmission cable to the specified site location to transmit data to the University Energy Management System.

23 20 00 HVAC Piping and Pumps

23 21 00 Hydronic Piping and Pumps

Specify that all piping be neatly arranged, running parallel with the primary lines of the building construction, and that right-of-way be given to piping that must slope for drainage. All changes in piping directions shall be made with the applicable fittings.

Specify that unions or flanges are to be provided at all connections to each piece of equipment and on both sides of automatic valves and devices that require removal for maintenance.

Specify that bronze adaptors are to be used at all copper to flanged or I.P.S. connections.

In locations where piping passes through or under corrosive fill or walls, specify that the piping shall be protected through the full depth of the construction by protective coating, wrapping, or with galvanized sleeves. Sleeves shall be at least two pipe sizes larger than the pipe plus insulation.

Specify that all bare steel piping, pipe hangers, supports and miscellaneous metal mechanical rooms and elsewhere exposed to view shall be cleaned and painted in accordance with requirements specified in Division 09.

All pumps shall have isolation valves installed to allow servicing the pump.

All pumps shall be controlled by differential pressure sensors. No sensorless pumps shall be installed.

When existing and new horizontal steam and hot water piped are tapped for feeder lines, the tap shall be placed on the top or side of pipe, not on bottom.

23 21 16 Hydronic Piping Specialties

Chilled Water Bypass Loop: Include a bypass loop for load control in all new construction.

23 30 00 HVAC Air Distribution

23 38 13 Commercial Kitchen Hoods

Specify that fire suppression systems shall be installed on all for cooking exhaust hoods. The hood shall exhaust to the exterior of the building. The system shall comply with the latest edition of NFPA 96.

23 38 16 Fume Hoods

Both teaching and research laboratories that are designed to be equipped with ventilation fume hoods shall be well planned with the necessary duct work system to support the hood operation. The [Clemson University Department of Environmental Safety](#) has guidelines on the operation, maintenance, and design information in the training section of their website under [Chemical Fume Hoods](#).

23 40 00 HVAC Air Cleaning Devices

23 41 00 Particulate Air Filtration

Indoor air quality (IAQ) shall be a major consideration in the design of air filtration systems for HVAC systems in facilities at Clemson University.

Filtration design shall be based on ASHRAE 52.2-1999 to provide MERV 8 or better filtration according to the application. Higher standards may be necessary for some laboratory applications and clean room designs.

Roll-a-matic air filter systems shall be designed and included as pre-filters for all HEPA filter banks as a means of extending the life of HEPA filter banks.

23 64 00 Packaged Water Chillers

Centrifugal chillers with single stage compressors are preferred at Clemson University. Refrigerants shall not be blended and shall be selected based on current availability, but the chiller shall be capable of being easily converted to accommodate the use of less ozone depleting refrigerants, without having to be derated, as they become commercially available.

23 73 00 Indoor Central Station Air Handling Units

Air handling units shall be appropriately sized and selected to fit the application with the appropriate modules for the required functions. All air handling units within the facility shall be specified to be supplied by a single manufacturer and shall have a stainless steel drain pan.

23 81 00 Decentralized Unitary HVAC Equipment

23 81 26 Split-System-Air-Conditioners

Provide hail guards for condensers. Repair or replace coil per manufacturer's instructions if the unit sustains hail damage.

23 82 00 Convection Heating and Cooling Units

23 82 19 Fan Coil Units

Specify each unit shall have the following:

Cabinets to have extended pocket, 18-gauge galvanized construction, closed cell insulation with insulated stainless steel drain pan. Coordinate finish color with Project Manager. All floor mounted unit models shall have sloped tops.

Provide 1" pleated filter sets. Install new filters after Substantial Completion. Provide factory installed service disconnect switch.

Provide that condensate overflow switch shall be installed. All chilled water piping components shall be located above auxiliary drain pan. Units to be configured for chilled water and hot water connections on either side of the unit.

Fan Motors shall have three speeds. All cooling and heating performance data must be based on high speed fan operation.

Chilled Water EWT shall be = 48 degrees. Hot Water EWT shall be = 160 degrees.

A Preheat Coil shall be installed, and Low Limit protection shall be provided if the unit has Outside Air connected to the unit. Coils shall be furnished with manual air vents. Chilled Water and Heating Coils shall be downstream of Preheat Coil. Heating Coil shall be located downstream of Chilled Water Coil.

All piping and piping components inside Fan Coil shall be factory supplied or factory installed. If piping package is shipped loose for field install, the union connection shall be factory installed. Piping packages will consist of: Supply side to have shut off valve, strainer with hose drain fitting and cap, union connections. Return side to have proportional control valve, automatic flow limiting balance valve, shut off valve and union connections.

All control valve actuators shall be proportional control 0-10VDC. All control valves shall be 2-way configuration. All control analog inputs and outputs shall have the ability to be field calibrated.

All units shall have the following points configured:

Discharge Air Temp, Room Temperature, Occupied Mode, Occupied Cooling SPT, Occupied Heating SPT, Standby Cooling SPT, Standby Heating SPT, Unoccupied Cooling SPT, Unoccupied Heating SPT, Supply Fan Start/Stop, Supply Fan Status, Condensate Overflow Switch Status,

IF DEHUMIDIFICATION IS REQUIRED: Room Humidity, Dehumidification SPT IF ECM MOTOR IS INSTALLED Supply Fan Speed Control

IF UNIT HAS OUTSIDE AIR CONNECTED Outside Air Damper Position, Low Limit Status, Room CO2

Condensate pan overflow sensors shall shut off chilled water to unit.

Unit microprocessor shall be factory supplied or factory installed and must have BacNet communication capability. All set points shall be adjustable via BacNet communication.

Specify a minimum of 8 hours of owner training for unit controls and operation startup with commissioning. All software and hardware for the field accessibility of the unit controls is required.

Thermostats shall be wall mounted. Thermostats shall have the capability of range limits and "dead band" control in accordance with policies set forth by [Facilities Energy Awareness](#).

PRODUCTS AND MATERIALS – DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING

Access Doors (Equipment)

Titus, Krueger, Cesco, Dowco, Air Balance, Kees, Louvers & Dampers, Ruskin

Air Control Tank Fittings

Bell & Gossett

Air Filtration Media

Comply with standards listed in Section 23 40 00 (above).

Air Handling Units

Trane, Carrier, York, Daiken – all units in a facility by same manufacturer

Chillers

Trane, Carrier, York

Dampers

- **Manual Volume Control Dampers:** Ruskin, Dowco, Louvers & Dampers, Air Balance, Arrow
- **Fire Dampers:** Air Balance, Louvers & Dampers, Prefco

Exhaust Fans

Carnes, Jenn-Aire, I.L.G., Penn, Acme, Greenheck, Broan, Cook

Fan Coil Units

Trane, Johnson Controls, Rittling

Flexible Ducts

Wiremold, United States Metal, Clevepack, Metal Flex

Flow Switches

Fluid: McDonnell-Miller FS-4, Johnson Controls, Penn
Air: Penn

Gas Piping

Black Iron, Schedule 40, meeting ASTM A53f or A120 Fittings: <2-1/2"-screwed fittings
>2-1/2"-flanged or welded connections

All black iron gas fittings shall be malleable black iron. No Teflon tape shall be used on gas piping.

Hangers and Support Devices

Grinnell, Unistrut, Fee & Mason, Elcene Kindorf, Mueller, Auto Grip

Insulation

- **Chilled Water Piping:** Armaflex or 1-1/2" Fiberglass with 850 degree F rating with self-sealing all-purpose jacket, 25/50 spread/smoke development rating. Insulation on fittings and valves on hot water and chilled water lines shall consist of insulating cement finished with a canvas jacket dipped in Arabol or aluminum sheet metal held in place with aluminum straps.
- **Low Pressure Steam and Condensate Piping:**
Pyrogel XTE: Use in steam vaults and areas with limited accessibility/working clearances.
John-Mansfield Thermo-12 Gold: Use in all locations except those with limited accessibility/working clearances.
- **Hot Water Storage Tanks and Generators:** 3" blocks of 85% magnesia, securely wired into place, covered with 1-1/2" mesh wire with layer of plastic insulating cement 3/8" troweled over the wire, then finished with a 1/8" layer of hard finish cement, troweled to smooth hard finish.
- **Converters:** Same as hot water storage tanks, except use 1/2" magnesia and add one coat of vapor barrier sealant
- **Refrigerant Piping:** 1" Armaflex
- **Supply Ducts (Exposed Areas):** 1-1/2" glass fiber blanket, 3/4 lb. density with .002 aluminum foil backing as manufactured by Owens-Corning, Certainteed, Johns-Manville, Armstrong, or BFG.
- **Supply Ducts (Exposed Areas):** 1-1/2" fiberglass, 3.0 lbs/cf density, with foil reinforced Kraft jacket (O-C Type 703)
- **PVC Fitting Covers:** Certainteed

Mastics, Coatings, and Adhesives

- **Mastics:** Insul-Coustic, Lion Oil, Foster, Armstrong, Childers white breaker coating, or Foster 30-36
- **Breather Mastic:** Foster GPM
- **White Vapor Barrier Coating:** Foster 30-35
- **Duct Insulation Adhesive:** Foster 85-20
- **Lap Adhesive:** Foster 85-75

- **Flexible Joint Sealer:** Foster 30-35

Packaged AC Equipment

Trane, Carrier, Lennox, York

Pre-Filter Chemical Feeder

Neptune

Pressure Gauges

Ashcroft, Dwyer

Pumps

- Taco
- Bell & Gossett
- Patterson Pumps

Steam Flow Meter:

Veris-Acclelabar Model AFS with Foxboro IMV30 Multivariable Transmitter with remote mount, instantaneous steam flow rate (lbs/hr) and energy total (BTU x 100), and connectivity to Johnson Control Metasys.

Chilled Water Meter:

Onicon Sysem-10-N2/BACnet Model F-3500 Featuring campus flow (gpm), instantaneous energy rate (KBTU/hr) and energy total (BTU x 100), and connectivity to campus Johnson Control Metasys.

Steam Traps:

Sarco, ITT, or Hoffman & Armstrong

High Pressure Steam Piping and High Pressure Condensate:

Thermal Pipe Systems Super Temp-Tite

Condensate, and Chilled Water Piping:

- **Piping:** Meeting ASTM A120 Grade A or ASTM A53 Grade
- **Fittings:** Meeting ASTM A234
 - < 2-1/2" – screwed fittings
 - >2-1/2" – butt weld fittings
- **Unions:** Federal Specs WW-V-531 Type B less than 2"
- **Flanges:** Meeting ASTM A181 Grade I (Forged carbon steel – weld neck)
- **Gaskets:** Compression type with spirothallic construction without asbestos

Thermometers

Weiss DVS35 to Weiss DVU35

Valves

- **Steam Valves:** 250 lb. with welded connections
- **Chilled Water and Heating System Valves:** Wafer butterfly type – Demco, Nibco, Watts

DIVISION 26 - ELECTRICAL

26 05 00 Common Work Results of Electrical

Design Standards

Provide a design for a complete electrical system with specifications and drawings that show floor plans, riser diagrams, schedules, all power, lighting, and communication plans, including any necessary details to accurately depict the scope of work included in the project. Design must include all conductors, raceways, fittings, circuit protection devices, wiring devices, fixtures, panel boards, boxes, supports, meters, switches, and other electrical equipment necessary to furnish a complete electrical system for the facility. Design must specify the necessary testing of the system prior to being put into service.

Give special attention to the coordination of the installation of electrical equipment that is specified in other divisions (particularly Division 23). These pieces may, in general, include motor starters, controls, relays, etc. that are associated directly with the piece of equipment. Power wiring to all equipment must be specified under this Division 26, regardless of the division under which the equipment is specified.

Clearly specify that the products to be provided for installation under this Division are in strict accordance with the Product and Material listing for this Division.

26 05 13 Medium Voltage Cables

Specify that the contractor's personnel who will be making the splices, terminations, and/or stress cones on medium voltage (primary) cable be required to present evidence of past successful experience in this trade. It is preferable that this task be done by a single individual throughout the project.

Contact [University Electrical Engineer](#) for product details.

26 05 19 Low-Voltage Electrical Power Conductors and Cables

Do not deviate from the National Electrical Code (NFPA 70)

Specify that all building power wiring shall be copper of 12 AWG or larger, rated at 600V minimum, type THWN-2, THHN, or XHHW-2, and have a 90 °C (194 °F) minimum temperature rating for both dry and wet applications.

Conductors pulled inside Electrical Metallic Tubing (EMT) is the preferred construction method for low voltage pathways (under 600V) in all cases except those listed below.

- Rigid Metal Conduit (RMC) is to be used in areas likely to see impact or damage as well as for exposed interior pathways above the finished floor to a height of 7'-0".
- Flexible conduit be used for final connections to light fixtures in drop ceilings. The maximum length of flexible conduit or cable shall be 6 feet.
- Flexible conduit is to be used for all connections to vibrating equipment such as motors, air compressors, etc. The maximum length of flexible conduit shall be 6 feet.
- Nonmetallic-sheathed Cable (Romex) is not allowed in any circumstance.

Metal Clad (MC) cabling containing a dedicated insulated ground conductor may be substituted for conductors pulled inside EMT only in the following limited situations with prior written approval:

- Raised computer floors where utilized as air plenums, overhead airspace above drop ceilings or other locations with ready access for maintenance. All locations will be considered on a case-by-case basis.
- Final flexible connections to lighting fixtures, fire alarm devices, etc. with readily available service access. These connections must be 6 feet or less.
- For Renovation Projects Only: Locations where EMT presents constructability concerns or is technically infeasible. All locations will be considered on a case-by-case basis.

