

**STATE OF VERMONT
DEPARTMENT OF BUILDINGS AND GENERAL SERVICES
DESIGN GUIDELINES**

IMPORTANT NOTE FOR USE OF GUIDELINES:

The approval and adoption of this document is effective **October 1, 2022**. All projects commencing design after this date will follow the **2022** Design Guidelines and not the previous version(s). Please be sure to refer to the approval date on the front of the document to ensure that the correct version is being used by the entire project team on your project.

The following guidelines are intended to be used on all types of projects at the Department of Buildings and General Services (BGS). This guideline is meant to serve as a supplement to, not a replacement of, any code, design or industry standard. Contact the BGS project manager if there are any conflicts raised by these guidelines. This guideline is a living document and meant to provide the institutional knowledge gained at BGS over the years to provide best practice guidance, and to prevent repeating the mistakes of the past. What is written here is not so much cast in stone, as it is etched in wood, deviations may be allowed at the discretion of the BGS Project Manager, and those decisions should be reflected in the Basis of Design (BOD) Document. The guiding principle is BGS builds institutional buildings intended to last a hundred years, not big box stores designed to last 12-15 years. Contractors and BGS Project Managers please provide comments and feedback to continue to improve this document.

Abbreviations: Define abbreviation and acronyms the first time they are used in the document

Yellow highlighted items are what has changed from the previously published version.

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OVERVIEW (10,000-foot view):

Priorities

The residents and businesses of the State of Vermont publicly fund BGS construction and renovation projects. The expectation is to expend these resources wisely. This funding process usually involves budgetary estimates from the BGS Regions. Projects occasionally fall short on funding due to constraints, leading to conflicts involving competing interests. In cases where the legislature does not provide specific direction, the projects' competing interests are resolved through the following:

- 1) Develop a safe facility: organizationally, structurally and consistent with all project permits
- 2) Satisfy program goals: maximize developed spaces and minimize circulation space
- 3) Develop a high quality, long lasting and maintainable facility, properly sized with provisions for future needs
- 4) Minimize value engineering of the essential components of the building
- 5) Maximize the utilization of energy efficient designs and the incorporation of energy efficient equipment, materials and methods, following the goals of Vermont's State Energy Plan
- 6) Maximize integration of sustainability in design and construction; consistent with the State's energy and environmental objectives
- 7) Utilize locally sourced materials, avoid shipping materials long distance to reduce carbon footprint from transportation
- 8) Maximize the incorporation of alternative renewable energy technologies

Design all new construction and major renovations to be in compliance with the currently adopted Vermont Commercial Building Energy Standards (2020 CBES) and achieve, at a minimum, Efficiency Vermont's [High Performance building certification](#) (10% greater energy savings over a minimally code compliant building) and strive to achieve [Net Zero ready certification](#) where feasible (20% greater energy savings over a minimally code compliant building).

- 1) Collaboration between the State, contracted design team, and applicable Energy Efficiency Utilities (Burlington Electric Department, Efficiency Vermont, and/or Vermont Gas Systems) shall occur.
- 2) Achieving LEED certification or LEED certification equivalency will be assessed as a project goal on a case by case basis and is not currently a requirement unless established in a project's RFP. If the RFP does not state a level of certification, then new buildings shall be designed and built to a minimum equivalent of LEED Gold. Existing buildings shall be renovated to a minimum equivalent of LEED Silver.
- 3) The means to achieve these goals shall be presented to BGS by the end of Concept Phase.
- 4) When altering a building that has previously been certified in programs such as LEED or through Efficiency Vermont, ensure that the changes will not remove or alter the features that earned credits towards the certification unless it is prudent to do so.
- 5) All equipment shall be the most energy efficient choice that will still perform the task desired.

- 6) Whenever possible specify ENERGY STAR, premium efficiency or another efficient standard.

“Life cycle cost” has been mandated by the State Legislature, in 2013 **Act 51**, as the primary factor for selecting many components of a building and site.

Project Objectives

Encourage the use of locally and sustainably produced products

Vermont **and the Northeast** have some of the most valued and unique natural materials that can be incorporated into our building environment, including granite, marble, slate, a variety of hardwoods and other valuable resources. In addition, many product and service providers in the building trade industry are unparalleled in their ability to incorporate regional natural resources into our building environment, including: cabinetmakers, wood workers, stonecutters, masons, brick manufacturers, and other trades people, as well as: energy auditors, weatherization professionals, designers, engineers, and architects. **All things being equal** these resources should be developed and expanded, rather than squandered. Existing specifications should be strengthened, and new specifications should be developed to encourage and provide new market opportunities for this sector of the economy.

Energy Efficiency, Energy Conservation and Renewable Energy

- 1) The design team shall incorporate renewable energy sources, energy efficiency, thermal energy conservation and water conservation in **all** new building construction, **and** major renovation projects **in excess of \$250,000.00** unless a life cycle cost analysis demonstrates that the investment cannot be recouped, there are limitations on siting or other laws, rules or regulations prohibit such measures.
- 2) The “life cycle cost” shall mean the present value purchase price of an item, plus the replacement cost, plus or minus the salvage value, plus the present value of operation and maintenance costs, plus the energy and environmental externalities’ costs or benefits.
- 3) Utilize the latest accepted version of the IECC which incorporates ASHRAE 90.1 that requires designers to incorporate control strategies for the following:
 - a. Unoccupied **and seasonal** setback, where appropriate,
 - 1) Areas of some facilities are occupied 24/7 such as the cells of Correctional facilities and 911 call centers, so setbacks are inappropriate
 - 2) **Some spaces have second shift work such as DMV**
 - 3) **Some spaces have seasonal occupancy such as Tax**
 - 4) **Some buildings can benefit from seasonal setpoints**
 - b. Heat recovery
 - c. Air side economizer
 - d. Water side economizer
 - e. Heating water temperature reset control

- f. Cooling staging
 - g. Demand ventilation control of ventilating air
- 4) Specific other areas to examine for cost vs. benefits:
- a. Enthalpy heat recovery
 - b. Geothermal
 - c. Radiant heat
 - d. Solar
 - e. Biomass
 - f. Wind
- 5) Utilize the [2017 Vermont Stormwater Management Manual Rule and Design Guidance](#)
Effective stormwater management must include both water quality and water quantity controls. Since the Vermont Stormwater Management Manual (VSMM or Manual) was first published in 2002, substantial advances in the design and range of best management practices (BMPs) and site design approaches available to meet these goals have occurred. New methodologies – variously referred to as low impact development, environmental site design, and green stormwater infrastructure – have been developed for managing stormwater runoff. These methodologies include an emphasis on the application of small-scale management practices that minimize stormwater runoff, disperse runoff across multiple locations, and utilize a more naturalized system approach to runoff management.

Recycling Programs

- 1) The State encourages the use of recycled building products and building products that contain recycled content using LEED or equivalent standards as benchmarks.
- 2) The State encourages its employees and visitors to recycle and/or compost their waste materials, so spaces need to be provided to facilitate these activities.

Codes, Permits and Other Documents

Codes

- 1) All necessary permits, to include Act 250, shall be in place prior to construction. Copies shall be included in the Permit file, Submittal Exchange, and O&M Manual.
- 2) Buildings shall comply with all current State and Federal codes. Information on all State codes is available on the Department of Public Safety, Division of Fire Safety web page at: <http://firesafety.vermont.gov/buildingcode>
- 3) Local building codes and zoning ordinances as limited by 24 V.S.A. § 4413 <https://legislature.vermont.gov/statutes/section/24/117/04413>.

Reference Standards

- 1) BGS "Space Management Standards and Strategies"
- 2) Occupational Safety and Health Administration (OSHA)
- 3) Vermont OSHA (VOSHA)
- 4) Vermont Department of Environmental Conservation Environmental Protection Rules, <http://www.anr.state.vt.us/dec/rulesum.htm>
- 5) State Agency Energy Plan, <http://bgs.vermont.gov/sites/bgs/files/files/energy-environment/2016-State-Agency-Energy-Plan.pdf>
- 6) BGS Agency Energy Implementation Plan, <http://bgs.vermont.gov/sites/bgs/files/BGS%20AEIP%202016.pdf>
- 7) Vermont Hazardous Waste Management Regulations, <http://dec.vermont.gov/waste-management/hazardous/regulations>
- 8) The goal of building design should be to achieve a high-performance building. The Energy Efficiency Utility, EVT provides information on the resources: <https://www.encyvermont.com/services/renovation-construction>
- 9) Lighting levels should comply with:
 - a. Foot-candle levels provided by the Illuminating Engineering Society or IES of North America - latest accepted version.
 - b. Lighting levels with lighting power densities specified in the latest accepted version of ASHRAE 90.1.
 - c. Light levels should require no more than the lighting power densities specified in the E-Benchmark - latest accepted version.

- 10) American National Standards Institute (ANSI)/ASHRAE/USGBC/IES Standard for High-Performance Green Buildings 189.1 - latest accepted version.
- 11) Vermont Commercial Building Energy Standards (CBES) – latest accepted version for designing the HVAC, refrigeration, and lighting systems - available at: http://publicservice.vermont.gov/energy_efficiency/cbes
- 12) American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Energy Standard for Buildings except Low-Rise Residential Buildings 90.1 - latest accepted version.
- 13) ASHRAE Ventilation for Acceptable Indoor Air Quality Standard 62.1 - latest accepted version.
- 14) ASHRAE Thermal Environmental Conditions for Human Occupancy Standard 55 - latest accepted version.
- 15) Consider the existing architecture when making adjustments based on the latest accepted version of the Space Management Guidelines.
- 16) Utilize the latest accepted version of the Vermont Agency of Transportation (AOT) Standard. Specifications for construction **materials** whenever possible. Items specified include sand, gravel, bituminous concrete, etc. Information to include how to get a copy can be found on the AOT website: <https://vtrans.vermont.gov/docs>
- 17) All designs will consider the latest accepted version of the Americans with Disabilities Act (ADA) Standards and Accessibility Guidelines as a minimum standard.
- 18) Latest accepted version of National Electrical Code.
- 19) Agency of Natural Resources Regulations - latest accepted version.
- 20) Vermont Stormwater Management Manual Treatment Standards - latest accepted version.
- 21) GSA's National Business Space Assignment Policy, most current version. https://www.gsa.gov/cdnstatic/NBSAP_July2017_Final.pdf.
- 22) Meet these standards whenever feasible:
 - a. National Environmental Balancing Bureau Specifications (NEBB)
 - b. International Society of Arboriculture
 - c. American Society of Sanitary Engineering 1055
 - d. Building Industry Consulting Services International (BICSI) Standards

- e. National Air Duct Cleaners Association Standard Assessment, Cleaning, and Restoration of HVAC Systems - for a process on duct cleaning

Useful guidelines:

- a. LEED Pilot Credit Library, USGBC, LT Pilot Credit 14: Walkable Project Site, www.usgbc.org/pilotcredits
- b. Energy Management Handbook, Eighth Edition, Wayne C. Turner and Steve Doty
- c. Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act, <https://www.epa.gov/nps/stormwater-management-federal-facilities-under-section-438-energy-independence-and-security-act>
- d. Water Sense Water-Efficient Landscape Design Tips from the United States EPA at: http://www.epa.gov/watersense/outdoor/landscaping_tips.html
- e. Vermont Green Infrastructure initiative Green Stormwater Infrastructure: <https://dec.vermont.gov/watershed/stormwater/green-infrastructure>
- f. 2009 Sustainable Sites Initiative Guidelines and Performance Benchmarks <https://digital.library.unt.edu/ark:/67531/metadc31157/>

Reference Documents

- a. Commissioning Guidelines
- b. State Agency Energy Plan
- c. BGS Burner Start-up Sheet

GENERAL/ADMINISTRATIVE (1,000-foot view, affects multiple disciplines)

- 1.1 Budgets and Estimates: Provide preliminary budgets or statements of probable cost at the end of each significant project phase for review and signoff by BGS before going ahead to next phase. Include contingencies early in the budget process. Provide intermediary and final construction estimates. Communicate any anticipated adjustments that adversely affect the budget to the State's Project Manager at the earliest possible time.
 - A. Be aware that the Construction Cost is only a component of the actual Project Cost, which includes all costs associated with the project including, but not limited to: Construction Cost, A& E fees, Reimbursable expenses, Permits, Bonds, Inspection, Contingencies, Furniture, Security systems, Moving costs and Art in State Buildings and fit up costs.
 - B. Budget shall also include costs for fit up of BGS Maintenance and Custodial equipment purchases and initial stocking of consumable products.
- 1.2 Document submission: Submit all documents for review by .pdf.
- 1.3 Owner: In all instances where bid documents use the term Owner, they shall be changed to say State.

