

GREEN BUILDING & DESIGN STANDARDS

Producing healthy
affordable homes
for Vermonters

**Vermont Housing
Finance Agency**
www.vhfa.org



SINCE ITS CREATION IN 1974, Vermont Housing Finance Agency has provided financing and technical assistance to support the development of safe, decent and affordable housing for low- and moderate-income Vermonters and their families. VHFA's mission includes promoting effective public policy on housing, sound land-use planning, and up-to-date design and construction practices. As part of that effort, VHFA has been working with several partners, including Maine State Housing Authority and Efficiency Vermont, on developing standards for green building and design for projects that submit applications to the Agency.

Green building is the design, construction and operation of buildings that save money and energy, reduce their impact on natural resources and create healthy, comfortable living environments. Developers who design and build in accordance with these standards will assure long-term affordability by providing dwellings with low energy use that will insulate owners and occupants from rising fuel prices. The intention is to create healthy, economical and durable buildings that are efficient to operate and maintain.

The attached standards are a requirement for all projects that submit applications for funding after April 7, 2008. These standards will be implemented on a voluntary basis through October 2009. During this 18 month period, developers are asked to meet these standards to the best of their ability, and to document the ways in which they do not. If possible, the incremental cost of bringing the development up to the standard would be helpful and should be shared with VHFA when available. The emphasis is on energy efficiency, good indoor air quality, and additional site and building features, such as native vegetation, that reduce the negative environmental impact of development without adding to the bottom line. VHFA's Green Building and Design Standards promote regional products, and support local economies and economic development.

If you have any questions regarding these new standards, please contact a Development Underwriter at 802.864.5743. Thank you for your attention, and we look forward to working with you to produce the kind of affordable housing Vermonters need.

Sincerely,



Sarah Carpenter
Executive Director
Vermont Housing Finance Agency

NOTES

VHFA expects these standards to be followed in their entirety for all projects receiving Housing Credits, Construction and/or Permanent loans unless a specific waiver is requested and granted by VHFA Development staff. The only exception to this rule is if a project already in VHFA's portfolio is simply refinancing in which case that project will not need to meet these standards.

VHFA strongly recommends Developers engage in an Integrated Design Process that incorporates green building strategies from the very beginning of the design process with a development team.

VHFA acknowledges that some of these standards may be required by existing municipal building and energy codes. Should existing codes exist, VHFA requires that the more stringent standard is employed by the developer.

VHFA requires the Architect(s) to provide 1) a certificate of substantial completion; 2) a certificate of final completion; and 3) a certification of compliance with these standards. Of these three requirements only the third is new and it is a final certification from the project Architect which states the design conforms to the standards, the specifications conform to the standards, and the final product conforms to the standards. NOTE: Until September 2009 or such later time as determined by VHFA, the Owner may certify compliance

with these standards in lieu of the project Architect.

VHFA requires that all documentation of the products used be contained in the Operations and Maintenance Manual. This will provide building managers with the information necessary to maintain or replace the green components and reduce the effort and/or expense to the developer for creating an additional manual. Should additional documentation be required, it is up to the General Contractor to provide this information to the developer.

VHFA incorporates the Efficiency Vermont Energy Standards as part of the Green Building and Design Standards. The Energy Standards can be found in Appendix I.

VHFA incorporates its Design Standards as part of the Green Building and Design Standards. The Design Standards can be found in Appendix II.

ACKNOWLEDGEMENTS

VHFA thanks the Maine Housing for their guidance and assistance in creating these Standards especially Dale McCormick and Don McGilvery. Additionally, we would like to thank Dave Anderson, the Vermont Green Building Network, Businesses for Social Responsibility, Efficiency Vermont, Vermont Energy Investment Corporation, Housing Vermont, Bob Duncan, Laz Scangas, and the Vermont Home Builders Association.

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SECTION 1: SITE

1-R1: Landscape plantings

Standard

Landscape with at least 75% northern hardy native species that do not require irrigation and are not considered invasive species. This is measured by number of plantings.