The support system MC Cabling must be approved as part of the cabling approval. Support system must facilitate easy maintenance and replacement of individual cables.

Approvals for MC Cable for any section of branch circuits concealed in walls or ceilings, homerun pathways from distribution panels, and interior exposed pathways above finished floor will not be given. Pathways in these locations are required to be constructed using EMT.

See information in Division 33 for instructions regarding cable installation for delivery of electrical service to the facility service point.

26 05 26 Grounding and Bonding

Specify that all ground connections are to be of a type which will ensure against corrosion and electrolysis, and that connections are to be of the brazed, welded, bolted, or pressure connected type except that bolted connections are to be used for connections to removable equipment. Specify that all grounding systems are to be interconnected with the main electrical service grounding conductor.

Specify that all exposed non-current-carrying metallic parts of the electrical equipment, raceway systems, and neutral conductors are to be grounded as permitted by the electric code but shall not be grounded by connections to the grounded circuit conductors.

Specify that all neutral circuit conductors beyond the service entrance switch shall be insulated in all cases. Service entrance cable without individual insulation on the ground circuit conductor shall not be used beyond the service entrance.

Specify that ground connections for all panelboards, cabinets, wiring gutters, or troughs are to be by means of bonding the enclosure to the separate grounding conductors in accordance with the requirements of Article 250 of the National Electric Code, and that a green colored insulation grounding conductor, sized as indicated or as required by the code, is to be installed in all raceways.

Specify that the transformer's neutral conductor is to be bonded to the substation housing.

Install a loop of #3/0 AWG stranded, bare copper wire around the unit substation base, at the floor within 2 inches of the side of the 6-inch concrete base. Specify that all connections between wires and ground rods are to be visible. Attach (braze) a $\frac{3}{4}$ " x 8'-0" copper weld ground rod to the loop at each corner of the substation above the floor. Specify that additional rods shall be added to obtain a minimum of 5 ohms of resistance between the neutral and each rod. Specify that one #2/0 AWG bare, stranded copper wire is to be installed at each corner of the loop and run to the substation housing.

Specify that one #2/0 AWG bare, stranded copper wire is to be run from two opposite corners of the grounding loop and exothermically welded to a steel building column if applicable. Specify that one #2/0 AWG bare, stranded copper wire is to be run from one of the remaining corners of the loop and exothermically welded to the largest cold-water line available.

Consult with the Project Manager concerning the Owner's requirements for a "Clean Ground" versus an "Isolated Ground," if any.

26 05 29 Hangers and Supports for Electrical Systems

Specify that firm, neat supports are to be provided for all electrical equipment and raceways, using shop coated standard steel shapes, light steel framing members, or prefabricated structural systems, and that all supports exposed to the weather are to be hot-dip galvanized.

Specify that conduit hangers for banded conduit runs are to be made of steel angle, channel iron, or light steel framing, of adequate size and supported by steel all-thread rods from ceiling inserts or building structure. Specify that single conduits are to be supported by means of clamps to the building structure or pipe hangers supported by steel all-thread rods from ceiling inserts or building structure. Do not allow the use of wire supports or perforated steel straps.

Specify that galvanized rigid steel conduit, intermediate metal conduit, and electrical metallic tubing are to be firmly fastened within three (3) feet of each outlet box, junction box, cabinet, or fitting, and that the types used are to be suitable to the particular location and type of construction to which attached.

Specify that electrical hangers shall be mounted to the building structure and shall not be attached to other mechanical systems.

26 05 33 Raceways and Boxes

Specify that raceways are to be provided for all conductors and cables and that the minimum size of any conduit shall be $\frac{3}{4}$ ", and that a pull wire be installed in all empty conduits. All raceways are to be installed in straight lines, parallel and/or perpendicular to building lines. Conduit shall be installed with no more than 360 degrees of bend and 100' of length between pull boxes.

The design must provide for two conduits (one used and one spare) for each service entrance to the facility.

Specify that Galvanized Rigid Conduit (GRC) or Intermediate Grade Metallic Conduit (IMC) is to be used as Service Entrance, Feeders, Raceways installed below grade (coated with bitumastic coating), Raceways for grounding conductors Interior exposed raceways up to 7'-0" above finished floor, Raceways installed outdoors, Branch circuit raceways exposed to weather.

Specify the installation of proper fire-stopping material where conduits pass through rated wall or ceiling assemblies. Do not permit the installation of "back-to-back" boxes in walls and partitions.

Specify the use of suitable extensions or plaster rings as necessary to come flush with the finished surface in which the boxes are mounted.

Specify that all junction boxes shall be installed with a screw attached cover plate.

26 05 36 Cable Trays

The installation of cable trays shall follow each hallway according to the building plan.

26 05 53 Identification for Electrical Systems

Specify that each major piece of equipment, electric starter, motor panel, and control device be provided with name plate attached for identification.

Specify that all panels be labeled on outside top of door frame.

Specify that any panel that is modified shall have a complete and correct panel schedule installed. Any circuit tracing needed to accomplish this is the responsibility of the designer.

Specify that color coding is required for all service, feeder, branch, control, and signaling circuit conductors as follows:

- 120/240 volt and 120/208 volt systems:
 - Phase A - Black
 - Phase B - Red
 - Phase C - Blue
 - Neutral - White
 - Ground - Green
- 277/480 volt systems:
 - Phase A - Brown
 - Phase B - Orange
 - Phase C - Yellow
 - Neutral - Gray or White
 - Ground - Green
- Motor Control Wiring:
 - Start Circuits - Black
 - Stop Circuits - Red
 - Common - Orange

Specify that conductors smaller than #6 AWG or smaller are to be color coded with a solid

color insulation, and that colored, permanent, non-aging, insulating tape banding at conductor ends may be used on larger sizes. Green colored grounding conductors are to be installed in all raceways. Require that multi-conductor cables for control, signal, and alarm circuits requiring a ground wire are to be color coded in accordance with IPCEA Standards, except as noted otherwise.

Specify that multi-colored cord is Type "SO" and is to contain a green colored grounding conductor.

Specify that identifying markers are to name the contents of the conduit in full or abbreviated form with black letters on a background color as follows:

- Power feeders and branch circuits - Orange background with voltage named
- Lighting feeders and branch circuits - Yellow background with voltage named
- Telephone and communications circuits - Blue background with system named

Specify that markers are to be placed at all junctions and terminations of raceways.

Specify that, wherever possible, the position of markers is to be such that the view of them is unobstructed, preferably placed lengthwise along the raceway, or, where not suitable, that the markers be wrapped around the raceway to form a tag.

Provide arc-flash hazard warning labels on equipment. Install labels as required by the NEC. Labels shall indicate the available energy, personal protective equipment requirements and approach distances.

26 05 73.19 Arc Flash Hazard Analysis

For new construction and renovations, arc flash analysis conforming to the applicable specifications below will be required if either of the following conditions are met:

- Addition or modification of a three-phase circuit over 30 amps as described in applicable specification.
- Addition or modification of a single phase or phase-to-phase, two pole circuit over 50 Amps as described in the applicable specification.

Adding and modifying single phase and phase-to-phase, two pole circuits less than 50 amps, as described in the applicable specification, do not require arc flash analysis.

[Arc Flash Risk Assessment Specifications for New Construction](#)

[Arc Flash Risk Assessment Specifications for Renovations](#)

If an arc flash analysis is to be performed independently of any system addition or modification, it is to be done in accordance with the specifications below:

[Arc Flash Risk Assessment Specifications for Existing Systems](#)

All Arc Flash analysis is to be done in the latest version on SKM Power Tools, and upon completion of the study, a backup copy of the model generated is to be submitted to Clemson University Facilities.

26 10 00 Medium Voltage Electrical Distribution

Existing Systems and Design Information

University power is transmitted at 4160 or 12,470 volt wye, 3 phase, 4 wire, 60 cycle AC. The existing 4160 volt system is in the process of being phased out and shall not be used to power new construction unless written authorization is given by the Clemson University Utilities Director.

In the event that a medium voltage distribution system design is deemed necessary, the designer shall contact Clemson University's Utility Director and/or Utilities Electrical Engineer prior to starting the design process to obtain any application specific requirements deemed necessary.

26 12 00 Medium Voltage Transformers

Clemson prefers loop fed, pad mount transformers for all medium voltage distribution systems. Please contact the [University Electrical Engineer](#) for transformer specs.

26 24 00 Switchboards and Panelboards

26 24 13 Switchboards

Specify that safety switches are to be 240 volt, or 600 volt as indicated, with quick-make, quick-break operating mechanism, and that safety switches are to be heavy duty type with full cover interlock and indicator handle.

Specify that safety switches are to meet applicable requirements of Federal Specification W-W-865C for heavy switches. They are to be UL listed, and are to meet the applicable requirements of NEMA KS1 for Type HD.

Specify that the number of poles, ampere rating, whether fusible or non-fusible type of NEMA enclosure, and other data is to be as noted, and that safety switches are to be securely mounted to the surface on which they are installed.

26 24 16 Panelboards

Cabinets for all panelboards are to be large enough to provide a minimum wiring gutter space 4" wide by 5" deep on all four sides. Specify that front trim is to be single sheet full-finished, code gauge, sheet steel, and that door opening is to expose only the operating handles of the circuit breakers. The inside of the door shall accommodate a typed directory card, protected by a heavy sheet of unbreakable transparent plastic.

Specify that panelboard buswork is to be copper and all branch circuit breakers are to be bolt on type.

Specify that all panelboard front trim and door are to be given a coat of rust-inhibiting primer, followed by paint to match the adjacent wall surface.

The designer shall allow for at least 25% spare breaker space in every lighting and power panelboard.

26 24 19 Motor Control Centers

Specify that all motor controllers are to be equipped with thermal overload protection in each phase, and short circuit protection. Magnetic type motor controllers are to have under

voltage protection when used with momentary contact pushbutton stations or switches and are to have under voltage release when used with maintained contact pushbutton stations or switches.

Specify that when used with a pressure, float, or similar automatic type or maintained contact switch, the controller is to have a "Hand-Off-Automatic" selector switch, and that connections to the selector switch are to be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the "Hand" and "Automatic" positions. Specify that control circuit connections to any "Hand-Off-Automatic" selector switch or to more than one automatic regulatory control device is to be made in accordance with manufacturer's approved wiring diagram.

Specify that enclosures for starters and controllers shall be NEMA 1 per NEMA ICS6, unless otherwise indicated.

Specify that manual starters are to be single, double, or three pole, designed for surface mounting as indicated.

Specify that multiple speed motor controllers and reversible motor controllers are to be across the line type, electrically and mechanically interlocked. Multiple speed controllers are to have compelling relays and are to be multiple button station type with pilot lights for each speed. Combination starters are to be provided with integral circuit breakers.

Specify that motors and motor controllers are to be furnished with the driven machine under the respective specification section, unless otherwise noted, sized to assure the specified output and operation of the driven equipment without excessive temperature rise, and suitable for the environment in which they operate. Specify that specific motor characteristics are to be determined to insure provision of correctly sized starters and overload heaters. Motors are to be designed to operate at full capacity with a voltage variation of plus or minus 10% of the motor rating.

Motors are to be of sufficient size for the duty to be performed and are not to exceed their full load nameplate current rating when driven equipment is operated at its specified capacity under the most severe conditions likely to be encountered.

Unless otherwise specifically indicated, specify that motors of $\frac{1}{2}$ horsepower or smaller are to be for 120 volt operation, single phase, 60 hertz. Motors of $\frac{3}{4}$ horsepower and larger are to be for operation on 208 volts, three phase, 60 hertz, or 480 volts, three phase, 60 hertz as required.

Specify that the selector switch is to have a means for locking it in any position, and that for each motor not in sight of the controller, the controller disconnections means is to be capable of being locked in the open position or a manually operated, non-fused switch which will disconnect the motor from the source of supply is to be placed within sight of the motor location.

Specify that overload protective devices are to give adequate protection to the motor windings, be of the thermal inverse-time-limit type and include a manual reset type push button on the outside of the motor controller case. The cover of a combination motor controller and manual switch or circuit breaker is to be interlocked with the operating handle of the switch or circuit breaker so that the cover cannot be opened unless the handle of the switch or circuit breaker is in the "Off" position.

Specify that all pilot devices, such as thermostats, pressure switches, limit switches, pilot lights, float switches, control switches, control relays, and the like are to be provided under Division 23 – Heating, Ventilating, and Air Conditioning, providing all control supervisory

functions indicated and/or specified.

Specify that all pilot devices are to be ruggedly constructed mechanically and properly insulated for the control voltage. Pilot devices are to be conservatively rated with precious metal contacts to handle inrush and continuous currents of the control system and suitably enclosed for the environment and for the type and class of area in which they are installed, with all necessary provisions made for external connections thereto.

Specify that control circuits generally are to be provided with individual control power transformers and adequate over-current and short circuit protection to meet code requirements. Unless otherwise required, control circuit voltage is not to exceed 120 volts, 60 hertz.

Specify that pushbutton stations are to be provided with "start-stop" momentary contacts having one normally open and one normally closed set of contacts and ruby indicating lights to indicate when the motor is running. Specify that stations are to be heavy duty, oil tight, designed for flush or surface mounting, as required, and that pilot and indicating lights are to be transformer, resistor, or diode type.

Specify that equipment connections are to include the providing of power wiring for the connection of motors and control equipment under this section of the specifications, and that except as otherwise noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but are to be provided under other applicable sections.