- 1.4 Specifications Numbering: Number specification sections with the current Construction Specifications Institute (CSI) MasterFormat: www.masterformat.com.
- 1.5 Drawings Order: Civil, Architectural, Structural, Fire Protection, Plumbing, HVAC, and Electrical. Life Safety analyses and other code reviews may be at the beginning or end of the set.
- 1.6 Drawing Appearance: Keep drawings simple and uncluttered. It may appear acceptable in the computer-aided design software, but it may not reproduce acceptably when mass printed. Use text larger than eight (8)-point font in all documents and drawings.
- 1.7 Schedules of values and requisitions for payment, break out subcontract amounts using CSI format into sufficient detail so that the Clerk-of-the-Works and Project Manager can easily ascertain the value of work performed.
- 1.8 Delegated design: Designs shall be complete when bid. Limit the use of contractor and/or vendor designed, e.g. curtain walls, mechanical systems, fire sprinklers, radiant heat, etc.
- 1.9 Mercury Content: Use products that do not contain mercury whenever possible. When a product must contain mercury, such as florescent lights then select the model with the lowest amount of mercury. Identify products containing mercury to the State Project Manager for approval
- 1.10 Formaldehyde Content: Avoid products containing formaldehyde whenever possible. Identify products containing formaldehyde to the State Project Manager for approval.
- 1.11 Asbestos: Do not use any materials containing asbestos.
 - A. Vermiculite: Prior to 1990 some vermiculite may have been contaminated with asbestos. Do not use vermiculite, or products containing vermiculite. If products must contain vermiculite, obtain a certification that the vermiculite used does not contain any asbestos.
 - B. During construction in existing buildings if vermiculite is encountered, assume it contains asbestos, until testing proves otherwise, if it is a small amount it may be less expensive to abate it without testing.
- 1.12 Fiber cement panels and siding shall not be used in any project.
- 1.13 Keep it simple: To the greatest degree possible, keep system designs and sequences as simple as practical, overly complicated designs and systems cost more to maintain.

- 1.14 Value Engineering: An item to try and avoid, however if value engineering is required, try to eliminate items that can easily be added/corrected at a later date, such as landscaping, and finishes. The backbone of the building; foundation, structure, mechanical and electrical systems, are much harder to change at a later date and should not be considered.
- 1.15 Local products: Use whenever possible to support Vermont and other regional businesses.
- 1.16 Bonding: Remember capital construction projects are bonded for 20 years, do not include products that wear out before the construction is paid for, that's like taking out a 30-year mortgage on a car.
- 1.17 Flood Elevation: In the absence of more stringent requirements, minimum design elevation shall be either the 500-year flood elevation or the 100-year flood elevation plus 12" whichever is greater.
- 1.18 Pavers: Due to the number of tripping related claims against the State of Vermont, pavers shall NOT be used on any future projects.

MISCELLANEOUS PROGRAM REQUIREMENTS (100-foot view)

- 1.1 Pre-Construction:
 - A. Review the feasibility of incorporating any previous recommendations prior to completing the design of any new work within a building.
 - 1. Review all outstanding capital requests, Facility Condition Assessments, major maintenance items and work orders for the building.
 - B. Review potential utility savings:
 - 1. Electric utility savings is an important consideration. In the case of the electric bill, reduction in peak use could result in more savings than just the costs per kilowatt-hour. Achieve cost effective savings by addressing both of these areas.
 - 2. Fuel savings for heating will result in cost savings and a reduction in the associated greenhouse gas emissions.
 - 3. Water savings pays double, because municipal sewage rates are typically calculated based upon water usage.
 - C. For renovation projects, conduct field verification of the existing plumbing fixtures. Provide the following findings to the BGS Project Manager:
 - 1. Compatibility of existing plumbing fixtures with any proposed additions to the building,
 - 2. Accessibility requirements and code compliance
 - 3. Applicability of existing plumbing fixtures in relation to current acceptable industry practices,

4. Ease of maintenance of proposed plumbing fixtures.
- D. At the first Design Team/Owner meeting, principal decision makers shall agree upon the Basis for Design (BOD) for the project.
1. They shall go through this entire document, editing until it accurately reflects the details for the project. This edited document shall become part of the Basis for Design.
 2. They will also review any space/site programs developed to date, identifying and sustainability documents such as Historic Preservation, LEED and Efficiency Vermont/ASHRAE.
 3. The BOD will define the functional, operational, and occupant requirements for the facility.
 4. If the BOD is modified, all project documents, such as the O+M manual, shall also be modified.
- 1.2 Space for building systems: **There shall be a minimum of three (3) feet of space designed between the bottom of the structural steel and the finished ceiling.** When multiple air handlers are grouped together, such as in a mechanical room or on the roof, then the floor closest to the air handlers shall have a minimum of four (4) feet of space to accommodate main trunk lines.
- A. In mechanical intensive buildings such as laboratories the minimum space between the bottom of the structural steel and finished ceiling shall be at least 1 foot greater than above.
- 1.3 Telecommunication Rooms: All buildings shall have a telecommunications room or rooms meeting the following requirements:
- A. The main telecommunication room shall be the telephone and data demarc for the building. And shall be used solely for the installation of telephone, data, door control, security and CATV devices and not used as a storage space or for any other purpose.
 1. The telecommunication room(s) shall be sized to house all of the telephone, data, security, door control and CCTV equipment. 27 00 00 1.6 A provides the minimum space for telephone and data, BGS security will define the space necessary for door controls, security and CCTV.
 - B. The walls of the room shall be lined with unpainted, fire resistive, ¾" plywood, each piece of plywood shall visibly display at least one FR label.
 - C. Provide adequate blocking/structure so the plywood can support wall mounted IT racks.
 - D. If the entire building cannot be reached from one telecommunication room, provide stacked telecommunications closets so that every room in the building can be reached by a maximum 250' cable utilizing the wire management system from one of the closets.
 - E. When stacked rooms are provided, there shall be a minimum of two (2) 4" conduits/sleeves between rooms.

- F. Provide energy efficient 24/7/365 cooling capability in all telecommunication rooms, so that the entire building HVAC system is not required to operate to condition these rooms.
- 1.4 Adjacency: In all buildings with more than one tenant group the offices of the tenant group shall be collocated to the greatest extent possible.
- 1.5 Noise and Vibration: Design buildings with an integrated approach to acoustical comfort and vibration control with effective detailing of floor, wall, and ceiling assemblies integrating with HVAC systems, sound and noise control systems, whether fixed or movable equipment. For open office use ASTM E1374-18, standard guide for open office acoustics and applicable ASTM standards sourced via <http://www.astm.org/cgi-bin/resolver.cgi?E1374>
- A. Consider the location of moving machinery in relation to occupied spaces: pumps, fans, chillers and the like located in spaces adjacent to courtrooms make noise in the sound system that makes it difficult for the court stenographer to transcribe the recording.
- B. Roof mounted equipment should be located above corridors and utility spaces not occupied spaces.
- 1.6 Conference Rooms: Provide at least one (1) medium to large ADA compliant conference room that is accessed directly from a public area with sufficient ADA compliant toilet facilities available. Ideally, the conference room shall be located near the main lobby or some other prominent entry that would allow off-hours meetings while securing the balance of the building. The goal is to limit the public's access to the rest of the building. In buildings where there is more than one tenant, this may be a shared conference room.
- A. All medium and large conference rooms shall be equipped to allow for refreshments and shall include an open counter with sink at the back of the room for setting up food and drinks with space underneath for waste/recycling/compost containers.
- B. All conference rooms shall be provided with adequate infrastructure to accommodate current audio-visual technology, and the backbone shall be flexible enough to handle foreseeable advances. Overhead projection, Wi-Fi, whiteboards, smart boards, etc.
- 1.7 Kitchenettes: Provide at least one (1) kitchenette for the building. Consider additional kitchenettes when the project has multiple floors, multiple tenants and/or is a large facility. No cooking equipment shall be provided, or planned for, unless appropriate fire-protection systems and hoods are designed into the project. This includes stoves, ovens, hot plates, fat fryers etc.
- A. What should be included as part of fit-up:
1. Refrigerator

2. Sink
3. Counterspace, cupboards, drawers.
4. Microwave
5. Space for coffee pot or coffee maker
6. Paper towel dispenser and waste receptacle

1.8 Recycling and Composting:

- A. In new buildings and major renovations, space shall be set aside for recycling and composting storage that is separate from custodial storage or any mechanical rooms.
- B. Provide designated waste management areas where recycling is likely to occur, such as printer/copier rooms, kitchenette areas, and in medium and large conference rooms. To do so, specify that the hallway and/or kitchenette to have a recessed area within the wall or under an open counter area to house the recycling center with enough height to place the recycling items in the top of the removable recycling center and remove containers for maintenance. Clearly label each bin for recycling, composting and trash. Provide a sink for washing of items to be recycled.



Montpelier Capitol Complex at State House Cafeteria Area

1.9 Drinking Fountains: When provided assembly must include a bottle filler.

1.10 Restrooms:

- A. In staff areas and buildings primarily used by State employees, provide single user restrooms that comply with Act 040-2011 and Act 127-2018.
- B. In buildings with high visitor counts, such as DMV, courts, AHS or large meeting rooms or assembly areas; provide two (2) multiple user restrooms, designated Men's and Women's, and at least 2 single user restrooms for use by the public.
- C. In multiuser restrooms:
 1. Provide large roll paper towel dispensers or folded paper towel dispensers that are not proprietary.
 2. Large roll toilet paper dispensers.

3. Use non-metallic partitions and urinal screens

D. In single user restrooms there is no need for partitions or screens.

E. Provide sanitary napkin/tampon dispensers and sanitary disposal receptacles in all women's rooms and single user restrooms. Devices shall be ADA compliant.

F. Place the waste receptacle near the exit door(s) so people can use a paper towel to open the door then throw it away or provide a hand's free way of opening the door(s).

G. Do not provide soap dispensers, these are provided by the contracted soap vendor.

H. Every public restroom shall have at least one ADA compliant baby changing table. In employee only restrooms there shall be at least one ADA compliant baby changing table per building.

I. Use of metal within 3' of a toilet or urinal is very strongly discouraged. Privacy screens, cabinet heaters and baseboard radiation prematurely rust from the salt spray.

J. Urinals shall be equipped with sensor flushometers and shall use 1.0 gpf unless the drain is configured so that a lavatory waste rinses the urinal waste. No waterless urinals. Lack of adequate dilution causes minerals to build up and eventually clog the drain.

1.11 Showers: Provide at least one (1) ADA compliant shower with changing area for each building. Shower/changing rooms shall be designed as single user facilities.