Intent

Create natural areas that provide wildlife habitat, promote biodiversity appropriate to the ecosystem and lower water consumption needed for non-native plantings.

Requirement

1. Plant with trees, shrubs, perennials, annuals and groundcovers that have one or more of the following attributes:
 - a. Northern, hardy and native to this area
 - b. Edible and/or wildlife enhancing
2. In addition to one of the above — drought tolerant
3. Permanent irrigation system to be permitted by VHFA on a case by case basis

Verification

1. Provide VHFA with a site plan demonstrating areas of paving, landscaping (with species) and building footprint.
2. Provide a list of all species to be planted
3. Construction Inspector to verify on site

Resources

University of Vermont Extension-Invasive Plant Information (www.uvm.edu/mastergardener/invasives/invasivesindex.html)

Vermont Invasive Exotic Plant Committee (www.vtinvasiveplants.org)

Rehab/Renovation

The requirements of this standard must be followed where landscaping is included within the scope of the renovation project

Cost Implication

No additional cost

1-R2: Preservation of existing plantings

Standard

Preserve existing trees and vegetation, not including within 30' of buildings, driveways, solar access, areas

cleared for food production and as required for grading for drainage requirements. Within those 30' preserve existing trees and vegetation to the extent possible and practical.

Intent

Preserve mature trees and vegetation which are not within 30' of buildings, et al and to the extent possible preserve mature trees and vegetation within that 30' buffer zone.

Requirement

1. Use best practices to preserve existing trees and vegetation to the extent possible
2. Inventory existing healthy trees and vegetation on the site
3. Identify trees and vegetation to be saved
4. Identify strategies to be used:
 - a. Protective barriers (Must extend to the drip line)
 - b. Relocation

Verification

Provide predevelopment and post development site plans highlighting trees and vegetation that were preserved and/or relocated on site

Rehab/Renovation

The requirements of this standard must be followed in all rehab projects

Cost Implication

No to low additional cost

1-R3: Light pollution

Standard

Minimize light pollution to the night sky.

Intent

Eliminate light trespass from the building site to reduce the impact on nocturnal environments and the night sky in municipalities which either do not have local foot candle level requirements or the local foot candle level requirement is less stringent than the IESNA foot candle requirement.

Requirement

*If compliance with any of these requirements cannot be done while maintaining compliance with other regulatory or funding agency requirements (such as the National Parks Service's Secretary of the Interior's Standards for Historic Preservation) then the other standards supersede these standards.

1. Design outdoor lighting to provide security without creating light pollution.
2. Do not exceed Illuminating Engineering Society of North America (IESNA) foot candle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments (IESNA RP-33-99) OR local foot candle level requirements as required by local towns or municipalities, whichever is more stringent.
3. Design interior and exterior lighting so that zero direct beam illumination leaves the project site.
4. Do not use unshielded fixtures (floodlights)

Verification

1. Specifications
2. Site lighting plan
3. Foot candle verification (completed post-construction)

Resources

The IESNA standard is RP-33-99, IESNA Recommended Practice Manual: Lighting for Exterior Environments

IESNA (www.iesna.org)

Rehab/Renovation

The requirements of this standard must be followed where exterior lighting is included within the scope of the renovation project.

Cost Implication

No to low additional cost

1-R4: Thorough evaluation of site conditions

Standard

Thorough evaluation of site conditions to:

1. Limit costs associated with unexpected environmental hazard mitigation
2. Limit costs associated with unexpected site improvements

For All New Construction Projects the following are required:

- Floodplain determination (if site is located in a floodplain)
- Wetlands delineation (if site is located near a wetland as per State of Vermont standard)
- Opinion from a Professional Engineer (PE) on the adequacy of water/wastewater connections (to be provided after conceptual approval from the municipality); or, all relevant permits

If Full or Partial Foundation:

- Soil classification
- Borings for ledge

If on a site with Wastewater and/or Storm Water disposal:

- State Water/Wastewater and Storm Water Discharge Permit; or a Professional Engineer's opinion on the site's capacity

Requirement

A thorough site evaluation must be completed by civil engineers and other professionals to detail any site challenges.