Specify that all motors and motor operated equipment are to be checked for proper clearance and alignment and lubricated, if necessary. Specify that motors are to be wired using a short section of liquid tight, flexible metal conduit, unless otherwise indicated, in which shall be provided a grounding jumper, and that the motors are to be checked for proper rotation and left in completely satisfactory operation condition, all under this division.

Specify that motor controllers are to be firmly mounted and wired under this division, unless otherwise pre-mounted and pre-wired integrally with the driven equipment, and that motor controllers are to be accessibly located, equipped with properly selected overload heater elements, and checked for proper contact alignment and proper operation.

Specify that pilot devices, disconnect switches, etc., are to be firmly and accessibly mounted and set or adjusted as required, and that the contractor for this section is to review all parts of the contract documents, particularly work covered under this division, and connect all motors, devices, etc., shown in the contract documents.

26 27 00 Low Voltage Distribution System

26 27 13 Metering

Unit substations shall include one switchboard type AC indicating voltmeter and six position transfer switches to provide readings of the one-to-ground and line-to-line secondary bus potentials. It shall also include one switchboard type AC indicating ammeter and a three position switch to provide readings of the secondary bus currents.

New construction and major renovations must include sub-metering of lighting, plug loads, equipment loads, and HVAC by floor, major departments, and/or other functional operational units featuring connectivity to the campus Johnson Control Metasys. Main meter shall provide connectivity through Ethernet to Powerlogics server.

26 27 26 Wiring Devices

Specify that all devices shall be mounted plumb and at the height indicated.

Do not allow the use of oversized or "jumbo" cover plates except where there is no other reasonable alternative.

Specify the installation of duplex outlets in hallways for use by floor cleaning and other housekeeping equipment. Outlets shall be rated as needed for the equipment to be used.

26 41 00 Facility Lightning Protection

Specify installation to conform to the requirements of NFPA 780 and Underwriter's Laboratories "Standards for Installation of Lightning Protection Systems (UL96 and 96 A),"

26 51 00 Interior Lighting

The use of incandescent and low voltage lighting is not permitted.

Indoor lighting levels shall be as recommended by the Illuminating Engineering Society of North America, IESNA. Careful consideration of the end user must be used in classrooms and labs with special needs or multipurpose uses.

For general purpose lighting, specify installation of 24"x 24" or 24"x48" LED fixtures with a minimum advertised service life of 50,000 hours.

Fluorescent lighting is to only remain in place if no work is being performed outside of routine maintenance.

If existing fluorescent fixtures are to remain in place, they are to be converted to LED function via a retrofitting kit that replaces the ballast with an LED driver, bulbs, and upfits with occupancy sensors as needed.

Support for all fixtures must be in accordance with all applicable structural and seismic requirements. Fixtures shall be supported independently of ceiling grids.

All exposed fluorescent and tube style LED bulbs shall be protected from breakage with safety tubes and end caps at time of installation. Specify that any plastic used in the fixtures will be fireproof, not subject to disintegration or discoloration with age. All fixtures shall comply with applicable requirements of Underwriter's Laboratories.

All lighting fixtures must be accessible using standard vertical devices such as A- frame ladders. Inaccessible locations will require automatic winches or if articulated lifts are required, they shall be provided as auxiliary building equipment stored in a logical place within the building.

Specify type and location of emergency lights in accordance with design codes.

26 56 00 Exterior Lighting

The University uses several different exterior lighting fixtures and poles, depending on the application and location. The different applications may include walk lights, street lights, major highway lighting, and parking lot lighting, both within the historic district and the general campus area. New exterior lighting shall be laid out and carefully coordinated with

existing adjacent surroundings. LED fixtures shall be used when appropriate. These fixtures are listed in the Products and Materials section of this Division and on the [Planning and Design website](#).

Concrete bases must have a minimum height of 8" above existing grade and are to be placed, with no grass divider, against any adjacent concrete walks, curbs, or paved areas. Concrete bases are to have a 3/4" chamfer on all vertical and horizontal corners. Concrete bases are to have an 8' ground rod. Concrete bases exceeding 36" in depth shall be designed by a professional engineer.

PRODUCTS AND MATERIALS – DIVISION 26 – ELECTRICAL

Boxes

- General: Ferrous metal, cadmium or zinc coated, complying with UL 514, as manufactured by Steel City, Thomas & Betts, or Appleton.
 - Lighting Fixtures: 4" octagonal x 1" deep.
 - Switches and Receptacles: 3" x 2" x 2-3/4" with appropriate plaster ring.
 - Telephone/communications: 4" x 4" x 2-1/4".

Exterior Lighting (Historic District)

- Street Lights and Walk Lights:
 - Fixture: AT23A 150S MOG PCT TB1 ANPP, with appropriate selection of model number, depending on orientation and application.
 - Pole (cast iron): P1 C17 11A ANPP with anchor bolts
 - Pole (aluminum): PAW/1710 ANDB with anchor bolts
 - Concrete Base: 20" x 20" x 36" with appropriate reinforcement
 - Beacon LED Retrofit kit - LRK-2V/55W/T5/UNV/LSP/GYS

Exterior Lighting (Non-Historic District)

- 12' High Pedestrian Sidewalk LED Lighting (not Historic District)-
 - Fixture head – Cree Edge (example spec – ARE-EDG-2M-DA-04-E-UL- BZ-350)
 - Head mounting style: side arm
 - Pole Type – Hapco SSA12B4-4BZ (12'x4"x.125" aluminum square pole)
 - Finish/color: Polyester Power Coat Finish /Dark Bronze
- 20' High Parking Lot Area LED Lighting
 - Fixture head – Phillips Gardco with comfort optics (Medium Area) (example spec P26-64L-800-NW-G2-AR-5-120-HIS-MGY)
 - Head mounting style: side arm
 - Pole Type – Phillips Gardco 4" (Example Spec: SSS6-30-6-11-(Drilling)-BRP-(Options))
 - Finish/color: Polyester Powder Coat Finish /Dark Bronze
- 30' High Street LED Lighting
 - Fixture head – Phillips Gardco (Large Area) (example spec: P34-(# of LEDS)-(Drive Current)-NW-G2-AR-(Distribution)-(Voltage)-(Options))
 - Head mounting style: side arm

- Pole Type – Phillips Gardco 6” Square Pole (Example Pole Spec: SSS6-30-6-11-([Drilling](#))-BRP-([Options](#)))
- Finish/color: Polyester Powder Coat Finish /Dark Bronze
- Uplighting for Buildings, Gates, Sculpture, etc:
 - Fixture: BK – KZ-68-BZW-13-C
 - Ballast: HP70-120 V, in ground
 - Lamp: 70W Par 38, Metal Halide

In projects where area lighting already exists and is not listed above, coordinate with [University Planning and Design](#) to determine appropriate fixture type for consistency and compatibility.

Lighted Exterior Bollards

- Cordia LED Lighted Bollard LBCOR-LED with either 3000K or 4000K LED engine as specified.

Site Lighting Conduit

In-ground rated HDPE conduit, pre-wired or not, can be used for buried power distribution for all exterior site lighting as long as conduit path transitions to metal conduit before turning up into fixtures and concrete bases.

Hangers and Support Devices

- Support Rods and Straps: Galvanized all-thread rod with applicable connections or heavy duty, zinc-coated conduit hangers or straps of proper size and spacing.
- Ceiling and Wall Anchors: Lead, expansion, lag type suitable to particular location and application.

Identification of Electrical Systems

- Name Plates: Engraved, white on black Bakelite.

Interior Lighting

- Phillips EvoKit Series LED retrofit kit in 2”x2” and 2”x4” or approved equivalent.
- Phillips EvoGrid Series LED fixture in 2”x2” and 2”x4” or approved equivalent.
- Phillips FBX Series Hi-Bay fixture or approved equivalent.
- T-5: 228MVPS-A ballast and GE F28W/T5/841/ECO lamps
- T-8: GE*32MAX-N-ULTRA ballasts and F28T8/XL/SPX41/ECO lamps

Medium Voltage Distribution

- Switches: G & W or S & C SF6 insulated to match existing switches in the system.
- Splice Kits and Terminations: Elastimold, Cooper, or G & W.
- Cable Racks: McGraw Edison, Joslyn, or A.B. Chance; standard underground manhole type, fully galvanized steel, with wall channel, projecting support, and cable rack.
- Grounding Materials: Cadweld.

Meters

- Square D Powerlogics Model PM820 or PM 850, with connectivity to Powerlogics server through Ethernet. See Section 26 20 00 concerning requirements for sub-metering.

Panelboards

- Panelboards and Load Centers: Square D, GE, Siemens, or Cutler Hammer. All panelboards and load centers shall be furnished with lock, all keyed alike with the facility.

Raceways

- Galvanized Rigid Conduit (GRC): UL 6 and ANDI C80.1 with full weight screwed fittings. Bushings shall be malleable iron; bushings 1-1/4" and larger shall have insulated throat and grounding lug.
- Intermediate Grade Metallic Conduit (IMC): UL 1242, galvanized with full weight screwed fittings. Bushings shall be the same as specified for galvanized rigid conduit.
- Electrical Metallic Tubing (EMT): UL 797 and ANSI C80.3, galvanized with compression type fittings. Fittings 1-1/4" and larger shall have nylon insulated throat. Set screw, indented, or drive-on fittings are not allowed.
- Flexible Steel Conduit: UL 1, with galvanized fittings.
- Liquidtight Flexible Steel Conduit (Sealtite): UL 360, with compression type fittings.
- Plastic Conduit: Schedule 40, polyvinylchloride (PVC), NEMA Standard TC-2, TC-3, and UL Standards. Conduit, solvent, and fittings shall be supplied by the same manufacturer.
- Cable trays: Cablofil, open ladder, divided type configuration. Minimum size shall be one foot wide and three inches high. Closed cable trays are not allowed.

Wire and Cable

- Conductors: Copper, soft drawn, per ASTM B3. All conductors to be stranded – no solid conductors are allowed.
- Low Voltage Cable (less than 600 volts): See Electrical Cable Specification.
- Medium Voltage Cable (4,160 volts and 12,470 volts): See Medium Voltage Cable Specification.

Wiring Devices

- Switches: Hubbell, Pass & Seymour, Leviton; 20 amp, 120/277 volt, side and back wired in color specified. Single or double pole, three or four way as needed.
- Receptacles: Hubbell, Pass & Seymour, Leviton; 15 amp, 125 volt, three wire grounding, NEMA 5-15R, side and back wired in color specified.
- Ground Fault Interrupter Receptacle (GFI): Hubbell, Pass & Seymour, Leviton; 15 amp, 125 volt, feed through type, complying with UL 943.
- Cover Plates: Reinforced fiberglass, brushed or polished metal specified to suit installation application.

DIVISION 27 – COMMUNICATIONS

27 05 00 Common Work Results for Communication Systems

Existing System and Design Information

Clemson University operates and maintains its own communications distribution system for voice, data and video system. This infrastructure includes both inside plant infrastructure (under Division 27) and outside plant infrastructure (under Division 33).

When starting a project, design teams shall inquire with the Facilities project manager to determine who from the Clemson Network Services and Telecommunications (NST) department has been assigned to serve as the NST Technical Lead (NSTTL). It is imperative that the NSTTL and the telecommunications designer on the A&E team be involved from the beginning of the project (typically the pre-design phase).

Refer to Clemson's Telecommunications Distribution Design Guide (TDDG) (<https://ccit.clemson.edu/services/network-phones-cable/infrastructure-standards>) for instructions about designing telecommunications infrastructure on campus. Adherence to these requirements is mandatory, and many of the requirements involve interaction with the NSTTL to inquire about project-specific nuances.

In addition to the design guidelines in the TDDG, a set of specification sections have been prepared to adapt for specific projects on campus. For any projects involving telecommunications infrastructure, please send an email to ITHELP@clemson.edu and request that the current version Word documents for the following sections be sent to you. Designers shall directly edit these specification documents for applicability to each Clemson project.

DIVISION 28 - ELECTRONIC SECURITY

28 05 10 Operation and Maintenance of Access Control

Clemson University has deployed a centrally managed Physical Access Control System for all university facilities. The design of the access control system must be consistent in every way with the centralized system and comply with the [University Access Control Policy](#).

The access control system is managed and administered by TigerOne – Division of Student Affairs.

The decision whether to have the access control system as part of the construction contract or to contract directly with the University-approved vendor will be made on a project-by-project basis. The Project Manager, in consultation with TigerOne, will provide that decision and supply all contact information.

The designer shall coordinate drawings and specifications with all other related trades to include Div. 8 (door/frame/hardware coordination), Div.26 (pathways, power) and Division 27 (data cabling, MDF/IDF elevation). Coordinate system design with the Division 28 Access Control vendor, CUPD and TigerOne.

These standards address technology, topology, product selection, door hardware and campus security protocols.

- 1.) All devices must be compatible and approved for use with the Genetec Security Center Synergis access control software.
- 2.) All credential readers shall be capable of reading the HID Elite iClass SE and Elite SEOS credentials.
- 3.) All controller hardware shall be Mercury brand and licensed for Genetec Security Center
- 4.) All PoE, WiFi, or otherwise IP enabled locks shall be licensed for Genetec Security Center.
- 5.) All electronic locking mechanisms must be 24volt
- 6.) All electronic locking mechanisms shall be capable of being powered by centralized power supplies located in data closets with maximum distance of 300' (size conductors according to manufacturer specification)
- 7.) All exit devices equipped with electric latch retraction shall be of the quiet motor driven type. High amperage in-rush solenoids are not acceptable.

Equipment Sole-Source Suppliers

Clemson University has A3, Inc. under contract to provide installation of approved card access systems and components for all new construction. The contractor must review and submit to Clemson for evaluation of the pricing received in accordance with the terms and conditions of that contract. Specific details of each contract must be provided in the specifications; name, contact information, solicitation number, and expiration date. Documentation of the evaluation of this pricing information must be kept in each procurement file for review by Audit and Certification.