A. Card access for entry, if the building has card access, not accessible to the public if no card access.

B. Provide the outside door with a one-sided deadbolt with Occupancy Indicator.

C. Larger buildings shall have multiple shower rooms.

D. Shower stalls shall slope to a drain.

E. The area outside shower stall shall slope to a drain, this can be the same drain.

1.12 Lactation Room: At least one (1) ADA compliant lactation room will be provided for each building, pursuant to Vermont labor laws. To include the following:

A. Minimum of 70 square feet, with card access for entry.

B. One-sided deadbolt with Occupancy Indicator.

C. All furnishings and surfaces smooth, rounded and easily cleanable

D. Sink with hot and cold water.

E. Paper towel dispenser and waste receptacle.

F. A task chair suitable for a workstation with easy cleaning surfaces, casters, seat, back, armrest, lumbar, tension, and height adjustments are preferable.

G. Solid surface shelf, minimum of 32" x 18" at desk height

H. Electrical outlets above the shelf or table.

I. If more than one station is included, provide a curtain and/or walls for privacy.

J. Small refrigerator.

K. At least three small, lockable, lockers to hold pumps and accessories.

L. Coat hooks

M. Full length mirror

N. In building with large visitor counts consider an additional lactation room for public use with these minimum requirements:

1. Single occupancy

2. One-sided deadbolt with Occupancy Indicator.

3. All furnishings and surfaces smooth, rounded and easily cleanable

4. Sink with hot and cold water.

5. Paper towel dispenser and waste receptacle.

6. Electrical outlets above the shelf.

7. At least one bench with a shelf adjacent.

8. Coat hooks

9. Full length mirror

1.13 Exterior Wall Design: When designing with steel stud and masonry cavity walls, place rigid insulation exterior to the stud space to prevent thermal bridging and to create a continuous plane for air and water barriers.

1.14 Flooring: High traffic and other areas that should have easy to clean hard durable surface flooring, i.e., Ceramic tile, Quarry tile, epoxy, linoleum, rubber or Quartzite tile or Wood.

A. Typical high traffic areas include: Main lobbies, corridors, rest rooms, elevators, etc.

B. Other areas that shall have hard durable flooring include: Kitchenettes, recycling areas.

C. No slab on grade construction under carpet, tile, linoleum or other flooring which can trap moisture and cause the adhesive to fail.

1.15 Wood Products: For all wood, wood products, and materials and products containing wood products used on a project, provide wood from certified, well managed, or sustainable sources whenever feasible and cost effective.

1.16 Room and Door Numbering: The idea is to create wayfinding so that emergency personnel, that are not familiar with the building, can easily and readily respond. Number all rooms and cubicles with three-digit numbers where the first digit represents the floor the room is on, number rooms sequentially (clockwise) around the floor starting at the principal entrance, rooms that are accessed from another room instead of the corridor shall bear sequential letter suffixes.

A. Each room should have only one number regardless of the number of doors opening into it. Exceptions can be made where a particularly large room is subdivided into

different areas of use, such as by cubicles or foldable partitions. In these cases, one-character letter suffixes are added to create unique numbers. Where the number of areas exceeds the suffixes available, additional sequential numbers should be used.

- B. Number all accessible spaces: In addition to rooms, all interior spaces that can be directly accessed, such as corridors, vestibules, stairwells, elevator shafts, and accessible pipe spaces shall be numbered in a manner as consistent as possible with standard room spaces. Where doors or walls separate different areas of these spaces, each area shall receive its own unique number.
 - 1. If you get to a spot where a room could be numbered either of two or more ways and still fit with the convention, pretend you are an EMT looking for someone hurt, which convention gets you there the fastest.
 - C. For door schedules, doors shall be numbered the same as the room, if there is more than one door to enter the room then use decimal suffixes, i.e., 117.1, 117.2, etc.
- 1.17 **Room Naming:** Room naming conventions shall follow the current GSA National Space Assignment Policy. Signage should only include the room name if the use is unique and not likely to change such as restrooms, mechanical rooms, courtrooms...
- 1.18 **Anchoring:** Secure items to the building structure. Plastic anchors, sheetrock anchors and toggle bolts into gypsum wallboard alone shall not be allowed.
- 1.19 **Mechanical Rooms:** Shall never be located above occupied spaces, they tend to leak causing expensive damage to spaces below.
- A. Mechanical rooms shall have floors that nominally pitch to a drain.
 - B. All penetrations in mechanical room floors that are not slab on grade shall be made with sleeves that extend above the floor and are sealed to the floor so that if a leak occurs the fluid cannot escape the mechanical room except through the provided floor drains.
- 1.20 **Access Performance Requirements:**
- A. Priority for mechanical equipment placement should be in mechanical rooms or at grade; not "shoe-horned" into ceiling spaces or placed on the roof.
 - B. Access to all major building system components shall be by stairs or an elevator, use of straight or ship ladders for means to access shall not be considered. Access areas include those to roofs and catwalks around large mechanical systems and generators. If any equipment is placed upon the roof, then:
 - 1. Access shall be through a door, not a roof hatch.
 - 2. Provide a convenience outlet within 25' of each piece of roof mounted equipment, unless one already exists.

3. Provide a hose bibb within 50' of each piece of roof mounted equipment, unless one already exists.
 4. Comply with owner safety requirements below.
- C. Pathways for removing/replacing the system components shall be large enough to transport them from their location within the building to the curb.
- D. Spaces that house mechanical and electrical building systems will be required to have at least six (6) feet unobstructed headroom with at least three (3) feet of open travel way around and in front of all systems.
- E. Access doors shall have sufficient access. Other equipment, pipes, ducts and conduits shall not impede access or removal of items such as filters.
- F. No crawl spaces or hand holes for major system maintenance. Ensure that preventative maintenance areas are accessible without climbing on ductwork or piping.
- G. Filters, valves, meters, and other items that require regular maintenance shall be easy to access from the clear travel ways.
1. Mixing valves for emergency eyewashes and showers shall be flush mounted below the ceiling in the occupied space in near proximity to the equipment being served.
- H. Generators shall have catwalks to provide access for fueling and servicing if the installation of the base rail of the generator is more than 24 inches above the surrounding grade.
- 1.21 Storage and Staging Areas: Provide adequate recycling, maintenance and custodial staging areas, each in separate dedicated rooms, and separate from the mechanical/boiler room.
- A. There should be a storage and receiving areas for BGS that is accessible by delivery vehicles.
 - B. Maintenance areas shall include a laundry tub and space for work benches, tool storage and storage of spare parts, with an adjacent office with workspace for a computer, phone, and writing surface, space for As-built drawings, O&M manuals, etc.
 1. Be sure the building has adequate designated storage space for ALL the spare parts listed in the specifications, do not store a little here and a little there.
 2. Storage space for equipment with internal combustion engines shall be included. These spaces cannot be internal to the building, attached is acceptable as long as it meets all Division of Fire Safety requirements.
 - C. Custodial areas shall include space for a computer, phone, writing surface, a floor mop sink and storage areas for cleaning supplies and paper products. When custodial

closets have mop sinks, at least one custodial closet per building will have a minimum of three (3) feet of clearance on two (2) sides of the mop sink to allow space for a person to stand with cleaning equipment without standing on/in the mop sink.

D. There shall be a restroom within acceptable distance to mechanical office.

E. There shall be a restroom within acceptable distance to custodial office.

1.22 Design Temperatures: Building design shall utilize the temperatures as specified in the CBES for design, but since these temperatures are ASHRAE 99%, it means that the systems may not achieve desired effect on the 1% the days, or 30 days out of 10 years the average is calculated from, so after designing the building and selection of equipment because of round up of components, verify that the systems are capable of heating the building with a ΔT of 90°F, and cooling with a ΔT of 25°F.

1.23 Owner Safety Requirements:

A. Provide guards or tie-off points, with safe access, where appliances, equipment, fans, or other components that require service are located within 15 feet of a roof edge or open side of a walking surface, and where such edge or open side is located more than 30 inches above the floor, roof, or grade below. Construct the guard to prevent the passage of a 21-inch diameter sphere. Tie-offs shall be installed in pairs, unless the tie-offs are interconnected with horizontal lifelines to provide safe access, so that two employees can service the equipment.

1. Exceptions will be:

- a. Sloped roofs where no equipment exists,
- b. Roofs that will not need general maintenance such as snow shoveling,
- c. Slate roofs that can only be accessed by a lift to prevent damage to the slate,
- d. Existing compliant tie-offs or permanent guardrails, and
- e. Flat roofs that have parapet walls 42 inches plus or minus 3 inches high.

2. "Safe access" means having guardrails or parapet installed around rooftop access points, along with ladder or stairway roof access that meets provisions of OSHA 29 CFR 1910.23 and 1910.25.

1.24 During Construction:

A. The design consultants and sub-consultants, as per contract requirement, shall be required to:

1. Inspect the site,
2. Attend project meetings, and
3. At least monthly, each sub-consultant where work has been performed in their field of expertise, shall verify the work has been satisfactorily completed in accordance with the construction documents and that any changes are documented on the red line as-built record drawings prior to approval of that month's requisition.

- B. Project manager, GC, and subs shall be required to:
 1. Hold regular jobsite meetings
 2. Inspect the site
 3. At least monthly verify as-built drawings and site for work completed. This shall be tied to requisitions for payment.

- C. Work and storage areas shall be maintained and swept clean on a daily basis. Exterior areas shall be maintained, and items stored in a neat manner.

- D. During activities that may generate dust or noise:
 1. Seal off all areas of construction from non-construction areas using pre-approved partitioning systems.
 2. Use dustless sanding during construction with a High-Efficiency Particulate Air (HEPA) filter vacuum system.
 3. Negative air pressure machines must be in operation for any construction or renovations that are in, or adjacent to, occupied spaces.

- E. Ceiling grids for dropped ceilings shall not be installed until all above ceiling utilities are substantially complete and inspected by the designer(s), these include, but are not limited to: Plumbing, Fire Sprinkler, HVAC, Controls, Electrical, Fire Alarm, Data and Communications.

- F. The ceiling tiles will not be installed, with the exception of tiles which are necessary for the installation of devices such as occupancy sensors or smoke detectors, until after the above ceiling final inspection by the applicable consultants.

1.25 Pre-Occupancy, substantial completion:

- A. All subcontractors shall be completed and out of the building at least one (1) month before State occupancy, with the exception of the controls, balancing and commissioning contractors. So the mechanical contractor can turn HVAC Systems on without possible contamination from building construction activities, the control contractor can wring out the controls, and the balancing contractor and commissioning contractor can work unimpeded.

- B. At the end of the construction phase, complete the commissioning process for the building in the presence of a representative of the State.

1.26 Training:

- A. Specify staff training and manuals as part of each project.
 1. Staff training shall include video recording the training for future reference by BGS.

- B. Cost of hands-on training shall be included in the project costs.

C. Any necessary O&M Manuals will be included in the project costs.

1.27 O& M Manuals:

- A. Each system requiring operation or maintenance shall include owner training. Each system shall include instruction in how to operate and maintain it, training shall utilize the O & M manuals, a draft O& M manual is acceptable for training as long as it contains the necessary information.
- B. Provide consolidated maintenance schedule in O&M Manual, as well as in frame(s) mounted to wall.

1.28 Post-Construction Submittals:

- A. BGS burner start-up sheet
- B. Balancing Report
- C. Commissioning Report
- D. O&M Manuals
- E. As-built documents

1.29 Warranty Close-out:

- A. The design team, project manager, building maintenance person and general contractor shall conduct a final building inspection prior to the expiration of the one-year warranty, identify any outstanding issues and prepare a warranty inspection punch list for the contractor to correct. This is also an opportunity for the design team to learn what works and what should be changed in their design for future projects.
- B. With respect to all warranties, express or implied, from the prime Contractor, subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:
 - 1. Require all warranties to be executed, in writing for the benefit of the State.
 - 2. At the end of the one-year warranty period transfer to the Owner all individual equipment and material warranties which are still in force.
- C. Test heating, cooling and condenser water by qualified agent. Adjust chemical levels if necessary.
- D. Review electric bill for "power factor penalty" and also monthly on and off-peak demand. If there is a penalty or high peak, locate any equipment that is causing the draw. Correct by adjustment or adding additional equipment.

SPECIFIC REQUIREMENTS (By Division Number)

00 00 00 Procurement and Contracting Requirements

1.1 The State of Vermont has a set of General Conditions that is included in all construction project bids. Do not duplicate or create conflicts with these General Conditions in the specifications. Always refer to the latest version that can be obtained at:

<https://bgs.vermont.gov/purchasing-contracting/forms>

- A. *General Conditions for Construction Contracts*
- B. *General Conditions for Design Build Contracts*

01 00 00 General Requirements

1.1 Specification section sections that shall be provided by BGS:

- A. 01 15 77 PROJECT WASTE REDUCTION PLANNING

1.2 Specification sections that may be provided by BGS as needed:

- A. 01 33 00.1 SUBMITTALS SubEx
- B. 01 33 00.2 SUBMITTALS NOSubEx
- C. 01 35 53.1 Security Rqmts Corrections
- D. 01 35 53.2 Security Procedures Courts
- E. 01 35 53.3 Security Procedures Public Safety
- F. 01 35 53.4 Security Procedures State House
- G. 01 35 53.5 Security Procedures Pavilion 5th Floor

01 91 00 Commissioning

1.1 Rigorous building commissioning is also required with an exception being when the Request for Proposal states otherwise. At this time, BGS does not require contracting with a third-party commissioning agent. Early in the process, the BGS Project Manager needs to determine the source of the commissioning:

- A. The contracted design team
- B. Third party under contract to the Design Firm as included in the design RFP
- C. Third party under contract to BGS
- D. Third party under contract to the CM

1.2 Refer to the BGS Commissioning Guidelines for further guidance, see website for latest accepted version, https://bgs.vermont.gov/dnc/design_guidelines

02 00 00 Existing Conditions

Complete a site survey/assessment to be provided to the BGS Project Manager prior to building design to include:

- 1) Topography - Contour mapping, unique topographic features, and slope stability risks,
- 2) Hydrology - Delineated wetlands, 500-year floodways, 100-year floodplains, lakes, streams, shorelines, and watershed modeling, design flood elevation.
- 3) Urban Soils contamination.

- 4) Green Stormwater Infrastructure - For projects with greater than 1,000 SF of new impervious area, site planning, design, construction, and maintenance strategies to maintain or restore predevelopment hydrology of the site with regard to the temperature, rate, volume, and duration of the flow and identify rain and stormwater collection/reuse opportunities,
- 5) Climate - Solar exposure/potential array locations, heat island effect potential, seasonal sun angles, prevailing winds, monthly precipitation, and temperature ranges,
- 6) Vegetation - Primary vegetation types, green/brown field areas, significant tree mapping, threatened/endangered species, unique habitats, and invasive plants,
- 7) Soils - Delineated soils, prime farmland, healthy soils, and previous development disturbed soils,
- 8) Human Use - Views, adjacent transportation infrastructure, adjacent properties, construction materials with existing recycle or reuse potential,
- 9) Human Health Impacts - proximity of vulnerable populations, adjacent physical activity opportunities, and proximity to large sources of air pollution.

03 00 00 Concrete

1.1 Underground

- A. Footings - 3000 pounds per square inch (psi) @ 28 days or greater concrete

1.2 Interior Work

- A. Housekeeping pads - 3000 psi @ 28 days or greater concrete
- B. Slabs - 3000 to 4000 psi @ 28 days concrete
- C. Walls - 3000 to 4000 psi @ 28 days concrete

1.3 Exterior Work

- A. Housekeeping pads - 4000 psi @ 28 days or greater concrete with four (4) to six (6) % air entrainment
- B. Slabs - 4000 psi @ 28 days with four (4) to six (6) % air entrainment
- C. Walls - 3000 to 4000 psi @ 28 days with four (4) to six (6) % air entrainment

1.4 Utilize wet cure for slabs whenever possible.

1.5 Use of Welded Wire Fabric (WWF) is prohibited, its intent is to provide surface crack control, but in practice it never ends up in the upper half of the slab pour where it's needed. Use #4 deformed rebar at 12" on center, each way, at the very minimum.

1.6 For slabs on grade and floor slabs that will receive a finished flooring product that utilizes latex adhesives, include a porosity inhibiting admixture that guarantees adhesion such as Barrier One, (www.barrierone.com)

04 00 00 Masonry

Exposed exterior masonry and mortar shall include moisture repellent admixtures such as "Dry-Block" www.DryBlock.com

07 00 00 Thermal and Moisture Protection

1.1 Built-up Asphalt Waterproofing

A. When applying sealant to a hardened surface, refrain from the use of coal tar-based sealants. Use asphalt-based sealants or a pre-approved equivalent. Consult with the BGS Project Manager or contracted engineer on the appropriate equivalent.

1.7 When installing insulation below a floor slab, run the insulation in a continuous plane, don't try to dip it down under footings. It doesn't stay in place during construction, it shifts creating gaps. When run in a continuous plane below the slab, and over the footings the perimeter walls keep it captured and prevent movement as reinforcing steel, and radiant tubing are installed, and during the concrete pour. Insulation density needs to be evaluated by the structural engineer for compressive strength under point loads, and 400 or 600 psi insulation may be required in specific locations.

08 00 00 Openings

1.1 Lock cores shall be interchangeable core, seven pin Falcon cores with **spring cover (also known as slide cap)** as approved by the BGS Project Manager.

1.8 All exterior doors shall be heavy-duty, commercial grade or better, insulated galvanized metal or fiberglass, or demonstrably stable in changing humidity conditions. Wood doors are discouraged.

1.9 Door hardware shall be heavy duty, grade 1, as a minimum and shall be of the same expected durability as the door it is associated with. Locks shall be Grade 1.

1.10 In all new construction, and major renovations provide a rapid entry key vault. Vault shall be recessed Knox Box brand 3200 Series, color by architect. Mounted adjacent to the principal entrance where the fire alarm annunciator panel is located.

1.11 Entrances and Storefronts

A. Provide at least two entries, one for public access and the other for employee access.

B. Provide a vestibule for a reception and security clearance area. This area should strongly consider use of a radiant slab. If a receptionist or security guard is stationed in the lobby, radiant slab shall be required.

C. All designs will consider the latest accepted version of the ADA Standards and Accessibility Guidelines as a minimum standard.

1. Because of the freezing conditions in Vermont and the possibility of the entry way heaving and causing a step that would violate ADA smooth transition requirements, and that impact proper door swing, main entrances shall be designed to eliminate frost movement, either through the use deep foundations filled with stone tied to

the perimeter foundation drain, snowmelt which idles to prevent frost/freezing of the subbase, or engineered solutions such as dynamic bridges.

- D. Information and Welcome Centers and other high traffic volume buildings which serve the public. Special consideration needs to be made for the flow of traffic entering and exiting as well as the circulation within the buildings.
1. Entrances shall be designed with vestibules that are both ADA compliant and are designed so that in normal use only one set of doors is open at a time to maintain the conditioned space conditions.
 2. All exterior doors shall be located away from the prevailing winds and shall be manual swinging doors with Low Energy Power Operated doors.
 3. All public multiple user restroom entrances within the building shall be designed for touchless entry through an approved corridor design such that no physical doors will be required for the necessary privacy. And shall include maintenance corridors to ensure efficient use of space and proper maintenance.
 - a. Welcome Centers shall also include a swing restroom that may be used by either gender when that genders restroom is closed for repairs or cleaning.
 - b. In addition to the multiple user restrooms there shall be 2 single user restrooms.
 4. Strongly consider radiant heat, and at least a walk off area of snow melt outside the primary entrance.



5. Careful design of wall locations will allow restroom entrances without physical doors. (Courtesy of: The Full Wiki)

09 00 00 Finishes

- 1.1 High traffic areas should have easy to clean hard surface floors, i.e., rubber tile, ceramic tile, quarry tile, epoxy, linoleum, or wood. Typical high traffic areas include: Main lobbies, corridors, rest rooms, elevators, etc.
- 1.2 Slab on grade finish flooring is to be either polished concrete, ceramic, epoxy, terrazzo or other flooring type that allow moisture to travel thru the flooring.

- 1.3 Carpet should be a minimal of 20 oz, loop pile. No broadloom carpet. Carpet with factory installed adhesive preferred. Backing is to be closed cell vinyl, non-microbial.
- 1.4 Ceiling tiles shall be manufactures standard products that will be produced for many years to come, relatively inexpensive products. In subsequent years when accessing spaces above the ceiling for maintenance activities such as duct cleaning, we need tiles that are easy to come by to replace any that get damaged, without having to replace entire rooms for a single damaged tile.

10 00 00 Specialties

- 1.1 Use non-metallic toilet partitions and urinal screens
- 1.2 For single occupant restrooms the following signs shall be included in the signage package. Color to be coordinated with the balance of the signage package.
 - A. ADA compliant:



- B. All others:



1.3 Correctional Facility: Flush valves for correctional facilities shall be able to be flushed by the occupant, flushed remotely, and have the ability to lock out the flush valve after a pre-determined number of flushes for a period of time, similar to Zurn ZP6800.

12 00 00 Furnishings

1.1 If the modular furniture is being installed within 12" of fin-tube or baseboard radiation, the modular furniture must be open at the bottom so that air can enter the radiation at the bottom and exit out the top by natural convection.

21 00 00 Fire Suppression

1.2 Dry pipe sprinkler piping, and fittings, shall be galvanized.

1.12 Provide a refrigerated air drier for dry pipe systems.

22 00 00 Plumbing

1.1 Ease of maintenance is a priority for proposed fixtures.

1.13 All waste piping, overhead, within or passing through walls and floors, shall be cast iron, this is for noise concerns. Piping below slabs may be PVC.

1.14 Vent piping may be PVC except wet vents.

1.15 Cleanouts: Consideration shall be given to the modern technique of jet cleaning which takes place in an upstream direction.

1.16 Sanitary and Storm Drains down column lines to be coordinated with footings; footings shall be designed to allow pipe to follow column to below slab.

1.17 No automatic fill from domestic water on any system treated with glycol. System shall require either a pressure sensor, storage tank and pump; or manual filling.

1.18 Tank-type toilets: ~~Pressure-assisted or g~~ Gravity toilets with a minimum 3" flush valve and 2-5/8" trap way.

1.19 Avoid the use of wall-hung toilets. If it cannot be avoided, provide bariatric fixtures and appropriate carriers to prevent movement.

1.20 ADA compliant lavatories shall be nominally 20" x 18" not the special extended type.

1.21 Faucets shall be single lever style or automatic sensing; wrist blades handles are discouraged.

1.22 Flush valve fixtures to have sensor flush valves so they get flushed after each use.

- A. Sensors shall have battery back-up or be connected to a back-up power source so the fixtures can be flushed during a power outage. Battery powered only are acceptable if they will operate for multiple years on a battery change.
- B. Solar powered flush valves shall only be allowed in restrooms with adequate natural light to charge them. They shall not be used in windowless rooms.
- C. Urinals shall be equipped with sensor flushometers and shall use 1.0 gpf unless the drain is configured so that a lavatory waste rinses the urinal waste. No waterless urinals.
- D. Here is a poor example of a toilet installation. The flush valve is abnormally high, this causes the grab bar to be installed as two smaller grab bars, and pushes the sensor off to the side so it cannot sense use when the toilet seat is raised:



- 1.23 Mop sinks will have a separate cold-water hose connection with independent valve for custodial chemical mixing stations. Install backflow prevention to isolate the chemical mixing stations from the water supply.
- 1.24 All connections for hot water, cold-water, and chemical will have faucet valves to control the use of each.
- 1.25 Showers: Areas outside shower stalls are to slope to a floor drain. Showerheads should be listed as 1.5 gallons per minute flow rate or less.
- 1.26 Use indirect, tankless or heat pump water heaters based on the most efficient choice for the building. Avoid the use of direct-fired water heaters.