Clemson University has Johnson Controls, Inc. under contract to provide installation of approved building automation systems and components for all new construction. The contractor must review and submit to Clemson for evaluation of the pricing received in accordance with the terms and conditions of that contract. Specific details of each contract must be provided in the specifications; name, contact information, solicitation number, and expiration date. Documentation of the evaluation of this pricing information must be kept in each procurement file for review by Audit and Certification.

28 20 00 Video Surveillance

Video surveillance is employed in many existing facilities and is required in all new facilities for security purposes. These systems shall be designed and installed in accordance with Clemson's [Video Surveillance Policy](#) and Clemson's [Telecommunications Distribution Design Guide](#).

28 30 00 Electronic Detection and Alarm

The decision whether to have the fire detection and alarm system as part of the construction contract or to contract that work directly with the Sole Source Supplier will be made on a

project by project basis. The Project Manager will provide all contact information for the Sole Source Supplier.

The fire detection and alarm system shall comply with the latest edition of NFPA 72 National Fire Alarm Code.

The design of the fire alarm and detection system for facilities at Clemson University shall be a fully addressable fire alarm and smoke detection system. The design shall meet all applicable requirements in the state adopted revision of IBC and NFPA 72 and shall comply with the Americans with Disabilities Act. The designed system shall be UL listed. The standard FACP shall include voice evacuation for all new construction and major renovations.

All new fire alarm control panels (FACP's) be connected to the campus fiber network. All fire alarm cabling shall be run in appropriate electrical raceway systems.

The University contracts for its fire alarm services utilizing Johnson Controls, Inc. equipment for its components.

The Authority Having Jurisdiction (AHJ) for the design and installation of fire alarm systems at Clemson is the University Fire Code Official.

PRODUCTS AND MATERIALS – DIVISION 28 – ELECTRONIC SECURITY

Electrified Locking Devices and Accessories

Electrified Mortise Locks

- Sargent: NAC Eco-Flex 8200 series electrified mortise locks w/ integral request-to-exit switch and integral 'IDP' option for 3-point monitoring (door position, internal auxiliary latch, latch bolt position). Sample Part No.: NAC 82271-24V IDP LW1L (fail secure)
- Stanley: electrified mortise locks w/ integral request-to-exit switch and door position switch. Sample Part No.: 45HW-7-DEU-15H-626-RQE-DS-C

Electrified Cylindrical Locks

- Sargent: 10G Line electrified cylindrical lock with integral request-to-exit. Sample Part No.: RX-10G71-24V-GL (fail secure)
- Stanley: electrified cylindrical locks w/ integral request-to-exit switch Sample Part No.: 9KW-3-7-DEU-15-C-S3-626-RQE-C

Electric Latch Retraction Exit Devices

- Sargent: 8000 series exit devices with '56' electric latch retraction and '55' integral request-to-exit switch.
- Sample Part Number: 55-56-8804F-PSB
- Von Duprin 98/99 series exit devices with "QEL" electric latch retraction and "RX-LC" integral request-to-exit switch
- Sample Part No.: RX-LC-QEL-99NL-06

IP Enabled/900mhz

Wi-fi

- Sargent IN120 w/BLE (mortise, cylindrical, trim)
- Sargent Passport w/BLE (mortise, cylindrical, trim) *only if keypad required

PoE

- Sargent IN220 w/BLE (mortise, cylindrical, trim)
- Sargent Passport w/BLE (mortise, cylindrical, trim) *only if keypad required

900mhz

- Sargent Aperio (mortise, cylindrical, trim)
- NOTE: Allegion AD400, NDE and LE lock sets pending verification of credential reader ability to read secure sector of Clemson iClassSE and iClass Elite SEOS credentials.

Power Transfers

- Securitron: EL-CEPT (new construction)
- Securitron: EL-EPT (retro-fit)
- Von Duprin: EPT-10 (new construction)

Power Transfer Hinges

- McKinney
- Ives

DIVISION 31 - EARTHWORK

31 00 00 General Information

Scope

This division covers the design and specifications all grading and site clearing activities associated with construction projects at Clemson University. The work specified under this division must be carefully coordinated with the work that is associated in other divisions dealing with site utilities and landscaping. The designer shall be especially cognizant of coordination issues involving soil compaction requirements that may be required for the installation of other systems and improvements.

31 05 00 Common Work Results for Earthwork

Clearly specify that all grading activities shall comply with the tree protection requirements specified in Division 1 and in Clemson's [Urban Forest and Landscape Management Policy](#).

Clearly specify the requirement for strict adherence to OSHA regulations associated with work specified under this division.

Clemson University is located in the Piedmont Physiographic Province. In general, the virgin soils encountered in this area are the residual product of chemical and environment

weathering of rock similar to the remaining underlying rock.

Request any required subsurface investigation of the site in accordance with provisions of the A/E Agreement. The designer shall designate the location of any proposed soil boring locations and shall be especially aware of the locations of existing utilities. Notification to the local utility locating service and the CU Facilities Survey is also required and must be contacted for any preliminary subsurface investigation and must also be specified as a requirement for the contractor in any subsequent construction operations. The Owner will usually retain the appropriate geotechnical firm for subsurface investigation as well as testing services during construction.

The consulting A/E shall give special attention to ensuring that all required permits are obtained from the appropriate regulating authority and that they are obtained within the prescribed time. It is the consultant's responsibility to ensure that these permits are obtained. See section on Erosion and Sediment Control (below) and [Stormwater Planning and Management Policy](#).

31 11 00 Clearing and Grubbing

Specify that debris and excess material shall not be allowed to accumulate on the site during construction.

It may be possible for clean, excess material to be deposited on campus. In such event, specify that the soil be deposited in 6" layers and machined smooth prior to depositing the next layer. Consult with the Project Manager for location to deposit this material.

Specify that existing topsoil is to be stripped from the area covered by the building, roads, walks, cuts, and fills and stockpiled on the campus at a location designated by the Project Manager.

Specify that all other waste material and debris is to be removed from the campus and deposited in a legal disposal facility or landfill. Clemson University operates a limited use C & D landfill and may be available for limited amounts of waste material.

Require that hazardous waste of any kind be disposed of in accordance with applicable Federal and State laws and regulations.

Prohibit the burning of trash and debris and the use of explosives on campus. Please contact [Clemson Fire Department](#) and Clemson's [Office of Research Safety](#) for more information.

31 22 00 Grading

Specify the proper and adequate protection for the stability of any excavations be in accordance with applicable codes and regulations.

Specify the proper quality control for excavations for footings, pavements, and trenches.

The designer is cautioned to pay special attention to compaction requirements to assure a uniform, coordinated specification in each area of fill placement and compaction. Specify compaction requirements for each particular area to comply with the appropriate ASTM density requirements.

A source of suitable fill material has become increasingly scarce on the campus. In general, the acquisition of any required additional fill material must be specified as part of the

contractor's responsibility.

31 25 00 Erosion and Sediment Control

All Erosion and Sedimentation Controls and Soil Stabilization Practices shall follow design standards defined in the SCDHEC BMP Handbook or the elected permit authority's [Stormwater Management Program](#) as required by Clemson University's [Stormwater Planning and Management Policy](#).

The size of the disturbed area on a project will determine the type of Erosion and Sediment Control and/or NPDEES permits that must be obtained. The procurement of any required permits, including notifications, is the responsibility of the consultant on the project. Be aware that grading and land-disturbing activities must be performed in accordance with a specific plan designed to control erosion, retain sediment on the site, and manage storm water in such a manner that either neither on-site nor off-site damage occurs or problems are caused or increased, and that all structural measures are designed to accepted standards for health and safety. Be sure that all provisions of the plan specified are in compliance with the Regulations contained in Chapter 72, Article 2, South Carolina Code of Regulations (Erosion and Sediment Reduction and Stormwater Management Regulations). The design must include an approved erosion control plan as required in the Manual for Planning and Execution of State Permanent Improvements.

31 31 00 Soil Treatment

Specify the appropriate soil treatment for the control of subterranean termites on the project site. Specify that the person applying these soil treatments must be licensed with the Clemson University Department of Pesticide Regulation.

Specify that the termiticides shall be applied at the highest label rate and strictly according to label rates and that the treatment must follow the standards for the prevention and control of wood destroying organisms prescribed by law.

Specify that the contractor shall notify a representative of the Pest Control Department at University Facilities at least 48 hours prior to the treatment. Inherent in this notification is the right of the Facilities staff to observe the termiticide containers being opened, seals being broken, mixing, and application. The termiticide used shall also be made available to University Facilities for testing and sampling.

Specify that a submittal be required from the contractor identifying the termiticide to be used, the rate of application, and the total quantity of material to be applied. Specify that this submittal must be approved prior to the contractor awarding this subcontract for the work. Specify that the contractor submit follow-up documentation of the actual use rate and total quantity of material applied to the site.

Specify that the final surface preparation must be done by the pest control operator prior to the treatment. This will include the removal of foreign matter and debris which would decrease the effectiveness of treatment and the loosening and raking the soil in the treated area prior to treatment.

Specify that termiticides must not be applied when the soil is excessively wet or frozen, or when rainfall is predicted as imminent.

Specify that the treatment of soil adjacent to exterior foundation walls is to be done only after all required grading, excavating, and final landscaping and filling operations are

completed, except as otherwise required in construction operations.

Specify that voids in block wall construction shall be treated as practicable to the footing in order that the termiticide reaches the footing rather than being absorbed by the masonry.

Specify that rodding alone is not permitted as the primary technique of treating the soil adjacent to the foundation walls. Trenching or trenching combined with rodding is acceptable.

Specify that signs shall be posted in the areas of application to warn workers that soil termiticide treatment has been applied.

Specify that a quality control inspection be conducted post treatment and documentation of this inspection be submitted to the Pest Control Department at University Facilities.

The contractor shall furnish a written warranty certifying that the applied soil treatment will prevent infestation of termites, and that if termite activity is discovered during the warranty period, the contractor will re-treat the soil and repair any damage caused by termite infestation. This warranty will consist of a five-year period from the date of Substantial Completion, signed by a representative of the pest control company and the general contractor. After this initial warranty period, Clemson University will have the right to assume the annual renewal with the pest control company.

PRODUCTS AND MATERIALS – DIVISION 31 – EARTHWORK

Termiticides

- Fipronil (Termidor)
- Isofenphos (Pryfon 6)
- Permethrin (Dragnet TF and Torpedo)
- Cypermethrin (Demon TC and Prevail FT)
- Fenvalerate (Tribute)

Erosion and Sedimentation Control

- All erosion and sedimentation control BMPs shall use materials specified in the SCDHEC BMP Handbook or the elected permit authority's design manual

Soil Stabilization

- All soil stabilization BMPs shall use materials specified in the SCDHEC BMP Handbook or the elected permit authority's design manual

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 00 00 General Information

Scope

This division covers the design and specifications of exterior improvements including paving roads, parking lots, curbs, sidewalks, and landscaping associated with construction projects at Clemson University. The work specified under this division must be carefully coordinated

with the work that is associated in other divisions dealing with site utilities and landscaping including, OSHA regulations, erosion and sediment control, notifications to the local utility locating service, and to comply with the [Fire Apparatus Access Requirements](#) and [CUFD Fire Lane Markings](#).

Contractual responsibilities for testing are identified in Division 1 Section "Quality Requirements". The designer will specify all testing requirements in accordance with pertinent codes and standards. In general, the owner will engage a testing laboratory as needed to perform materials testing on the specified products. Materials failing to meet the specified requirements shall be retested at the contractor's expense. The testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements. Additional testing of work that was initially found not in compliance with the specifications will be conducted at the expense of the contractor. The contractor shall be responsible for coordination of testing services and maintain a log, preparation of test cylinders as needed, etc.

Specify complete technical data and performance properties for each product design, certifications, qualification of firms Specify any warranties, certificates, or test reports signed by the applicable manufacturer or contractor, certifying that each material complies with requirements. Require MSDS sheets on each product as requested by the owner.

Instruct contractor to conduct operations so as to minimize any disruption to the owner's operation. The contractor is responsible for the protection of any existing property or utilities in or adjacent to the construction site. Protect exterior improvements from damage. Protect the surface finish of newly placed concrete or asphalt paving from damage by rainwater or construction traffic. Maintain exterior improvements free of stains, discoloration, dirt, and other foreign material until substantial completion.

32 01 00 Operations and Maintenance of Exterior Improvements

32 01 16 Cold Milling of Existing Asphalt Pavement

Milling shall reference the requirements of Division 31 and the appropriate sections of the SCDOT "Standard Specifications for Highway Construction". Specify milling must be scheduled so that the period between the milling and the installation of the new paving is minimized. The schedule must be approved by the Project Manager.

Specify the equipment to have a self-contained water system to control dust and other fine particles. Specify the planed surface to be free from gouges, ridges, oil film, and shall have a uniform appearance suitable as a riding surface that is capable of handling traffic prior to the installation of the new paving.

The designer shall require particular care to be taken in milling adjacent to existing utility rings and covers and beneath existing tree cover. Damages to adjacent structures and areas where all the existing paving is removed shall be stabilized and/or repaired as directed by the project manager at no additional cost to the owner.

The milling debris becomes the property of the contractor and shall be disposed of by the contractor in compliance with all statutes governing the disposal of this waste. Recycling of the milling waste is strongly encouraged.