- 1.27 Any plumbing fixtures, existing or proposed, within the construction site will have inline valves to isolate the plumbing fixtures for future maintenance. At a minimum, the isolation valves will isolate two (2) restrooms with an ideal application being the ability to isolate each fixture individually to minimize impact of use during maintenance.
- 1.28 Valves shall be easily accessible.
- 1.29 Shut off valves will be ball valves with stainless steel ball and stem.

23 00 00 Heating, Ventilating, and Air Conditioning (HVAC)

- 1.1 Maintenance-friendly designs are required: all designs will carefully consider the ease of regular and special maintenance tasks.
- 1.30 Facilities with large heating needs (for example, greater than 500,000 British Thermal Units (BTU) should consider using staged boiler systems utilizing either two boilers at 67%, or three boilers at 33% capacity, each.
- 1.31 Natural gas- and propane-fired water systems should be designed/sized to allow the return water temperature to drop below 130°F this will allow the use of modulating/condensing low mass boilers. Systems that do not have adequately cold enough returns should not waste money on condensing technology.
- 1.32 Use separate systems for: heating, cooling and ventilation. Where space or costs require it, two of the systems may be combined, but not all three.
- 1.33 Design HVAC Systems such that heat shall not be required during the summer. Do not use constant volume re-heat.
- 1.34 Mechanical designs shall consider either air side economizers or water side economizers (free cooling).
- 1.35 Try to design buildings which do not need mechanical cooling and maximize passive cooling wherever possible.
- 1.36 Spaces that require cooling in the winter shall utilize “free cooling” whenever possible.
- 1.37 Cooling systems which operate into the winter shall incorporate measures to reduce their energy consumption even further, such as air-cooled condensers, or plate and frame heat exchangers in parallel with the chiller (water side economizer), or liquid pump amplifiers in the refrigeration circuit.
- 1.38 Demand controlled ventilation should be considered for areas with varied occupancies.

- 1.39 Provide heat recovery on all systems of 500 cubic feet per minute (cfm) or greater, of outside air.
- 1.40 Use of total heat recovery systems such as enthalpy energy recovery is strongly encouraged. That is, where appropriate, use enthalpy cores for latent heat exchange, (wintertime humidity retention and summertime humidity rejection). Provide minimum of two (2) inch pleated filters on both airstreams before entering the heat exchanger.
- 1.41 Outside air intakes shall be designed with careful consideration to: Fume, odor, dust, fog and snow intake. Locate intakes to prevent entry of any of these or similar substances, be sure intake velocities are slow enough not to entrain them and cause them to be vacuumed into the system, in the case of fog which will enter the system in spite of passive means, provide a means of eliminating the moisture before it contacts the paper framed filter bank(s).
- 1.42 On AHU's serving VAV systems, a system shall be employed to ensure the minimum outside air CFM is entering the system irrespective of the total CFM the system is delivering.
- 1.43 Select air conditioning units that meet the highest Tier energy efficiency ratings (EERs), as specified by the national organization Consortium for Energy Efficiency (CEE). If there is a choice between Tiers, select the highest Tier.
- 1.44 Specify the AHU with hinged and latched access doors, and not with screwed on access panels.
- 1.45 Specify all AHU with cooling coils upstream of heating coil, to allow for dehumidification cycle if needed later. Design cooling cycles so that the air does not blow warm-cool on the occupants. Design should use chilled water coil with proportional control, or DX with face and by-pass, or some other strategy that allows proportional control.
- 1.46 All return air shall be ducted, no plenum returns.
- 1.47 NO FIBERGLASS IN THE AIRSTREAM! No interior fiberglass duct lining, sound attenuators, VAV box lining or Air Handler lining containing fiberglass. AHUs are to be double walled; where double wall units are not available, line units with Armaflex SA or a foil scrim faced insulation. Use Armaflex sheets, mechanically fastened, or foil scrim faced insulation for sound attenuation.
- 1.48 Utilize "smart pumps" where possible, pumps shall be connected to the BAS to provide feedback to the system on how they are operating, using either BACnet, Modbus or LON.

- 1.49 Use Closed Loop Evaporative Coolers for heat rejection not Open Cooling Towers. Closed Loop Evaporative Coolers shall be designed to operate dry in the winter, with no sump heaters required.
- A. Closed Loop Evaporative Coolers shall have catwalks to provide access for servicing.
- 1.50 When glycol is required, Propylene Glycol shall be used. No automatic fill from domestic water on any system containing glycol. The system shall require either a pressure sensor, storage tank and pump; or manual filling.
- A. Glycol shall be specified using burst protection of -20F not 35% concentration. Contractors typically use Cryotek -100F which is already a blend of glycol and water, then try and blend that at 35/65, which creates a lot of solution which is not strong enough.
- 1.51 No piping smaller than $\frac{3}{4}$ " on heating systems. $\frac{1}{2}$ " has proven to cause more problems with poor flow and require more pump head than the cost savings warrant.
- 1.52 Balancing valves shall be Tour-Anderson STA or Griswold automatic balancing valves.
- 1.53 Self-contained radiator valves shall be Macon N107X7 with B26000 heads.
- 1.54 Install fin tube with bottom @ 6" AFF, to facilitate cleaning underneath.
- 1.55 Pipe coils with supply in at the bottom return out the top to make the coil self-bleeding. Multi row cooling coils shall have the coldest water at the leaving face of the coil, multi row heating coils shall have the hottest water at the leaving face of the coil.
- 1.56 Shut off valve shall be ball valves with stainless steel ball and stem.
- 1.57 Wye Strainers shall be installed vertically in "wet" systems (hydronic or condensate) and horizontally for steam.
- 1.58 In-floor radiant heat: Keep tubing back at least 12" from all toilet flanges, the heat melts the wax ring.
- 1.59 For steam and condensate:
- A. Valves, fittings and pipe products shall be made in the United States or Canada.
- B. No cast-iron fittings on steam piping where the steam pressure may exceed 15 psi.
- 1.60 Design hydronic systems with "side arm" combination chemical pot feeder.
- A. Pot Feeder shall be Neptune FTF-5hp Filter feeder, with a stainless-steel screen, 5-micron and 20-micron filter socks.

- 1.61 Air handlers shall have a minimum of 2" pre-filter section; combination 2"/4" is preferred. Final filters shall be considered on a case-by-case basis. Minimum filter shall be pleated 2" MERV-8.
- A. Due to the increased probably of future pandemics, on systems with recirculated air, provisions shall be made for MERV-14 final filters, system shall be designed to provide design air flow with both pre and final filters in place and system shall be balanced and commissioned with both sets of filters in place. If there is no current pandemic, the final filters shall be removed and stored for future use, system should recognize the decreased pressure drop through the system and automatically adjust to design airflow.
 - B. Provide a Magnehelic to measure pressure drop across each filter bank.
- 1.62 To help control bioaerosols in recirculated air and to control microbial growth on cooling coils to help maintain their efficiency and reduce pressure drop through the system all new AHU's shall include UV-C lights as part of the accessory package.
- 1.63 Do not bury the heat pumps and fan coil units within ducting and piping. Where crowding cannot be avoided, provide coordination drawings, including sections showing all mechanical and electrical items. Ensure that filters, compressors, and motors are accessible for maintenance to include service work and replacement.
- 1.64 When mechanical items are being specified in building additions or renovations, match manufacturer and model numbers with existing equipment, i.e., if Taco 1600 series pumps exist, then the new pumps shall be Taco 1600 series.
- 1.65 Label all pieces of equipment, and if this is a renovation, then the labeling shall be consistent and coordinated with existing pieces of equipment. Utilize Seton style pipe labels and Plastic laminated labels for equipment and ductwork. Indicate direction of flow. Mechanically fasten all labels.
- A. For above ceiling equipment, isolation valves, control modules, etc. provide an additional phenolic tag; white face, black core, identifying the equipment and placed on the grid so that the tile at the top of the writing is the tile to remove to access the item.
- 1.66 Provide spare valved ports on all water supply and return lines to major pieces of mechanical equipment such as boilers and chillers so that the start-up technicians have places where they can take pressure readings.
- 1.67 Noise and Vibration Design Considerations:
- A. Minimize air velocities to minimize air noise. Design air handlers, fans, and pumps to operate at the lowest possible design pressure, airflow, and speed. Configure ductwork to avoid high pressures arriving at dampers by using longer runs.
 - B. Locate equipment where noise and vibration from mechanical items is minimized. Locate rooftop units above corridors or utility spaces. Locate mechanical rooms away

from sensitive areas like courtrooms and conference rooms. Locate above-ceiling heat pumps and fan coil units above corridors or closets where possible, where not possible locate items so they can be accessed easily not above cabinets, furniture etc.

- C. Design systems without sound attenuators whenever possible. When attenuators are required utilize duct silencers with Mylar or foil scrim-faced insulation where necessary. Use sound attenuation devices, Armaflex duct lining, Vibro-Acoustics silencers where appropriate.
- D. For all diffusers and return grills, specify curved, insulated flex duct with extra slack so there is not a straight run between metal duct and diffuser or grill. Maximum length of flex duct shall be six (6) feet in length.
- E. Keep hydronic velocity under five (5) fpm in runout piping.
- F. Keep steam velocity between 8,000-12,000 feet per minute. Consider mufflers at pressure reducing stations unless sound can be controlled.
- G. Take extraordinary measures to eliminate noise in courtrooms, and other rooms where audio recording activities take place.

1.68 Ductwork/Accessories:

- A. The ductwork will meet the following criterion:
 - 1. Minimum radius on ductwork elbows shall be one and a half times the width
 - 2. Maximum width of ductwork shall be 48 inches
 - 3. Duct should be as close to square in profile as possible with the ductwork profile not exceeding a ratio of two to one (2:1) unless approved by the BGS Project Manager.
- B. All take offs shall have volume dampers. Registers, grilles and diffusers shall NOT have integral dampers, these produce unacceptable noise.
- C. Volume dampers shall be stand-off, quadrant lock. These shall be tagged with brightly colored surveyors' tape, so the balancers may locate them with ease.
- D. Provide an ample number of access doors in ductwork for maintenance and cleaning.
- E. Access doors shall be double walled and piano hinged, with a minimum of two cam locks and rubberized seal.

1.69 Post construction/renovation cleaning:

- A. All mechanical systems shall be thoroughly cleaned, after the building is cleaned, and before each system is started or balancing commences.

- B. Ductwork shall be cleaned by a subcontractor specializing in duct cleaning.
- C. Hydronic systems to be flushed and chemically cleaned inside. Proper passivators shall be circulated for a prescribed length of time. Inhibitors shall be installed. Testing by qualified lab shall take place, and water chemical treatment shall be adjusted according to lab recommendations.
- D. Testing of water by qualified agents and adjusting of proper chemical levels shall take place within one (1) month, and at one (1) year, after completion of a project.
- E. Construction strainers will be removed and hung on their respective strainer prior to balancing, and fin tubes and terminal units vacuumed before covers are set.
- F. Replace all construction filters with new ones at prior to balancing.

1.70 Balancing: In addition to standard NEBB Specs, include the following language:

- A. Notification: Balancer is to immediately notify Owner and engineer as soon as balancing problems are discovered, i.e., specify not to wait for Owner and/or engineer to discover the problems in the final report.
- B. Proportionality: Where it is impossible to obtain design flows within 5% at every room within a zone, balance air flows within zones such that the proportionality of the original design is obtained. For example, if there are three rooms that are designed to have 100 cfm each, but one room can only obtain 92 cfm max., proceed balance to as close as possible at 92cfm in all three rooms; i.e., do not balance at 100, 100 and 92. If air flows are less than 90% of design, notify design engineer immediately.