32 10 00 Bases, Ballasts, and Paving

Design, material, and execution shall adhere to applicable standards that apply to aspects of asphalt and concrete construction. Among these referenced may include the following:

- American Association of State Highway and Transportation Officials (AASHTO):
- M 154 Air-Entraining Admixtures for Concrete
- M 226 Viscosity Graded Asphalt Cement
- T 179 Effect of Heat and Air on Asphalt Materials
- T180 Moisture-Density Relations of Soils Using a 4.54-kg rammer and a 457- mm drop.
- T 245 Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- American Concrete Institute (ACI) Publications:
- ACI 301 Specifications for Structural Concrete
- ACI 305 Recommended Practices for Hot Weather Concreting
- ACI 306 Recommended Practices for Cold Weather Concreting
- ACI 308 Standard Practice for Curing Concrete
- ACI 318 Building Code Requirements for Structural Concrete
- ACI 347 Guide to Formwork for Concrete
- American Society for Testing and Materials (ASTM) Publications:
- A 82 Steel Wire, Plain, for Concrete Reinforcement
- A 185 Welded Steel Wire Fabric for Concrete Reinforcement
- A 307 Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- A 615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- A 780 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- C 31 Making and Curing Concrete Test Specimens in the Field
- C 33 Concrete Aggregates
- C 39-72 Compressive Strength of Cylindrical Concrete Specimens
- C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C 94 Ready-Mixed Concrete
- C 143 Slump of Hydraulic-Cement Concrete
- C 150 Portland Cement
- C 171 Sheet Materials for Curing Concrete
- C 172 Sampling Freshly Mixed Concrete
- C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
- C 260 Air-Entraining Admixtures for Concrete
- C 309 Liquid Membrane-Forming Compounds for Curing Concrete
- C 494 Chemical Admixtures for Concrete
- C 881 Epoxy-Resin-Base Bonding Systems for Concrete
- C 1059 Latex Agents for Bonding Fresh To Hardened Concrete
- C 1064 Temperature of Freshly Mixed Hydraulic-Cement Concrete
- D 698 Laboratory Compaction Characteristics of Soil Using- Standard Effort
- D 946 Penetration Graded Asphalt Cement for Use in Pavement Construction
- D 979 Sampling Bituminous Paving Mixtures
- D 1188 Bulk Specific Gravity and Density of Compacted- Bituminous Mixtures Using Coated Samples
- D1556 Density of Soil in Place by the Sand-Cone Method.

- D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort
- D 1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
- D 1752 Preformed Sponge Rubber Cork and Recycled PVC- Expansion Joint Fillers for Concrete Paving and Structural Construction
- D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- D 2726 Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
- D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods
- D 2950 Density of Bituminous Concrete in Place by Nuclear Methods
- D 3017 Water Content of Soil and Rock in Place by Nuclear Methods
- D 3549 Thickness or Height of Compacted Bituminous Paving Mixture Specimens
- D 5581 Resistance to Plastic Flow of Bituminous Mixtures
- E 329 Agencies Engaged in Construction Inspection, Testing, or Special Inspection
- Asphalt Institute: MS-4 "The Asphalt Handbook"
- Concretes and Reinforcing Steel (CRSI): "Manual of Standard Practice"
- South Carolina Department of Transportation "Standard Specifications for Highway Construction"

The designer shall detail the examination, preparation, quality control measures, temperature and other environmental factors, for the installation of the base courses, paving, and concrete materials in accordance with the above referenced standards. Specify the type and frequency of testing and inspection. Stipulate alterations or correction procedures. Instruct the contractor to verify existing conditions before starting work. Design all surface paving and exterior flatwork with a positive drainage flow towards appropriate conveyance.

32 11 00 Base Courses

32 11 23 Aggregate Base Courses

Provide placement instructions and emphasize that application on frozen, muddy, or soft surfaces is prohibited unless addressed in the design. Contractor shall provide a ten (10) foot straight edge and any needed labor for its use in the vicinity of paving operation at all times for measuring surface irregularities. The surface of all courses shall be checked with a straight edge as necessary to detect surface irregularities. Unless other conditions warrant, design tolerances from the above referenced standards are:

- Flatness: Maximum variation of 1/2 inch measured with an acceptable 10-foot straight edge.
- Scheduled Compacted Thickness: Within 3/8 inch.
- Variation from Design Elevation: Within 1/2 inch.

32 11 26 Asphaltic Base Courses

As with aggregate base courses tolerances shall be checked with a straight edge as necessary to detect surface irregularities. Unless other conditions warrant, design tolerances from the above referenced standards are:

- Flatness: Maximum variation of 1/4 inch measured with an acceptable 10-foot straight edge.
- Scheduled Compacted Thickness: Within 3/8 inch.
- Variation from Design Elevation: Within 3/8 inch.

32 12 00 Flexible Paving

32 12 16 Asphalt Paving

Design must indicate placement of hot-mix asphalt binder course in number of lifts and thicknesses. Unless other conditions warrant, design tolerances from the above referenced standards are:

- Base and Binder Course Thickness: Within 1/2 inch.
- Surface Course Thickness: Within 1/4 inch.

Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straight edge applied transversely or longitudinally to paved areas:

- Base or Binder Course: 1/4 inch
- Surface Course: 1/8 inch
- Crowned Surface: Test with crowned template centered and at right angle to crown.
- Maximum Variance from template is 1/4 inch.

Designate contractor to reset utility frames for manhole covers, cleanout covers, valve boxes, and other such units with areas to be paved to the final grade as part of this work. It is preferred that adjustments be made with appropriate paving rings.

Surround the frames that have been adjusted to grade with a ring of compacted asphalt base prior to paving. Adjust frames as required for paving, providing temporary closures over openings to prevent damage during the rolling operations and construction traffic. Replace covers at the completion of the paving operation.

The contractor shall be responsible for the installation of any signalization sensor loops beneath the finish asphalt surface course. The installation of these sensor loops shall be provided by an SCDOT approved installer/contractor. Loops shall be installed prior to the placement of the finish asphalt surface course.

Design concrete paving in lieu of asphalt, in any loading dock, dumpster pad, or receiving area subject to heavy vehicular traffic, or where liquid oxygen may be present.

32 13 00 Rigid Paving

32 13 13 Concrete Paving

Unless other conditions warrant, specify concrete with the compressive strength of 4000 psi for 28-day strength as minimum for pavements and curb and gutter subject to vehicular traffic. Specify reinforcement method. Specify slump in the range of 1 to 2.5 inches for slip-form paving and no greater than 4 inches for fixed-form or other means of paving. Specify entrained air voids in the mix ranges from 3% to 6% at the point of

placement in the roadway. Unless other conditions warrant, design tolerances are:

- Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
- Maximum Variation from True Position: 1/2 inch.
- Maximum Variation in Thickness: 1/2 inch.

Contractor to proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement. Inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete. Do not use concrete that is not placed within one hour after water is first introduced into the mix. Emphasize consolidating concrete with care to prevent dislocating reinforcement, dowels, and joint devices. Honeycombed areas are considered defective and will not be accepted.

Specify construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Specify temperature and environmental conditions and note concrete which fails to meet strength requirements, dimensional tolerances, weathertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the project manager at no expense to the Owner.

Specify finish surfaces to true planes. Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

Allow concrete curing by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.

Contractor to protect freshly placed concrete from mechanical injury, premature drying, and excessive cold or hot temperatures. Exclude vehicular traffic from concrete pavement for at least 14 days after placement.

32 14 00 Unit Paving

32 14 16 Brick Unit Paving

Walkways and pedestrian circulation are discussed in the Clemson University Site Design Guidelines and must be reviewed when selecting paving material for walkways on the campus. The brick that is in general use for brick paved areas on the campus is solid paver in the red-brown range. All brick pavers shall be installed with a 4" concrete sub base with a 3/4" sand base.

32 16 00 Concrete Curbs, Gutters, Sidewalks and Driveways

Concrete work shall reference the requirements of Division 3 as well as 32 13 13. The location and type of curb and gutter shall match adjacent whenever possible.

Provide concrete with the compressive strength of 3000 psi for 28-day strength as minimum for sidewalks and curb and gutters not subject to vehicular traffic. Specify slump and air entrainment, environmental conditions, reinforcement method and joint location.

Finish all concrete surfaces in accordance with the following schedule:

- Form finish: Surfaces not ordinarily exposed to view; including the underside of slabs not exposed to view by repairing defective concrete, filling tie holes and depressions deeper than 1/4". Remove fins exceeding 1/8" in height.
- Broom finish: Exterior slabs exposed to view including: Outdoor floor slabs and walkways, other floors which may become wet or otherwise require a non-skid surface, Sidewalks and concrete pavements. Provide a scored texture by drawing a broom across the surface.
- Edge finish: Exposed edges of slabs not receiving chamfer including: Sidewalk and pavement edges and joints. Tool slab edges with a 1/4" radius tool.

32 16 23 Sidewalks

All sidewalks and concrete walking paths shall be at least 5 feet in width and maintain a maximum of 2% cross-slope at all times and a maximum of 5% running slope everywhere technically feasible. All sidewalks and concrete walking paths also meet all applicable requirements set forth in the current edition of ICC/ANSI A117.1.

32 17 00 Paving Specialties

32 17 23 Pavement Markings

Specify paving to cure for 14 to 30 days before starting pavement markings. Sweep and clean surface prior to painting to remove any loose material and dust. Apply paint with mechanical equipment to produce pavement markings with uniform, straight edges.

Pavements markings shall consist of pavement marking paint or thermoplastic pavement markings as required by the project manager or authorities having jurisdiction. Paint shall typically be used for low traffic installations such as parking lots and Thermoplastic shall be used for higher traffic applications.

Fire lane markings shall be placed in accordance with the [CUFD Fire Lane Markings Standards](#) and approved by the University Fire Code Official.

32 80 00 Irrigation

Provide an irrigation system if determined necessary by the University Landscape Architect for all new or renovated lawn areas and planting beds designed and constructed by the project.

Specify all site irrigation system controls shall be Weathermatic compatible. Design all systems with appropriate backflow preventers and require a manual shutoff valve to isolate the irrigation system from the water supply main.

Record "as-built" drawings for all newly installed, removed and/or relocated irrigation sprinkler piping including location and type designation of all associated sprinkler heads, valves, controllers, etc.

The contractor shall take necessary precautions to protect site conditions to remain. All work in the vicinity of trees shall be in accordance with the [Urban Forest and Landscape Management Policy](#).

32 84 00 Planting Irrigation and Underground Sprinklers

Depending on the size and scope of the irrigation on a project, Landscape Services may choose to do the installation with their own forces. The designer shall discuss this with the Project Manager.

If the installation of the underground sprinkler system is specified as part of the construction contract, specify that the contractor shall notify Landscape Services prior to beginning the installation and make all underground work available for inspection by Landscape Services prior to covering.

PRODUCTS AND MATERIALS - DIVISION 32 – EXTERIOR IMPROVEMENTS

Aggregate Base Course

Shall conform to Section 305 of SCDOT Standard Specifications.

Hot Mix Asphalt Surface Course:

Type C as specified in Section 403 (2" compacted typical) unless otherwise directed.

Hot Mix Asphalt Binder Course:

Type C as specified in Section 402 (3" compacted typical) unless otherwise directed.

Hot Mix Asphalt Base Course:

Type B as specified in Section 310 (4" compacted typical) unless otherwise directed.

Traffic Marking Paint:

Sherwin Williams SetFast Traffic Marking Paint (Lead Free)

- Highway White: Finish 0.0TM0226 – Acrylic Waterbourne Paint White
- Handicap Blue: Finish 0.0TM2133 – Latex Paint Blue
- Fire lane Red: Finish 0.0TM2132 - Latex Paint Red
- Blackout Black: Finish 0.0TM2135 - Latex Paint Black
- Highway Yellow: Finish 0.0TM0227 - Acrylic Waterborne Paint Yellow
- Green Marking Paint: Finish 0.0TM0226 - Acrylic Waterborne Paint White (Formula [5 gallons] – 50/32 b1, 60/32 y3, 8 oz. G2, 47/32 y1)
- Clemson Orange Marking Paint: Finish 0.0TM0227 – Acrylic Waterborne Paint Yellow (Formula [5 gallons] – add 1-gallon DTM safety Red to 4 gallons Setfast Yellow
- Magenta: Finish 0.0TM0226 - Acrylic Waterborne Traffic Marking Paint White (Formula [5 gallons] 4 oz. 47/32 b1, 61/32 1/128 r2, 16 oz. .38/32 r33)

All paints must comply with AASHTO M-247

Geosynthetic Soil Reinforcement Grid

Tensar BX1100 Geogrid 32 12 16-2

Underground Sprinkler Irrigation Systems

Bubbler:	Orbit 54042 Full Plastic Mushroom Bubbler
Controller:	Weathermatic Smartline SL1600 series with PE-39 communication cable Over 24 zones use Smartline SL4800 series with PE-39 Each shall come with a WEATHERMATIC SL-AIRCARD-FLOW with one year subscription
Drip:	NDS Agrifim SFPC-BR-6412-05 (.620) (Needs 40PSI pressure regulator and filter) Only NDS compression fittings to be used.
Flowmeters:	Tee type weathermatic ▪ 1.5" SLFSI-T1.5 or 2" SLFSI-T2 Saddle mount weathermatic ▪ 3" SLFSI-S30 or 4" SLFSI-S40
Master valves:	• 1.5" Buckner 3300150 24v normally open • 2.0" Buckner 3300200 24v normally open • 2.5" Buckner 3300250 24v normally open • 3.0" Buckner 3300300 24v normally open
Rotary Heads:	Weathermatic T3 or CT70 depending on size area covered (Speers or Lesco swingjoint)
Spray heads:	Weathermatic LX series Spray nozzles: Rainbird Van nozzle
Valves:	1" = Weathermatic max-dw-10 for 1" 1.5" = Weathermatic max-dw-15 for 1.5" 2" = Weathermatic max-dw-20 for 2" Contact Landscape Services for valves larger than 2"
Valve boxes:	NDS Pro Series 6" part number 208BC 10" part number 212BC Weatherstation: Weathermatic Smartline SLW 5

DIVISION 33 - UTILITIES

33 00 00 General Information

Scope

This division covers the design of the systems providing utilities to facilities and other infrastructure components of the campus. It is comprised of six separate areas dealing with utility distribution – water, sanitary sewerage, storm sewerage, mechanical (hydronic and steam) systems, electrical, and communication systems.