23 09 00 Instrumentation and Control for HVAC

1.1 Pre-Construction Submittals Required:

- A. Product literature for all system components.
- B. Logic diagrams for all control operations, by system, i.e., all the logic for the operation of an air handler shall be chained together to show how each sub loop interacts within the whole. (This could be generated by the engineer as part of the bid package.)
- C. Block diagrams for all control operations and equipment.
- D. System engineering for the entire control system (i.e., wiring diagrams with terminal numbers, calculations, reset schedules, etc.).
- E. Sample graphic display software.

- F. Equipment lists, including location of components within the building, part numbers, part names, and purpose/use.
- G. List of all components installed in a the Direct Digital Control (DDC) or Building Automation System (BAS), tabulated to show which will show up on the host/graphics screen, which ones are display only, and which are adjustable from the host/graphics screen.
- H. Zoning:
 - 1. The preference is for a thermostat/space sensor in every room if budget allows.
 - 2. Rooms with different exposure or thermal load characteristics shall never be same zone, especially interior and exterior exposures.
 - 3. Exterior office space (either open office or individual offices): Maximum of 600 SF per zone or a maximum of three rooms per thermostat.
 - 4. Interior office space (either open office or individual offices): Maximum of 1400 SF per zone or a maximum of three rooms per thermostat.
 - 5. Rooms that should be on their own zone shall include:
 - a. Classrooms.
 - b. Conference rooms.
 - c. Courtrooms
 - d. Jury rooms
 - e. Exterior Corner rooms
 - f. Lobbies.
 - g. Telecommunications room(s), (these require 24/7/365 cooling).
 - h. Equipment room(s).
 - i. Computer room(s).
 - j. Waiting room(s).
 - k. Break room(s).
 - 6. In addition, zones shall not cross functional boundaries between different departments/tenants.

1.2 DDC Controls:

- A. DDC controls shall be required in new construction that contains large multi-zone systems, heating and cooling systems, and complex HVAC systems as determined by the BGS Project Manager.
- B. Consider DDC on all new construction and major renovation projects. Factors to be considered and communicated to the BGS Project Manager are:

1. Size - SF of building
 2. Type and complexity of mechanical systems - HVAC
 3. Use of the building - office, technical, storage, and security spaces
 4. Costs - complete a cost benefit analysis
- C. DDC will not be required on a single-zone, heat-only system unless otherwise directed by the BGS Project Manager based on a cost benefit analysis.
- D. Location of local control modules to be preferably in closets or the like and always made to be completely accessible.
- E. The State of Vermont shall provide a computer for use by the maintenance personnel. The computer shall be provided with internet access and shall have a web browser that will be utilized to access the DDC system.
- F. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser. Operators shall be able to perform all normal operator functions through the web browser interface. The server shall be one of the virtual DDC servers the State of Vermont maintains at the National Life location in Montpelier.
1. The BMS software shall be the most current version that is not a BETA test version. Submit a manufacture's product support/end of life statement for the version to be included in this project.
- G. BGS shall provide one data jack at the master building controller location so the master building controller can communicate through the enterprises network to the virtual server. All controllers beneath the master building controller shall communicate using BACnet MS/TP. In the case of wireless controllers, communications shall be mesh configuration using either BACnet MS/TP or Zigbee.
1. If the control vendor needs BACnet/IP for connection to any controller, the control vendor shall provide the necessary pathway and CAT6 cable to the nearest designated data closet and shall provide the necessary network switch(es) to connect to the enterprise network. Switches shall be Cisco brand and approved by the State of Vermont Agency of Digital Services (ADS) for use on their enterprise network.
- H. Control components shall be BTL certified.

- I. Keep linkages on actuators as simple as possible. Damper actuators shall be direct-coupled type similar to Belimo.
- J. To the greatest degree possible, utilize industry standard control sequences, then modify as necessary.
 - 1. An example: The controls for the AHU-2 shall be ASHRAE Cycle III, except when outside air is below 32°F, then mixed air shall be controlled at 65°F.
- K. Unoccupied control of heating coils: Modulate heating coil valve to maintain a Mixed Air Temperature of 50F.
- L. For hot water systems where coils are exposed to outside air, that do not contain glycol, use a coil pump and a 3-way valve with the AB port looking at the coil. Pump shall run when there is a call for heating and shall run continuously when OAT is less than 34F. This way the coil sees full flow and should not freeze, the building sees the operation of the valve as 2-way, so system pump can modulate saving energy.
- M. Controls Commissioning:
 - 1. At the end of the construction phase, commission the building in the presence of a representative of the Owner. Demonstrate that all control components operate properly by verifying their operation; one contractor technician shall operate the host terminal to identify the status of each point, while a second technician is physically at the point being verified, with two-way communication between technicians. To verify each point:
 - a. The technician at the terminal will communicate the status of the point to the technician at the point. The technician at the point will verify, through observation or measurement, whether the status is correct.
 - b. For controlled points, valves, dampers, motors, etc., and other points which can be acted upon by manipulation of the controls, such as hot and cold-water sensors: The technician at the terminal will then cause the status of the point to change, and the technician at the point shall verify the following:
 - 1) The status of the point did change, through observation or measurement.
 - 2) The status changed in the correct direction.
 - c. For points which cannot be acted upon by manipulation of the controls, such as spaces sensors and transmitters: The technician at the point will then cause the status of the point to change (for example using a hair drier to change the sensed temperature), and the technician at the terminal shall verify the following:
 - 1) The status of the point did change, through observation or measurement.
 - 2) The status changed in the correct direction.

- d. Correct any deficiencies encountered, including replacing any salvaged actuators, sensors, or controllers, and re-verify. Record any changes in the project record documents.
 - 1) Replacement of salvaged components shall be considered a change of scope, since the bid price was based upon reusing them, a change order shall be issued for these items based upon the unit pricing provided on the bid form.
 - e. Work with balancing contractor to calibrate all DDC flow monitoring components.
 - f. Approximately 6-8 months, after the date of Substantial Completion, coordinate with the Owner and return to the building and re-commission the building, including:
 - 1) Modification of the control sequences and operations to fine tune the systems per the requirements of the Owner.
 - 2) Verification of the proper operation of all control components and software.
 - 3) Modification of the project record documents to reflect all changes and revisions made to date.
2. Include at least four (4) one-day training/fine tuning sessions:
- a. One off-site to familiarize the Maintenance personnel in the operations of the equipment prior to substantial completion.
 - b. One at the conclusion of the commissioning period.
 - c. One approximately 60 days later.
 - d. One to be determined by Maintenance.
3. Post-Construction Submittals:
- a. Revised logic diagrams, block diagrams, and system engineering based on the actual installation.
 - b. Hard copy of all system programming, block diagrams, etc.
 - c. Software copy of all system engineering, block diagrams control sequences, etc.
- N. Direct-Digital Control Virtual Servers
- 1. The controls server shall be one of the virtual DDC servers the State of Vermont maintains at the National Life location in Montpelier. [Unless ADS decides to allow vendors to host the servers in the cloud.]
 - ~~2. New virtual servers may be entertained for control systems not currently supported. The Agency of Digital Services (ADS) will create and manage the server to the vendor's specifications, but the vendor bears the cost to create the server, load the controls software and any licensing fees. Connectivity to the server may require~~

publicly accessible internet protocol (IP) for the device. We currently have 6 controls vendors with servers, which is adequate for competitive pricing.

3. Remember, these web-based tools need access to GOVnet to communicate. Be sure to plan on the required network connectivity and VPN permissions to be in place before expecting the control vendor to configure their devices. When in doubt, submit a tickets to ADS.
 - a. You will need a ticket to get the internet connected to the building unless it is already being provided.
 - b. You will need a ticket to get IP addresses assigned to the BAS, and to get the switch port in the building assigned to the BAS, and the proper ports is the switch opened to traffic for the BAS.
4. The virtual servers' base software is maintained, backed up, and patched regularly by ADS. The vendor applications on these servers shall be maintained by the respective controls vendors.
5. Current servers that exist are:
 - a. Automated Logic
Current Virtual Private Network (VPN) vendor with access: Temperature Controls of Vermont
4 Andrew Avenue
Suite 1
Essex, VT 05453-5536
Contact: Matt Williams
Phone: (802) 872-8000
Email: mwilliams@tcofvt.com
 - b. Niagra - Distech
Current VPN vendor with access: Control Technologies, Inc.
121 Park Avenue
Suite 10
Williston, VT 05495
Contact: Mike Van Horn
Phone: (802) 764-2200 extension 1006
Email: mvanhorn@controltechinc.com
 - c. Johnson Controls
Current VPN vendor with access: Johnson Controls, Inc.
310 Hurricane Lane
Williston VT 05495
Contact: Lee Voorhies
Phone: (802) 557-8137

Email: lee.r.voorhies@jci.com

- d. Schneider Electric
Current VPN vendor with access: Conserve Thru Control, Inc
8 Renfrew Street
PO Box 377
Adams, MA. 01220
Contact: Matt Pitoniak
Phone: (413) 743-8282
Email: pitoniakm@ctcinc-bas.com

- e. **Niagara/Schneider Electric Ecostruxure and I/A**, (formerly Barber-Colman, Siebe and Invensys)
Current VPN vendor with access: Alliance Mechanical
6 David Drive
P.O. Box 666
Essex Junction, VT 05453
Contact: Erik Packer
Phone: (802) 864-4000
Email: erikp@agusa.com

- f. Siemens
Current VPN vendor with access: SIEMENS
6 British American Blvd. Suite 104-C
Latham, NY 12110
Contact: Ryan Pipes
Phone: (315) 487-7041
Email: ryan.pipes@siemens.com

26 00 00 Electrical

- 1.1 No crawl spaces or hand holes for major electrical system maintenance. Ensure that preventative maintenance areas are accessible without climbing or crawling on conduit or other mechanical components. Electrical components that require regular maintenance should be easily accessed.

- 1.3 No shared neutrals on receptacle or florescent lighting circuits.

- 1.4 Provide full-sized neutrals.

- 1.5 All circuits shall have a separate grounding conductor, do not use raceway as grounding path.

- 1.6 Color code wires Red/Black/Blue for 120/208V circuits and Orange/Yellow/Brown for 277/460V circuits.

- 1.7 Identify circuits contained in: pull-boxes, junction boxes and connection boxes, by labeling cover **or connected conduits** with either a phenolic tag or neatly handwritten with indelible marker.
- 1.8 All switches and receptacle covers shall be labeled with panel name and circuit number using CLEAR stick-on labels with black characters. Labels shall be ½" minimum in height and have 3/16" minimum size characters.
 - A. Where subject to vandalism, such as public or patient areas, labeling on all switches and receptacle covers shall be duplicated on the reverse face of the device plate also.
- 1.9 Identification for Electrical Systems: Electrical equipment includes switchboards, panel boards, industrial control panels, and motor control centers. Descriptive markings will be located clearly visible to qualified persons before examination, adjustment, servicing, or maintenance. Electrical equipment hazards will be identified with the following descriptive markings and techniques described in the latest accepted version of NFPA 70E as necessary: electrical current, safety signs, symbols, and tags; safety barricades, use of safety attendants, voltage, wattage, and other equipment ratings as necessary.
- 1.10 When electrical power management equipment **and/or lighting control** is being considered, it shall be coordinated with the DDC HVAC controls. No servers are to be installed in the building, see Section 23 09 00.E and 23 09 00.N.
- 1.11 **Buildings with three-phase motors, devices or equipment shall have a means of protecting them from a single phasing event. Either at the motor, device or equipment; at the panel or at the main switchgear.**
- 1.12 Electric motors shall be premium efficiency, inverter rated, motors whenever possible.
 - A. **Small fractional horsepower motors shall be ECM were possible**
 - B. **Motors larger than 1 HP should consider VFD's, either for actual modulated control or as a soft start to reduce electrical peak demand.**
- 1.13 **VFD's for exterior equipment. VFD's do not like to run well when the weather gets really hot, or very cold, as such they need cooling fans for summer operation, and electric heaters for winter operation. One way to mitigate this is to install the VFD in conditioned space, but this then requires a disconnect at the equipment to meet the electrical code. If this is done then the disconnect should include a fast-acting auxiliary contact to trigger a freewheel stop on the drive before the main 3-phase contacts open.**
- 1.14 All life safety devices should contain battery back-up, and shall not rely on a generator, unless it can be shown to be more cost effective to use a generator. Keep generators as back-up generators not emergency generators whenever possible.
- 1.15 Provide quad electrical receptacles at each data jack location.