The design must include all necessary specifications and drawings to adequately detail the

work to be installed. The designer shall also be aware that in some cases portions of the exterior utility work may be accomplished by subcontractors doing work specified in other divisions. A single, comprehensive drawing showing all site work and utilities shall be provided. Depending on the complexity of the project, individual drawings may also be required.

33 05 00 Common Work Results for Utilities

Design Standards

New construction and major renovations must include submetering of lighting, plug loads, equipment loads, and HVAC by floor, major departments, or other functional operational units. Connectivity: Johnson Controls Metasys

See Section 00 03 00 concerning the requirements and charges for temporary utilities that may be specified in the contract.

Clearly specify soil compaction requirements for the backfill in the trenches used for the installation of all utilities in this Division. This needs to be in agreement with any compaction requirements specified in Division 31.

Clearly specify that all trenching activities shall comply with the tree protection requirements specified in Division 1 and in Clemson's [Urban Forest and Landscape Management Policy](#).

The designer shall give special attention to assuring that all required permits for both the construction of these utilities and the operation of them are obtained from the regulating authority.

Consult the Manual for Planning and Execution of the State Permanent Improvements for information concerning requirements, codes, and standards that are applicable to this design. The design shall comply with all local codes having jurisdiction, OSHA regulations, ADA compliance, and any applicable seismic codes.

Clearly specify the appropriate level of testing and inspections that are required of the individual utility systems and the specific phases of the inspections to be done at intervals of the installation, i.e., prior to backfill of the trench over any piping.

Design shall provide for manholes or catch basins at each point where either the grade or direction of storm sewers change. Manholes or catch basins in excess of 4 feet in depth must be provided with ladder type steps on a vertical wall of the structure.

All manholes and catch basins must be provided with frames and/or covers to allow access for maintenance.

Clearly specify that the products to be provided for installation under this Division are in strict accordance with the Product and Material listing for this Division.

Trenchless Utility Installation

The university incorporates trenchless utility installation (directional boring) in instances that are either economically feasible or are a better choice in dealing with possible disruption of other services on campus.

Utility Line Signs, Markers, and Flags

The university maintains a thorough mapping of the utility systems on campus. Although special attention is given to obtaining field locations of these utility systems as they are installed, various methods of marking these utilities for future reference is also desired. The designer is encouraged to utilize current technology available in providing on-site marking methods that will assist in utility location at later dates.

33 05 00 Common Water Utilities

Existing System and Design Information

Clemson University operates its own potable water distribution system, receiving water from Anderson Regional Joint Water System (ARJWS) at three connection points:

- the east campus standpipe
- the intersection of SC Route 93 and Palmetto Boulevard
- the elevated storage tank behind the Clemson House

The Anderson Regional Joint Water System line feeding the University proceeds from a tap off ARJWS's 24-inch line at the National Guard Armory situated between US Route 76 and SC Route 28 Business (Old Pendleton Road). It runs via a 20-inch line to the point of take off to the east campus standpipe along US Route 76 and the entrance ramp from SC Route 93 north to US Route 76. At this point the line reduces to 16 inches and proceeds along the south side of SC Route 93 to Newman Road. It crosses to the north side of SC Route 93 at this point and proceeds along the north side of the road to the intersection of Palmetto Boulevard. At this point, the line reduces to 12 inches and continues down SC Route 93 where it turns north to the elevated tank behind the Clemson House. No taps for building service shall be made on these lines. More details of these lines can be obtained from the University Atlas through the Project Manager. Distribution pressure varies around the campus, therefore, for any proposed facility, request that a flow test for both static and residual pressure be made (the University can usually conduct these tests as needed).

33 11 13 Public Water Utility Distribution Piping

Specify that no domestic water piping is installed as to enter a building from under the finished concrete slab.

Design must allow for and specify that piping shall be buried below recorded frost penetration, but no less than 36" below finished grade.

Specify the installation of appropriate thrust blocks that are needed to properly anchor piping at changes in direction and other required locations. The design must clearly indicate the details required for these thrust blocks.

Clearly specify the coordination of any permitting requirements for the installation of these water lines – both the permit to construct and the permit to operate the system. See Division 00 for permitting responsibilities. Specify the level and the method of disinfection of these water lines in accordance with permit requirements or other code requirements.

Regulations contained in the Safe Drinking Water Act concerning lead and copper concentrations shall be complied with, including the specification and the selection of piping materials to insure this compliance.

33 11 19 Fire Suppression Utility Water Distribution Piping

A major portion of the water distribution system on the campus that serves the fire protection systems in facilities are dual use lines and as such are designed in accordance with the appropriated codes. Lines that are dedicated fire protection lines are subject to the code requirements of the appropriate fire protection codes and fire officials, including the State Fire Marshal's Office and the Clemson University Fire Marshal.

The color scheme of fire hydrants installed on the fire suppression water system shall be in accordance with instructions contained in the AWWA Standard addressing Dry- Barrel Fire Hydrants.

33 12 13 Water Supply Backflow Preventer Assemblies

Reduced pressure type backflow preventers shall be used for domestic water service. Building backflow protection devices shall be designed and installed in parallel to facilitate annual maintenance.

Provide a complete rubber parts repair kit attached to the valve for future maintenance

33 12 16 Water Utility Distribution Valves

Specify that all underground valves shall be provided with a valve box and cover to allow access. Installations requiring special operating tools shall have the applicable tool furnished with the installation.

33 12 19 Water Utility Distribution Fire Hydrants

Adequately detail the orientation of fire hydrants to accommodate access by firefighting equipment and vehicles. Consult with the Project Manager concerning coordination of the location and orientation with the University Fire Marshal.

33 12 33 Water Utility Metering

Clemson University prefers that water meters for a particular facility be located in a mechanical room or other appropriate location within the facility. This meter assembly must include all applicable backflow preventers and isolation valves. See Division 22 for additional information on metering.

Provide combination meters for potable water and standard meters for irrigation.

33 13 00 Disinfecting of Water Utility Distribution

The disinfection of new water distribution systems and piping must be specified in accordance with South Carolina DHEC requirements.

33 30 00 Sanitary Sewerage Utilities

Existing System and Design Information

Clemson University operates its own sanitary sewerage collection system and sewerage treatment plant. The locations of the piping on the system are shown on the University Utility Atlas, with sizes of some of the main trunk lines indicated.

Consult with the Project Manager concerning the latest data base information concerning the

sizes of other collection lines.

Clearly specify the coordination of any permitting requirements for the installation of any sanitary sewer lines – both the permit to construct and the permit to operate the system.

33 31 00 Sanitary Utility Sewerage Piping

All sanitary sewer piping must be installed true to line and grade of the design. Clearly specify any allowable tolerances in these installations and insist on adherence to these tolerance values.

Distance between manholes shall not exceed 250 linear feet.

All new sanitary sewer systems shall be inspected via a recording CCTV system. Contact [University Utilities Services](#) for submittal requirements.

33 31 00 Sanitary Utility Sewerage Structures

Manholes must be located at all changes in plan direction and abrupt changes in elevations. Drop manholes must be specified in accordance with accepted design standards.

Specify that all inverts in sanitary manholes shall be constructed in place – the use of pre-cast inverts is not allowed.

Pre-cast sanitary sewer manholes shall be specified to with an eccentric top section with cast in place ladder rungs.

Manhole rings and lids shall be specified to meet the requirements of the application. Lids shall have cast in letters stating, "Sanitary Sewer".

33 39 23 Sanitary Utility Sewerage Cleanouts

The location of cleanouts on sanitary sewer piping is generally prescribed by the applicable building code. However, there may be unique situations that require the installation of additional cleanouts in the piping system. The designer shall be attentive to these needs and consult with the Project Manager for other special requirements.

33 40 00 Storm Drainage Utilities

Existing System and Design Information

Clemson University's storm sewerage system is generally laid out in three major distribution trunks, each draining approximately one-third of the campus. Proper storm drainage shall be addressed on any new structure or facility tied into the existing system. The designer shall be aware of the requirements of EPA/DHEC permitting requirements for NPDES Permits for Storm Water Discharges and assure that any applicable aspects of these requirements are complied. The Project Manager can provide current information concerning any existing NPDES Permit issued to Clemson University. Design calculations for large drainage projects shall be submitted to the Project Manager. Specify that all construction requirements of any storm water permits shall be strictly adhered to by the contractor.

The University's storm sewer system is not designed to handle storms of greater intensity than the theoretical ten-year frequency.

33 41 00 Storm Utility Drainage Piping

Specify that drainage lines are to be laid true to line and grade with properly connected joints and fittings. The minimum acceptable size for storm drainage piping receiving surface water from ground or paved areas is 15 inches in diameter.

Drainage systems serving foundations, areaways, and roofs shall connect to the University's storm sewer system at a catch basin with a top elevation lower than the ground floor elevation of the building.

All new storm sewer systems shall be inspected via a recording CCTV System. contact [University Utilities Services](#) for submittal requirements.

Curbs and gutters shall be planned to facilitate the disposal of storm water. Planter boxes and planted areas surrounded by walks shall be piped to the storm sewer system, rather than discharging onto walkways.

33 47 26 Storm Drainage Water Retention Structures

Storm drainage Water Retention Structures shall follow design standards defined in the SCDHEC BMP Handbook or the elected permit authority's design manual as required by the Clemson University Storm Water Management Plan (SWMP).

Clemson University recognizes the following BMPs as LID storm drainage structures when designed in accordance with specifications in the SCDHEC BMP Handbook:

- Vegetated Conveyance Swales
- Bioretention Areas
- Vegetated Filter Strips
- Infiltration Trenches
- Porous Surfacing

As stated in [Stormwater Planning & Management Program](#), use of LID BMPs is the preferred method of stormwater management and should be implemented whenever practical as part of the policy objective.

NOTE: The requirement of the construction of storm water retention structures is directly tied to the DHEC/NPDES permit that may be required for the project.

33 60 00 Hydronic and Steam Energy Utilities

Existing System and Design Information

Chilled water is distributed throughout the campus via a campus loop chilled water supply and reverse return systems. Detailed information relating to the chilled water system can be found in Chilled Water System Design Data.

Steam and condensate systems are distributed throughout the campus via an underground conduit system or through the main utility tunnel system. This piping system consists of a steam line at 115 psig saturated, a pumped condensate return line, and a high-pressure condensate drip line if required.

33 61 00 Hydronic (Chilled Water) Distribution Piping

Specify that the minimum depth of un-insulated chilled water lines be 6 feet below finished

grade.

Specify insulation of chilled water lines in accordance with the Products and Material Listing for this Division.

33 63 13 Underground Steam and Condensate Distribution Piping

Steam manholes must be designed for proper drainage. Pipe the drainage to existing storm drainage system if possible.

Main distribution steam line piping must be designed utilizing an underground conduit system. Design and layout of the distribution piping must be such to allow for expansion in the underground conduit system through the use of expansion loops. The design must adequately detail type and location of all required anchors, guides, and supports.

Service connections to individual facilities are installed utilizing direct burial, pre-insulated piping as indicated in the Products and Materials Listing at the end of this Division.

Specify insulation of steam lines in accordance with the Products and Material Listing for this Division.

33 61 33, 33 63 33 Metering

Both chilled water and steam distribution to the facility must be metered. The designer shall pay particular attention to clear piping requirements for the appropriate meter installation.

33 70 00 Electrical Utilities

Existing System and Design Information

Clemson University operates its own power distribution system through both concrete encased duct bank systems and the main utility tunnel system. Power is transmitted at 4160 or 12,470 volt wye, 3 phase, 4 wire, 60 cycle AC. Consult the Project Manager for the primary voltage to be provided for a project and standards on the specific circuit and connection equipment required and the number of conduits to be installed in a particular duct bank system.

33 71 19 Electrical Underground Ducts and Manholes

Conduit encased in concrete shall have spacers and supports installed in accordance with manufacturers specifications prior to placement of concrete placement. The concrete encasement surrounding the duct bank shall be rectangular in cross-section and provide at least 3 inches of concrete cover for the ducts. Conduit shall be separated by a minimum of 3 inches of concrete. Coordinate the requirements of the concrete encasement with the requirements for other concrete specified in Division 3.

Conduit joints shall be staggered by rows and layers to provide a duct line of maximum strength.

Specify that during construction, contractor shall protect partially completed line from the entrance of debris and dirt with suitable conduit plugs. At the completion of each section of duct line, specify that each conduit shall have a stiff bristle brush having the same diameter as the conduit and shall be pulled through each conduit until clear, then plugged with temporary end plugs. A pull string shall be installed in all empty conduit not used in the

present project.

Duct lines shall have a continuous slope away from buildings of not less than 3%. Changes in direction of the conduits shall be accompanied with long sweep bends having a minimum radius of curvature of 25 feet. Changes in direction of the duct bank shall be minimized between manholes to facilitate pulling of cable.

A drain shall be provided in the bottom of each manhole and this drain connected to the storm drainage system if possible. In the event that it is not feasible to connect the drain to a nearby storm drain, consult with the Project Manager for possible alternatives.

Take special care in determining the finish elevations of manhole tops and covers to accommodate the installation and minimize surface water infiltration.

33 71 49 Medium Voltage Wiring

The designer shall be especially thorough in coordinating the requirements for wiring under this Division with those requirements specified in Division 26 of this document.

Specify adequate experience level and documentation of all personnel engaged in the installation of medium voltage wiring and the making of cable splices for this wiring.

Adequately specify any special tests, precautions, notifications, etc. that are needed prior to energizing any medium voltage cable and associated equipment. Any required tests shall be in accordance with IPCEA Standards.

Specify the proper protection of medium voltage cable both prior to installation and during the actual installation within a conduit system.

For any additional information on Medium Voltage installations, please contact [University Electrical Engineer](#).

33 72 00 Utility Substations and Associated Equipment

The installation and construction of new substations or additions to existing substations require design based on the requirements of the individual substation. The Project Manager can supply the appropriate information on this type of facility and its specific requirements. See additional information supplied under Division 26 of this document.

33 80 00 Communications Utilities

Existing System and Design Information

Clemson University operates and maintains its own outside plant communications distribution system for voice, data and video system. This infrastructure includes underground ductbanks, manholes and fiber optic cabling.

Clemson uses Voice-over-IP (VOIP) for campus telephone services and therefore does not install any Clemson-owned outside plant copper cabling. Instead, for the limited amount of analog telephone services needed, Clemson obtains telephone utility services from AT&T.

Inquire with the Facilities project manager to determine who from the Clemson Network Services and Telecommunication (NST) department has been assigned to serve as the NST Technical Lead (NSTTL). It is imperative that the NSTTL and the telecommunications

designer on the A&E team be involved from the beginning of the project (typically the pre-design phase).

Refer to Clemson's Telecommunications Distribution Design Guide (TDDG) (<https://ccit.clemson.edu/services/network-phones-cable/infrastructure-standards>) for instructions about designing outside plant telecommunications infrastructure on campus. Adherence to these requirements is mandatory, and many of the requirements involve interaction with the CCITPM to inquire about project-specific nuances.

In addition to the design guidelines in the TDDG, a set of specification sections have been prepared for specific projects on campus. For any projects involving outside plant telecommunications infrastructure, please send an email to ITHELP@clemson.edu and request that the current version Word documents for the following sections be sent to you. Designers shall directly edit these specification documents for applicability to each Clemson project, rather than using their own specification documents.

PRODUCTS AND MATERIALS – DIVISION 33 – UTILITIES

Water Utilities

Fire Suppression Water Distribution Piping

- Ductile Iron – Schedule 40, with resilient joints. Use mechanical joints for fittings and appurtenances.

Fire Hydrants

- Mueller Super Centurion 250 (not with Aquagrip), 3-way valve, with two 2-1/2" and one 4" hose connections.

Potable Water Distribution Piping

- Ductile Iron – Schedule 40, with resilient joints. Use mechanical joints for fittings and appurtenances.
- Polyvinylchloride (PVC) – Schedule 40, may be acceptable for use in some locations. Consult the Project Manager prior to specifying the use of PVC.

Valves

- Eddy #F-2405, AWWA iron body, bronze trim, non-rising stem, mechanical joint connection, 200 psi, open to the left, with 2" operating nut. Underground installations shall require valve box and cover for access.

Sanitary Sewer Utilities

Manholes

- Concrete pre-cast manholes with eccentric top section, with cast in place ladder rungs.

Manhole Rings and Lids

Cast iron, selected for proper strength for particular application. Lids shall have cast in letters stating, "Sanitary Sewer."

Sanitary Sewerage Piping

- In areas subjected to heavy traffic loading or in difficult maintenance locations – Ductile Iron – Schedule 40.
- In areas not subjected to heavy traffic loading – A-2000 PVC as manufactured by Contech.
The use of reinforced concrete pipe (RCP) for sanitary sewerage piping is not allowed.

Storm Drainage Utilities

Catch Basins and Junction Boxes

- Pre-cast concrete, or built in place masonry, with cast in place steps if deeper than 4 feet.

Manhole Lids and Grates

- Cast iron selected for proper strength for particular application. Lids must have cast in letters stating, "Storm Sewer."

Storm Drainage Piping

- Reinforced concrete (RCP), Contech A-2000, or ADS (Advanced Drainage System slip-joint) depending on the location and particular application.
- The use of corrugated metal pipe is not allowed.

Storm Drainage Water Retention Structures

All storm drainage water retention structures shall use materials specified in the SCDHEC BMP Handbook or the elected permit authority's design manual

Mechanical Utilities

Hydronic (Chilled Water) Distribution Piping

- 6" and smaller – Schedule 40 Ductile Iron
- 6" through 12" – Schedule 30 Ductile Iron
- 12" and larger – Schedule 20 Ductile Iron

Steam Distribution Piping

- Steel pipe meeting ASTM A120 Grade A or ASTM A53 Grade B

Valves

- Steam Piping – Class 150 cast steel, bolted bonnet, seal welded seat rings, butt weld ends.
- Chilled Water Piping – Wafer type butterfly valves, as manufactured by Nibco or Demco, with 2" square operating nut, with valve box and cover.

Insulation

- Steam Piping – High pressure – 2" O.C. Kaylo

- Steam Piping – Low pressure and condensate – 1-1/2" O.C. Kaylo
- Pumped concentrate – No insulation

Electrical Utilities

Electrical Underground Ducts

- Concrete Encased Ductbanks – Rigid PVC, Type "EB", as manufactured by Carlon or Queen City Plastics. Spacers, supports, and end bells shall be PVC or high impact polystyrene.
- Direct Burial Ducts – Rigid steel conduit, galvanized with bitumastic coating.

Manholes

- Pre-cast concrete, with 36" opening in top for frame and cover, based on AASHTO HS 20 loading, complete with cast iron frame and cover, pulling irons, cable racks, bottom drain, with provisions for attaching entering duct or conduit, and provisions for electrical grounding, if required.
- Power manholes to be 8' x 8' x 8' inside dimension. Telephone and Communication manholes to be 6' x 6' x 6' inside dimensions.

Manhole Frames and Covers

- Cast iron, Neenah rated for AASHTO HS 20 loading vehicular traffic, as manufactured by Sumter Machinery Company – EJIW 1825. Covers to have cast in letters stating either "Electric" or "Telephone" as appropriate.

DIVISION 34 – Transportation

34 41 00 Transportation Signaling and Control

34 41 13 Traffic Signals

All traffic signal repairs, upgrades, etc. will be coordinated with Clemson University's Utilities Services division.

34 41 16 Traffic Control Devices

Provide all necessary barricades, flagmen, or other traffic control devices in accordance with the most current Manual on Uniform Traffic Control Devices, Section 600 of SCDOT's Standard Drawings, and any University approved project specific traffic control plans to prevent injury to people or damage to adjacent property or facilities. This protection includes the existing landscape and plantings. Provide protection for people and pedestrian traffic around the construction area. Do not close or obstruct adjacent streets and pedestrian walkways without permission from the project manager. Promptly repair, or remove and replace, project components, damaged utilities and owner's property, that are broken or defective or that do not comply with requirements in this Division, as directed by the project manager at no additional expense to the owner.

All traffic calming devices, both temporary and permanent, such as speed bumps, speed

tables, delineators, etc. shall be approved by the Clemson University Fire Marshal or Fire Code Official prior to installation.

34 71 00 Roadway Construction

34 71 13.16 Vehicle Crash Barriers

All traffic guardrail installations shall be approved by Clemson University Facilities' Planning and Design Office prior to installation.

Unless otherwise specified, all installations shall be installed in accordance with the current SCDOT Standard Drawings and to include the with the following:

- Powdercoated w-beam or thrie beam rails as deemed necessary
- Metal support posts
- Energy dissipating leading end treatments
- Rounded trailing end treatments

REVISION LOG

- 03/25/2009: Section 21 30 00 - Relocated this section to Section 28 30 00.
- 03/25/2009: Section 28 30 00 -Changed the designation of the sole source supplier of fire alarm equipment and services from Johnson Controls Inc. to Simplex-Grinnell.
- 04/01/2009 Revision Log Reformatted Revision Log and placed at end of document.
- 04/02/2009 Section 22 42 00 Added statement prohibiting waterless urinals.
- 06/09/2009 Section 32 80 00 Added information concerning Owner's option for installing underground sprinkler systems and specified Weathermatic irrigation systems.
- 09/07/2009 Section 22 44 00 Specified that basic water fountains be installed in both new and renovated facilities instead of the previously used electric water coolers. No hot water dispensers are to be included with the water fountain.
- 09/08/2009 Section 09 60 00 Changed flooring instructions to not allow VCT type products requiring labor and material intensive costs and to reduce environmental impact. (Tom Jones)
- 11/18/2009 Section 26 05 00 Hangers and Supports for Electrical Systems – Added statement that single conduits are to be supported by means of clamps to the building structure or pipe hangers supported by steel all-thread rods from ceiling inserts or building structure. (Bret McCarley)
- 11/18/2009 Section 26 05 00 277/480 volt systems: Changed Phase B color to Orange; changed Phase C color to Yellow; changed Neutral color to Gray or White. (Bret McCarley)
- 11/18/2009 Section 26 05 00 Identification of Electrical Systems: Revise sentence to read – Specify that conductors size #6 AWG or smaller are to be color coded with solid color insulation, and that conductor ends may be used on larger sizes. (Bret McCarley)
- 11/18/2009 Section 26 05 00 Raceways: Revise sentence to read: Conduit shall be installed with no more than 360 degrees of bend and 100' of length between pull boxes. (Bret McCarley)
- 11/18/2009 Section 26 05 00 Raceways: Revised specification for the use of flexible conduit to read: The maximum length of flexible conduit shall be 6'. (Bret McCarley)
- 11/18/2009 Section 26 10 00 Existing Systems and Design Information: Revise paragraph to read University power is transmitted at 4160 or 12,470 volt wye, 3 phase, 4 wire, 60 cycle AC. The existing 4160 volt system is in the process of being phased out and shall not be used to power new construction unless written authorization is given by the Clemson University Utilities Director. The paragraph immediately following this

- was relocated. See following revision. (Bret McCarley)
- 11/18/2009 Section 26 10 00 Substations: Add: Secondary voltage within the facility shall be distributed at 120/208 volts, 3 phase, equipment in the facility will be capable of utilizing a 480Y/277 volt system. The final selection of voltage should be based upon..... (Bret McCarley)
 - 11/18/2009 Section 26 50 00 Interior Lighting: Lighting voltage shall be 277 volts when available. (Bret McCarley)
 - 11/18/2009 Section 26 50 00 Interior Lighting: Specify the use of energy efficient fixtures wit electronic ballasts and T-8 tubes. Current T-8 standard is GE*32MAX-N-ULTRA ballasts and F28T8/XL/SPX41/ECO lamps. (Bret McCarley)
 - 11/18/2009 Division 26 Products and Materials: Medium Voltage Distribution: Switches: G & W or S & C SF6 to match existing switches in the system. (Bret McCarley)
 - 01/19/2010 Division 23 Products and Materials: Pumps: Added Patterson Pumps as an acceptable pump supplier. (Eddie Herring, Mike Parker, OK by Bob Wells)
 - 01/19/2010 Section 22 42 00 Added provision specifying the use of remote sensor lavatory faucets in new facilities. (Bob Wells, Allen Lohmann)
 - 01/19/2010 Section 00 03 00 Temporary Utilities: revised information concerning charge back for temporary utilities. (John McEntire, Tony Putnam)
 - 01/19/2010 Section 33 00 00 Design: Clarified information concerning charge back for temporary utilities. (John McEntire, Tony Putnam)
 - 07/29/2010 Section 22 11 00 Facility Water Distribution: Re-stated the requirement to comply with the Safe Drinking Water Act as applies to domestic water supply piping and piping materials – i.e., use of lead solder and piping. This regulation was already in place in Division 0.
 - 07/29/2010 Section 33 10 00 Water Utilities: Re-stated the requirement to comply with the Safe Drinking Water Act as applies to domestic water supply piping and piping materials – i.e., use of lead solder and piping. This regulation was already in place in Division 0.
 - 8/31/2010 Section 08 70 00 Finish Hardware: Clarified and expanded requirements for the selection and specification of Finish Hardware.
 - 8/31/2010 Division 08 Products and Materials: Created listing for acceptable Finish Hardware.
 - 9/1/2010 Division 22 Products and Materials: Added Viega ProPress compression fittings as acceptable Fittings for Copper Pipe.
 - 10/25/2010 Section 23 05 00 Specified requirement for steam meters to provide connectivity to Johnson Control Metasys system. (Tony Putnam)
 - 10/25/2010 Division 23 Products and Materials: Change specification for Steam Flow Meter and Chilled Water Meter. (Tony Putnam)
 - 10/25/2010 Section 26 20 00 Specified requirement for sub-metering and connectivity to Johnson Control Metasys system. (Tony Putnam)
 - 10/25/2010 Division 26 Products and Materials: Changed specification for electric Meters. (Tony Putnam)
 - 10/25/2010 Section 33 10 00 Water Utility Metering: Specified Combination Meters for potable water system and standard meters for irrigation system. (Tony Putnam)
 - 9/25/2012 Section 00 01 00 Drawings: Reference to CAD format and new sub paragraph 13.3
 - 9/25/2012 Section 00 03 00 Design Parameters: Additional emphasis on not permitting hazardous materials. New room numbering guidelines
 - 9/25/2012 Section 00 04 00 General Information: Additional emphasis on not permitting asbestos materials
 - 9/25/2012 Section 00 05 00 Sustainable Design: Hyperlink to LEED scorecard
 - 9/25/2012 Section 00 62 39 Minority Business Enterprise Certification procedures added
 - 9/25/2012 Section 01 14 00 Work Restrictions added