- 1.16 Where possible, no outlets on exterior walls, unless the insulation and air barrier is exterior to the stud cavity, and no baseboard heat is present.
- 1.17 Panels shall be the breaker bolt on type, not plug in.
- 1.18 Panels shall have door-in door access, such that breakers are accessible without needing to completely remove the panel cover.
- 1.19 Automatic transfer switches (ATS) for generators shall have a means for bypassing them so that maintenance may be performed on the ATS.
- 1.20 After installation, the generator set shall be subjected to all tests specified below using a resistor bank. Certified reports for these tests shall be submitted. The engineer shall be notified one week prior to testing so arrangements to witness the test can be made. Generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include, and certified reports shall be submitted for, the following:
 - A. Single-step load pickup.
 - B. Transient and steady-state governing.
 - C. Safety shutdown device testing.
 - D. Voltage regulation.
 - E. Rated Power (100% output for 4 hours).
 - F. Maximum Power (110% output for 20 minutes).
- 1.21 Use highest efficiency products where possible.
- 1.22 Lighting levels should comply with foot-candle levels provided by the Illuminating Engineering Society of North America (IES). These light levels must be achieved with lighting power densities specified in the latest accepted version of ASHRAE 90.1. Ideally, light levels should require no more than the lighting power densities specified in the E-Benchmark.
- 1.23 Lighting levels in small offices, conference rooms, breakout rooms etc., shall be adjustable, either by dimming or multiple switching. eg., three (3) lamp fixtures shall be switched to allow one (1), two (2), or all three (3) lamps to be lit.
 - A. Where occupancy sensors are used the sensor shall control the line voltage to the dimmer/switch so when someone enters the room the last set lighting level is reactivated.
- 1.24 For lighting:
 - A. Avoid incandescent, HID and Mercury Vapor lamps whenever possible.
 - B. Where possible use light emitting diodes (LED)'s.
 - C. The use of "Super T-8" and/or T-5 technology is encouraged where LED's cannot be used.

1. Use 4' florescent fixtures, the replacement bulbs are less expensive than the 2' tubes are.
- 1.25 For exit signs, use hard-wired white LED's that are one watt or less, and include battery back-up. Consider photo luminescent exit signs when the exit signs meet the specifications outlined by the latest accepted version of the Vermont accepted OSHA Standards 29 CFR 1910, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.37> , and the Vermont Fire and Building Safety Code, <https://firesafety.vermont.gov/buildingcode>
- 1.26 Consult with the BGS Energy Office when selecting new LED fixtures.
- 1.27 Consider use of space when selecting lamp type including the need for instant full light instead of having a warm-up period, indirect lighting for high computer use areas, typical temperature of the space, and frequency of use of the space.
- 1.28 For high use areas and detail-oriented work areas such as offices, classrooms and public spaces, lighting should specify color-rendering indices (CRIs) of 80 or higher. Attention should also be paid to selecting lamps with consistent color temperature in the space such as 3500 degrees Kelvin (°K), so that there is not a mixture of "pink" and "blue" lamps in a space. Use color temperatures of 3500-3700°K unless directed otherwise.
- 1.29 Detention Lighting: Design correctional facilities to have access to all light fixtures from a penthouse above the population area ceiling at least six (6) feet high. Ensure that preventative maintenance areas are accessible without climbing or crawling on conduit or other mechanical components. Electrical components that require regular maintenance should be easy to access from outside the population area.
- 1.30 Lighting Control Devices:
 - A. Adjust the time delay on all occupancy sensors prior to occupancy with minor adjustments as necessary after occupancy.
 - B. Include training for occupant in the specifications.
 - C. Provide at least 2 days of training for BGS O&M staff. Typically, one prior to occupancy or if a retrofit, as soon as the project is complete, and the second about 6 months later.
- 1.31 Use occupancy sensors, not motion sensors, in all intermittently used areas. Recommended areas for the installation of occupancy sensors include: private offices, conference rooms over 150 SF in size, restrooms, storage areas, less active hallways and break areas. BGS manager to ensure:
 - A. Technologies of sensors include passive infrared, ultrasonic and multi-sensing. Evaluate the space conditions to ensure that the appropriate technology is used for the space.
 - B. Consider each technology's effect on different users, such as people with hearing aids.

- C. Locations of sensors include wall, ceiling, fixture and switch mounted sensors. Evaluate the use of the space to include the items being moved in for occupancy such as furniture, shelving and equipment to ensure proper selection (sensors will not be blocked). In a retrofit application, consider the use of a wireless sensor system with review of the anticipated radio frequency equipment in the space. Consider reflective surfaces when locating the sensor to prevent reflected images from an adjacent space triggering the occupancy sensor.
 - D. Styles of sensors include automatic on/off, manual on/automatic off and timers. Based on the project manager recommendation, specify the style used in each space with public areas such as hallways using automatic on/off style.
- 1.32 Where daylight harvesting controls are being considered, they should be coordinated with the DDC HVAC controls. No servers are to be installed in the building, see Section 23 09 00.E and 23 09 00.N.
- 1.33 Consider daylight controls in spaces on the south, west, and southwest faces of the building. Evaluate the use of the space when considering the style of dimming or on/off controls. The location of the photocell should be unobstructed by fixtures, ductwork or any other structural features that will impair the line of sight to the outside. Dimming should be a slow event to prevent that disco strobe effect when clouds pass by.

26 33 00 Battery Equipment

- 1.1 Grid tied battery storage systems installed for the State of Vermont in Green Mountain Power (GMP) territory shall require GMP to be in the contracting chain, either as the prime bidder, or a sub-contractor to the prime bidder. It shall be GMP's responsibility to enter into a contracting agreement with their battery system vendor to pay any up-front costs for the procurement and installation of the system, and be responsible for ensuring the project is completed in a reasonable and timely manner. The State of Vermont only pays for items after delivery to the construction site.

27 00 00 Communications

- 1.1 Contact ADS to coordinate the voice and network connectivity and pathway requirements for the agency/departments utilizing the space with the design consultant to incorporate the latest accepted version of the Information Transport System Infrastructure Standard issued by the State ADS:
<https://outside.vermont.gov/agency/DigitalServices/SharedDocuments/Voice-DataCablingRequirements.pdf#search=cabling>, with the following edits into the bid package:
- A. The use of this standard requires strict adherence to the coordination requirements with ADS.
 - B. In all places where communication/coordination is to take place with ADS, it shall be the BGS Project Manager's responsibility.

- C. In all places where the contractor is required to deliver something such as test results, as-built drawings, etc., these items shall be delivered to the BGS Project Manager, who will forward them to ADS.

1.2 Responsibilities of the project manager are to:

- A. Contact the local phone company and schedule telephone cable entrance and termination, as well as Internet cable/GovNet entrance and termination.
- B. Schedule a meeting between the architect, and appropriate sub-consultants, and ADS.
- C. Keep ADS apprised of construction progress at regular intervals.

1.3 Designers, preferably RCDD (Registered Communications Distribution Designers), shall design for installation under the construction contract, the communication closets, raceways, cables, cable management and termination drops based on Building Industry Consulting Services International or BICSI standards.

1.4 Standard termination drops shall consist of one (1) inch conduit, a four-square box, and a single gang mud ring, unless modular furniture is being utilized. Conduit requirements will be dependent on the number of cubicles requested/designed for modular configurations.

1.5 ADS shall be responsible for coordinating with the Information Technology or IT representatives from the agency/department occupying the space for the final connections of network cables and business representative for the telephone connections in the communication closets.

1.6 DATA CLOSET DESIGN STANDARDS

- A. Size of space within the communications closets will include the following space for the ADS (telephone and data) equipment and shall be determined by the following matrix. The MDF normally requires a larger space (2 or more racks) to accommodate primary equipment (e.g., router, firewall, security equipment, demarcation, etc.).

Minimum Data Room Size	Max Racks	Max Patch Panels	Max Jacks
8x10	1	3	144
11 x 10	2	7	336
14 x 10	3	11	528
17x10	4	15	720
20x10	5	19	912

- B. ADS must be allowed to validate MDF and IDF locations/size prior to approval of construction.

- C. Centrally located and distributed throughout facility to minimize number of data closets, as well as ensuring cable runs do not exceed 250 feet, to allow for jumper cables at each endpoint.
- D. ADS will determine which data closet is the main distribution frame (MDF). The remaining closet(s) are identified as the intermediate distribution frames (IDF).
- E. Minimum of six (6) Cat 6a interconnects between MDF and IDF, unless distance is over 250 feet. If over 250 feet, then six (6) strand MM fiber from MDF directly to each IDF w/LC ends.
- F. Four copper or fiber (dependent on provider) strand interconnects between telecommunications demarcation and the MDF. The demarcation should be located in MDF, whenever possible. If the demarcation cannot be located in MDF, then four strand interconnects must be run between demarcation and MDF.
- G. Rack installation design (top to bottom): 1) voice feeder panels, 2) fiber panels, and 3) copper panels (data).
- H. At least one (1) 2-post floor mounted rack must be provided within each data closet.
- I. Racks must be bolted to the floor and the rack row parallel to the longest wall. Rack placement must allow for at least 3' of space from the front/back and one side of the rack row.
- J. Racks must allow for proper horizontal and vertical management solutions (e.g., Chatsworth).
- K. ADS will provide a rack design for each location.
- L. Recommend MDF walls are lined with 4x8 3/4" plywood mounted horizontally around entire room.
- M. Voice feeder panels at bottom of each rack.
- N. 48 port Cat 6a patch panels.
- O. Overhead cable trays between racks and conduit.
- P. MDF and IDFs should be protected by backup power when available on site.
- Q. Quad receptacles on wall adjacent to rack (dedicated circuit 5/20R NEMA).
- R. One surge suppressing PDU per rack.
- S. Climate control for MDF and IDFs (i.e., HVAC).
- T. MDF and IDFs should be dedicated telecommunications rooms.
- U. MDF and IDF must have capability to be secured (i.e., badge entry or cypher lock).
- V. All equipment must be rack (preferred) or wall mounted.

1.7 CABLING STANDARDS

- A. CAT 6a is ADS standard for voice/data cabling.
- B. Wall
 - 1. Two lines per drop box.
 - 2. One data drop per room up to 100 ft²; drop location to be determination ADS and customer.
 - 3. One additional data drop for every 50 ft² over 100 ft².

C. Ceiling

1. One data drop per projector location.
2. One data drop per wireless access point (WAP) location (refer to Wireless Design Standards).
3. One data line per ceiling drop.
4. Service loop of 20' (when possible).
5. Terminated to biscuit jack (similar to Ortronics OR-KSSMB2)
6. WAP brackets mounted by contractor (unless drop ceiling).
7. Labeled consistent with voice/data jack standard.

D. VOICE/DATA JACK LABELING

1. {Closet}{Floor}-{Jack#}
2. Closet = A letter designation A-Z representing a unique data closet or patch panel location within a facility.
3. Floor = Floor number the jack is located on (B, 1, 2, 3, etc.)
4. Jack# = 001 to 999 (each floor will begin with 001), jacks within the same room will be numbered sequentially.