- 9/25/2012 Section 1 31 00 Project Management and Coordination: Clarification of Special Inspections
- 9/25/2012 Section 01 32 00 Construction Progress Documentation: Requests for photographic documentation on major projects
- 9/25/2012 Section 01 35 53 Security Procedures new section
- 9/25/2012 Section 01 55 00 Vehicular Access and Parking new section
- 9/25/2012 Section 01 55 29 Staging Areas new section
- 9/25/2012 Section 01 56 00 Temporary Barriers new section
- 9/25/2012 Section 01 56 16 Noise and Dust Control new section
- 9/25/2012 Section 02 26 00 Hazardous Materials Assessment: New emphasis on hazardous Materials
- 9/25/2012 Section 04 00 00 Design Guidelines: New hyperlink to Planning document
- 9/25/2012 Section 06 00 00 Woods, Plastics, and Composites: Added references to fire retardant and pressure treated wood use conditions
- 9/25/2012 Section 07 55 00 Green Roof Systems: New Section
- 9/25/2012 Division 8 Products and Materials: Required mortise locksets
- 9/25/2012 Section 08 10 00 New building must have mechanically assisted door
- 9/25/2012 Section 09 60 00 Resilient Flooring: Added MCT to recommended flooring
- 9/25/2012 Section 10 10 00 Signage: Revised wording to comply with ADA
- 9/25/2012 Section 10 20 00 Interior Specialties: Rewording of toilet and bath accessories. Solid surface partitions and countertops preferred
- 9/25/2012 Division 10 Products and Materials: Owner will provide Soap Dispenser and Sanitary Napkin Dispenser. New specific bath accessories
- 9/25/2012 Section 12 48 13 Entrance Floor Mats and Frames: New section
- 9/25/2012 Section 13 00 00 General Information: New comment on special construction
- 9/25/2012 Section 21 10 00 Water-Based Fire Suppression Systems: New hyperlink to Reliable Sprinkler
- 9/25/2012 Division 22: Added Vacuum Breaker and comment on water meter
- 9/25/2012 Section 22 07 00 Plumbing Insulation clarification
- 9/25/2012 Section 23 20 00 HVAC Piping and Pumps: Comment on insulation
- 9/25/2012 Section 23 30 00 HVAC Air Distribution: Comment on insulation
- 9/25/2012 Division 23 Products and Materials: Steam Flow and Chilled Water Meter
- 9/25/2012 Section 26 05 13 Medium Voltage Cables: Hyperlink to Spec Sheet
- 9/25/2012 Section 26 05 19 Low Voltage Cables: Comment on LVC
- 9/25/2012 Section 27 10 00 Communication Systems: Added comments and hyperlink to a new CCIT document
- 9/25/2012 Section 32 00 00 Exterior Improvements: New Division added
- 9/25/2012 Section 33 00 00 General Information and Design Guidelines: New comment on Submetering
- 9/25/2012 Section 33 11 13 Public Water Utility Distribution Piping: Added hyperlink to new document showing water riser entry
- 5/1/2013 Section 09 60 00 Revised flooring requirements
- 5/22/2013 Division 32 Products and Materials: Irrigation systems
- 10/1/2013 Section 00 01 00 Revised CAD drawing requirements
- 10/1/2013 Section 01 50 00 & 02 21 00 Additional survey information
- 10/1/2014 Section 00 01 00 CAD requirements updated
- 10/1/2014 Section 00 30 00 revised room numbering, additional space and access information
- 10/1/2014 Section 01 56 00 Barricade plan requirements added
- 10/1/2014 Section 07 50 00 ½" minimum roof slope emphasized
- 10/1/2014 Products and Materials Division 07 Soprema modified bitumen added
- 10/1/2014 Section 08 71 13 Automatic Door Openers added
- 10/1/2014 Section 08 74 00 Access Control added

- 10/1 /2014 Products and Material Division 08 Panic hardware, Door stiles, and automatic doors
- 10/1/2014 Section 09 90 00 Link to approved paint colors
- 10/1/2014 Section 21 00 00 Major rewording from Fire Marshal
- 10/1/2014 Section 21 13 16 Dry-pipe sprinkler requirements added
- 10/1/2014 Section 22 00 00 Isolation provisions added
- 10/1/2014 Section 22 05 76 Cleanout specifications emphasized.
- 10/1/2014 Section 22 13 19 Trap primers emphasized
- 10/1/2014 Products and Material Division 22 Process Piping Viega pex added, Valves updated
- 10/1/2014 Section 23 05 53 HVAC Identification updated in referenced document
- 10/1/2014 Section 23 30 00 Added requirements for Kitchen and Fume Hoods
- 10/1/2014 Section 23 80 00 Added requirements for Fan Coil Units and condenser protection
- 10/1/2014 Products and Material Division 23 Clarified condensate insulation, Weiss thermometers
- 10/1/2014 Section 26 00 00 Minor restructure to match CSI format
- 10/1/2014 Section 26 05 53 Arc flash warning labels emphasized
- 10/1/2014 Section 26 40 00 Lightning Protection reference updated
- 10/1/2014 Section 26 50 00 LED lighting encouraged. Fixture access required.
- 10/1/2014 Section 26 56 00 LED lighting encouraged.
- 10/1/2014 Products and Material Division 26 Added LED
- 10/1/2014 Section 28 30 00 Voice evacuation added
- 10/1/2014 Section 32 14 16 Brick pavers sub base minimums defined
- 10/1/2014 Section 32 17 23 Fire Lane marking information added
- 10/1/2014 Section 32 12 13 Water Supply Backflow Preventer Assemblies added
- 10/1/2014 Products and Material Division 26 Added controller air card and NDS fittings
- 5/15/2015 Section 00 03 00 Revised Space and Access requirements
- 5/15/2015 Products and Materials Division 23 minor revisions
- 5/15/2015 Section 00 05 00 LEED certification updated
- 5/15/2015 Tree Protection Plan updated
- 5/15/2015 Section 26 56 00 Products and Materials Updated LED lights
- 9/1/2015 Products and Materials Division 32 Revised Irrigation
- 11/1/2018: All hyperlinks updated.
- 11/1/2018: All divisions updated with current approved products.
- 11/1/2018: Entire Green Book renumbered to reflect 2018 MasterFormat.
- 11/1/2018: 00 00 00 CAD Standards/BIM Modeling and Code Footprint updated. Use of AIA B101-2007 and E202-2008 added
- 11/1/2018: 00 03 00 Updated to include Custodial and Recycling space planning. Roof Access Requirements updated, access and code requirements for attics with equipment, and provision for Lactation/Medical Privacy Space added.
- 11/1/2018: 00 05 00 Green Globes option added for sustainability.
- 11/1/2018: 01 14 16 Silica and Asbestos compliance added. Tobacco Free Campus statement added.
- 11/1/2018: 01 35 53 Updated requiring visible ID's for workers. Alcohol Free Workplace statement added. Statement of required conduct towards passersby added.
- 11/1/2018: 02 84 16 Section added.
- 11/1/2018: 04 21 13 Updated to require all brick purchased at once for color matching.
- 11/1/2018: 07 05 00 NRCA and SMACNA Editions updated. Fall Protection added
- 11/1/2018: 07 76 00 Updated to reflect current usage/products
- 11/1/2018: 07 80 00 Section added
- 11/1/2018: 08 71 00 Updated hardware requirements and perm. lock cores.

- 11/1/2018: 09 05 00 VOC limits and flooring sole source added.
- 11/1/2018: 09 06 00 Updated to require flooring uniformity in flexible spaces.
- 11/1/2018: 10 28 00 Updated to reflect current equipment from Custodial.
- 11/1/2018: 11 21 00 Updated to reflect proper Univ. contact.
- 11/1/2018: 11 82 00 Updated bin types and Space Planning.
- 11/1/2018: 14 20 00 Updated to reflect current usage/products.
- 11/1/2018: 21 05 00 Updated to include off campus hydrant/FDC
- 11/1/2018: 21 10 00 Minimum pipe schedules updated.
- 11/1/2018: 22 63 19.53 Section added.
- 11/1/2018: 23 05 00 Climate control for elevator equipment added.
- 11/1/2018: 23 05 23 Service/Isolation valves added.
- 11/1/2018: 23 07 13 Updated for insulating exterior ducts.
- 11/1/2018: 23 09 00 Updated to include leak warning capability
- 11/1/2018: 26 05 13 Updated contact info.
- 11/1/2018: 26 05 53 Updated for requiring correct panel schedules.
- 11/1/2018: 26 10 00 Requirement to contact Utilities added.
- 11/1/2018: 26 12 00 Updated with current devices
- 11/1/2018: 26 41 00 NFPA 780 and UL 96 /96A references added.
- 11/1/2018: 26 51 00 Updated to include LED fixtures.
- 11/1/2018: Division 26 Products-Parking Lot/Street Lighting Updated.
- 11/1/2018: Division 34 created.
- 11/1/2018: 27 05 00 Updated to reference current CCIT Standards.
- 12/6/2018: 28 20 00 Section Added.
- 11/1/2018: 31 11 00 Links to CUFD and Research Safety added.
- 11/1/2018: 32 16 23 Section Added.
- 11/1/2018: 33 11 13 Updated verbiage to remove reference to obsolete document and add under-slab verbiage
- 11/1/2018: 33 47 26 Updated to reflect current Univ. MS4 Classification.
- 11/1/2018: 33 80 00 Updated to reference current CCIT Standards.
- 11/1/2018: Division 34 added.
- 6/13/2019: Division 32 Products-Errata update to underground sprinkler valves.
- 6/27/2019: Section 12 61 00 Added-Errata update to include Seating Warranty effective 03/2018.
- 1/1/2020: Title, Preamble, and body text updated to refer to documents as Standards for Commissioned Architects and Engineers.
- 1/1/2020: Preamble updated with conditions for consideration of deviations.
- 1/1/2020: All hyperlinks verified and updated as needed.
- 1/1/2020: Urban Forest Management links updated due to revised policy web address.
- 1/1/2020: 00 01 00 Updated to require a scale ruler on all scaled drawings.
- 1/1/2020: 00 01 00 Updated to require life safety drawings with const. drawing for plan review.
- 1/1/2020: 01 14 16 Updated with link to Tobacco-Free Policy.
- 1/1/2020: 00 03 00 Updated to link Room and Door Numbering Standards and to allow a combo drench shower/eyewash to be required based on chemical inventory.
- 1/1/2020: 08 10 00 Door Frame requirements updated.
- 1/1/2020: 08 10 00 and 08 71 00 updated to with storefront dimensions.
- 1/1/2020: 12 61 00 Section Added.
- 1/1/2020: 21 10 00 Updated to require sprinkler valves to be readily accessible.
- 1/1/2020: Division 21 Materials revised to reflect current piping insulation materials.
- 1/1/2020: Division 21 Products Updated Approved water heaters, emerg. showers/eyewashes, plumbing fixtures, hose bibcocks, chemical drains, deionized water piping, and water meter monitoring capabilities.
- 1/1/2020: 22 05 23 Valve Labeling and pipe hangers updated.

- 1/1/2020: 22 11 13 Updated requiring Utility entry through accessible trench and no visible exterior penetrations.
- 1/1/2020: 22 13 00 Updated requiring Utility entry through accessible trench and no visible exterior penetrations, and 2-way cleanouts built with 45 deg. Y-fittings.
- 1/1/2020: 22 40 00 Updated to require WaterSense certified fixtures
- 1/1/2020: 22 42 16 Updated to add Vitreous China to lavatory materials and define mounting centers for different faucet types.
- 1/1/2020: 22 45 00 Section Added
- 1/1/2020: 23 05 00 Updated to include check valve in primary crossover bridge and to require location of all controls, sensors, transmitters, etc.
- 1/1/2020: 23 05 93 Updated to include all valves and grills are working after TAB.
- 1/1/2020: 23 11 00 Updated to require parallel backflow preventers.
- 1/1/2020: 23 20 00 Updated to requirements for tapping horizontal steam and hot water piping.
- 1/1/2020: 23 21 00 Updated to require pumps be controlled by differential pressure sensors
- 1/1/2020: 23 64 00 Updated to disallow blended refrigerant and to require single stage compressors, and equipment that won't be derated with a refrigerant change.
- 1/1/2020: 23 81 00 Updated to require coils to be repaired or replace per manufacturer's instructions.
- 1/1/2020: 23 82 19 Updated to require condensate pan overflow sensor to shut off chilled water to FCU.
- 1/1/2020: 23 82 19 Updated to change fan motors from ECM to 3 Speed.
- 1/1/2020: Division 23 Products list updated to add Daiken air handlers.
- 1/1/2020: Division 22 Products list updated with preferred brands water heater type.
- 1/1/2020: Division 23 Products list updated to include Neptune Prefilter Feeder.
- 1/1/2020: Division 23 Product Updated to include octave Ultrasonic Master Water Meter.
- 1/1/2020: Division 23 Products updated to include Dwyer gauges and to reflect current product usage on duct insulation.
- 1/1/2020: 26 05 00 Modified to remove verbiage redundant with Section 00 00 00.
- 1/1/2020: 26 05 19 Section created to define allowable MC Cable usage.
- 1/1/2020: 26 05 73.19 Section Added.
- 3/12/2020: Division 26 Products-Errata update to remove comfort optics on 30' street lighting.