E. WIRELESS DESIGN STANDARDS

1. BGS will provide ADS an accurate floor plan (w/dimensions) for all construction and renovations.
2. ADS will use floor plan to specify WAP locations.
3. BGS will install cabling to these locations. Note: The purchase of WAP hardware and licensing is at the discretion of the tenant.
4. All WAP locations are ceiling mounted (unless otherwise specified).
5. If the ceiling is a hard surface, not a typical drop ceiling, please notify ADS; who will then provide a bracket for each WAP. The contractor is required to mount the bracket so that the Ethernet line is covered by the WAP when installed.
6. ADS will mount brackets for all typical drop ceiling installations.
7. Data lines for WAP locations must be labeled and numbered consistent with all other data jacks at the location.

28 00 00 Electronic Safety and Security

1.1 Access Control Systems Infrastructure:

1.8 The system of choice is the Honeywell Integrated Security ProWatch system. Integrate all buildings equipped with ProWatch controllers and modules with the State's ProWatch server located in Montpelier.

A. Card access system designs are handled through the BGS Office of Security.

- B. Use Card Access Systems whenever possible. The Card Access System shall be fully incorporated into the existing State System. (Honeywell Prowatch Access Control System)
- 1.9 In general, all exterior doors that are used by the public shall be on the card access system. All doors that enter departments should also be on the card access system. The use of push button locks should be discouraged. If it needs a push button lock, then it should probably be on the card access system. Exterior doors used exclusively by employees should also be considered for card access
- A. Exterior doors: Those that cannot justify a card reader should be equipped with a door position switch, so the door's status can be monitored.
 - B. Interior doors: It is the requesting department's responsibility to pay for the card reader if it is located within their space.
- 1.10 All card access doors shall be equipped with the following door hardware:
- A. HES electric strike, 24VDC Fail Secure, LBM option (or other where the door hardware will not allow a strike). Magnetic locks are not preferred. Use Fail Safe locks on fire-rated, emergency egress doors.
 - B. Storeroom function door hardware (or similar where the door requires something other than a lever-type model)
 - C. Door closer
 - D. Request to exit device (Kantech #T.Rex-XL)
 - E. Door position switch (only if the LBM option is not available)
- 1.11 Push Button releases, where used, should be hardwired and not wireless.
- A. Install pushbutton releases (preferred brand is Alarm Controls Corp #RP-26, momentary) at the request of the Department/Division, and only if authorized by the Director of Security or his/her designee.
 - B. They will only be installed if the person using the button has BOTH a visual and method to communicate with the person requesting access.
- 1.12 Intrusion Detection Systems Infrastructure
- A. Use Intrusion alarm systems if requested by the residing Agency, Department, or Division. It is the requesting agencies obligation to pay for the systems required. Intrusion systems shall consist of an alarm controller (preferred Honeywell Vista 21IP), motion detectors, door position switches, horns, panic buttons (hard wire or wireless), and/or zone expansions modules.
- 1.13 Video Surveillance Control and Management Systems
- A. Use video surveillance systems only if approved by the Commissioner of BGS and/or his/her designee. Video surveillance systems are designed by the BGS Office of Security. Systems that are installed would be for the protection of state assets and/or

for reasons to protect state employees. Cameras, when installed, would cover common areas (exterior and interior). Exemptions include Department of Corrections and Department of Public Safety.

- B. Typical cameras are fixed, color, network cameras capable of a minimum 720p High-definition or HD resolution, POE and 30 frames per second or fps, day/night capabilities, heaters and blowers (if necessary). Pan-Tilt-Zoom or PTZ style cameras are used only if the application can justify the cost.
- C. Wire typical cameras using Berk-Tek #10033815 (black riser-rated CAT6). Where plenum is required use Berk-Tek #10035304.
- D. Recommended recording systems are network video recorders or NVR. Brand and model are determined by the BGS Office of Security and are based on department use and requirements.

1.14 Electronic Personal Safety Alarm Annunciation and Control Systems

- A. Emergency notification systems shall consist of speakers, multi-zone page controllers, voice mass notification, page adapters, and/or strobe lights. Emergency notification systems are to be approved by the Director of Security and/or his/her designee. Justification must be determined if a system is being requested.
 - 1. The cost of an emergency notification system shall be assumed equally amongst all tenants in that specific building.
 - 2. The system shall be a Valcom (#V-9940, #V-2003A, and VP-6124) unless otherwise specified by the BGS Office of Security. Speakers shall be a Valcom #V-1016-W or #V-9022A-2.
 - 3. Emergency notification systems shall have a dedicated phone line.
 - 4. Voice Mass Notification Systems complying with chapter 24 of NFPA 72 shall be considered for all new construction and renovations in Courthouses.

28 46 00 Fire Detection and Alarm

- A. At locations where there is more than 1 building, specify the same manufacturer and model fire alarm system as in the existing buildings.
- B. Fire alarms shall be addressable.
- C. Devices shall be self-addressable and shall not require a special device to program them.
- D. Systems shall be such that the State can:
 - 1. reprogram them when adding or deleting a small number of devices.
 - 2. perform in-house inspection and testing of the systems.
 - 3. disable them during renovations, such as soldering, to prevent nuisance tripping.
- E. Submit reproducible or electronic as-built drawings showing each device, with its unique identifier prior to project completion.

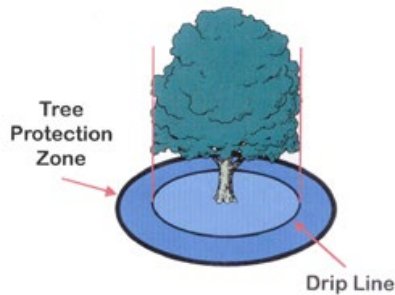
- F. **Systems shall include provisions for integrating with a future mass notification system.** Systems in courthouse shall include mass notification systems. In other buildings mass notification shall be included when directed by the BGS Project Manager.

31 00 00 Earthwork

- 1.1 Utilize Vermont Agency of Transportation Standard Specifications for construction whenever possible: Sand, Gravel, Bituminous Concrete, etc., which are available on line at: <http://vtrans.vermont.gov/docs> in the "Construction Manual", or hard copy from Contract Administration, VT Agency of Transportation, One National Life Drive, Montpelier, VT 05633-5001.
- 1.2 Add the total number of fleet vehicles to the occupancy-based totals for an overall parking space total.
- 1.3 Site Preparation Performance Requirements
- A. The purpose of this item is to prevent damage to branches, stems, and root systems of existing individual trees to remain and to ensure the trees' survival. Provisions under this item include steps to minimize soil and root disturbance and to construct protection measures for trees close to construction areas. The contractor shall install barrier fence to the drip line of existing trees or shrubs marked either 'Save' or 'Protect'. The Tree Protection Zone (TPZ) shall be visible on drawings prior to any earth disturbance; barrier fence shall not be removed until the final project inspection. There will be no activity within the TPZ or the drip line of the tree except watering or installation of erosion prevention or sediment control measures where required. The BGS Project Manager or the contracted engineer shall approve tree protection methods and schedule of work.
- B. Care shall be taken to avoid breaking tree limbs and branches with construction equipment. Prior to construction, tree limbs of trees identified for protection and any other trees identified by the engineer shall be pruned by a qualified tree service.
- C. Roots encountered during excavation work near a TPZ area, shall be cleanly cut with no tearing of roots. Exposed tree roots shall be protected by a double layer of dampened burlap at all times until the roots can be covered with soil, at which time the dampened burlap shall be removed. Following excavation and during construction season, water shall be provided to impacted trees at a minimum of 2.5 gallons per week, per one (1) inch caliper or as directed by the engineer.
- D. The contractor shall provide a log to document watering and natural rainfall to the engineer. If a tree is damaged due to the contractor's negligence and determined to be non-repairable by the engineer, the contractor shall replace the tree at no additional cost to the agency. The replacement tree will be of equal value or two (2) or more trees with a total value equal to that of the damaged tree, using the trunk formula method of appraisal established by the International Society of Arboriculture.

- E. The TPZ is defined as a circular area surrounding a tree, of which the center is the center of the tree trunk and which has a radius of at least one (1) foot for every inch of trunk diameter or diameter breast height (dbh) taken at 4.5 feet above grade.

TPZ radius - dbh in inches X 1 foot or the drip line of the tree (whichever is greater)



Courtesy of: Colorado State University

1.4 Site Improvements Performance Requirements

- A. Landscape planting selection shall include only native or adapted plants to reduce site maintenance needs. **Plantings shall not be invasive species.** Use the Water Sense Water-Efficient Landscape Design Tips from the United States EPA at: http://www.epa.gov/watersense/outdoor/landscaping_tips.html
- B. Locate plantings to aid in passive solar design by shading south facing windows and walls in the summer, and providing a windbreak from prevailing winds, with enough space for full canopy growth without touching the building.
- C. Improve tenant comfort by adding plantings that create pleasant views and muffle off-site noise.
- D. Space trees between the vehicle lanes and walkway at min. 40' o.c.
- E. Consider the use of gray water and rainwater capture systems for use as landscape irrigation.
- F. Consider the use of vegetated roofs in new construction designs using native or adapted plants only. When considering such systems design with structural capacity, long-term operations and maintenance, warranties matching other roofing products in mind.
- G. Review proposed planting and vegetation plans with BGS Security, whether for new construction, or renovations, to coordinate with exterior site safety-standards, camera locations and so on.

- 1.5 All condensers will have three feet of open space around them, weed guard fabric and stone. No planting allowed within the three (3) foot space.

32 00 00 Exterior Improvements

- 1.1 Provide at least 2 flag poles for each building site.
- 1.1 Walk-way width should be consistent with the equipment proposed for snow removal.
- 1.2 Locate walkways and parking areas at least 3' from drip edges, buildings with sloped metal roofs shall require more space to prevent snow and ice from falling on people and vehicles.
- 1.3 Design entryways to buildings so that the roofs provide protection from roof rainwater and snow runoff.
- 1.4 Roads, parking and walkways shall be designed to facilitate snow removal, in urban settings places for temporary snow storage shall be included.
- 1.5 When designing the parking area, locate at least one designated parking space as close as feasible to the electrical room for electric vehicles. Site preparation should be designed and constructed to support future installation of transportation infrastructure such as conduit and a designated area in the electrical room and near the parking space to accommodate any and all support equipment for electric plug-in vehicles. Each building will be designed with:
 - H. A flat area at the edge of the parking area with properly sloped edges to accommodate a concrete slab and any other support infrastructure for a charging station with signage indicating the space as a future location for a charging station.
 - I. Consult with the BGS Energy Office on the number and size of conduits to be buried empty for dedicated use with all foundation penetrations completed.
 - J. Conduit sealed from water penetration, locating tape, and surface identification inside and outside, such as signage, for future use.
 - K. An electrical room designated area on the closest feasible wall to the parking area with signage indicating the designated area for future transportation infrastructure to include all panels, transmitters, and other necessary equipment.
 - L. Bollards to protect the charging station from physical damage should be installed at this time since the location of the conduit(s) is known.

- M. When charging stations are installed they shall have automatic cord retractors to prevent damage to the cord when laying on the ground.



**Montpelier, corner of State Street and Governor Aiken Avenue:
Example of designated area after installation is complete**

33 00 00 Utilities

- 1.1 Coordinate with the electrical utility to make use of off-peak rates, etc., to minimize utility costs.
- A. One option for monitoring and verification would be to follow the ASHRAE Guideline 14. The information would be utilized to verify energy savings on all projects for reporting purposes. We are supposed to reduce our Btu consumption by 5% every year.
- 1.2 Underground steam and condensate piping shall be installed in concrete utility trenches utilizing BGS standard details. Direct buried piping will not be allowed.