Timing of the above evaluation is determined by the developer; however, if the evaluation of the site is not completed prior to the purchase of the land and development budget, VHFA will require a higher contingency for site conditions.

Verification

Final plans and specifications with a civil engineer stamp and signature as well as necessary permit documentation.

SECTION 2: BUILDING DESIGN

2-R1: Indoor air quality & mold

Standard

Implement an overall water management plan for the building envelope for prevention of indoor air quality (IAQ) problems from mold.

Intent

Create durable and healthy buildings

Requirements:

Exterior

Footings & Slab

1. Capillary break over footing with damp proofing, low perm or elastomeric paint (for basements, crawlspaces, and slabs, but not for monolithic slab assemblies)
2. Foundation drain at outside perimeter edge of footing (only for a basement)
3. Sub-grade (footing) drainage system where conditions require
4. Gravel bed beneath slab minimum 4" depth, 1/2" gravel, no fines
5. Minimum six mil polyethylene vapor diffusion retarder between slab and gravel with joints lapped at least one foot
6. One inch foam under slab on grade where you have living space on the slab

Surface Drainage

1. Slope final grade away from foundation wall (recommend slope of 5/8" per foot for 10 feet and patios & driveways at 1/4" per foot) but not to conflict with Americans with Disabilities Act (ADA) requirements
2. Downspouts, when connected to a gutter system, should deposit roof water at least 5' from the foundation
3. Provide a 3' wide graded perimeter of impermeable backfill around the foundation, or other equally efficient method of controlling surface water

Basement

1. Damp proofing or moisture barrier assembly system applied to grade
2. Use porous backfill material against foundation walls
3. Provide exterior wall insulation and/or capillary break finish system that drains water to footing drain
4. Capillary break between the foundation and framing

Crawlspaces

1. Crawlspaces must be approved by VHFA staff
2. Approved crawlspaces must be sealed and conditioned

Windows & Doors

1. Sill jams and head wrapped with membrane for moisture protection
2. Casement windows should not be used for family housing unless prior approval is given by VHFA

Roof

1. Overhangs — Minimum of 1 foot at eaves

Interior

Appliances

1. Drainage pans or floor drains are required under water heaters and clothes washers when installed on or over finished floors - not required when located within unfinished basements

Envelope

1. No wet blown insulation (damp spray cellulose)

Verification

1. Construction plans highlighting envelope details for water management
2. Architect to issue certificate of compliance

Resources

Building America: http://www.eere.energy.gov/buildings/building_america/

Building Science Corporation:
<http://www.buildingscience.com/>

Housing and Urban Development (HUD) 'Durability by Design' available at http://www.huduser.org/intercept.asp?loc=/Publications/PDF/durability_by_design_part1.pdf

Rehab/Renovation

The requirements of this standard must be followed to the maximum extent possible where rehab of the building envelope and site work that would permit water management improvements are included within the scope of the renovation project.

Cost Implications

Cost implications are dependent on which and how many of these measures differ from standard practice.

SECTION 3: INSPECTION/CERTIFICATION

3-R1: Central mechanical certification

Standard

Certification is required for projects of five units or more with central mechanical systems.

Intent

To verify that systems are operating as designed and specified.

Requirements

Independent certification is required for:

1. Boilers and Controls (for systems over 250,000 BTUs total heating capacity)
2. Air-conditioning systems and controls (for systems over 10 tons total cooling capacity)
3. Ventilation systems and controls (for all projects)

Verification

A certification from a qualified engineer, EIT or technician of a HVAC contractor or an independent testing firm not employed by or affiliated with the installation contractor or general contractor.

The certification must say that the system specified was installed and that it is working as specified. Certification must be done by no later than 10 months after initial occupancy/certification of completion. (The intent of the timing is to verify proper function while there is still time remaining on the typical 12 month warranty.)

Resources

Vermont Residential Building Energy Code — Eff. January 1, 2005

http://publicservice.vermont.gov/energy-efficiency/ee_files/rbes/energy_code_handbook_09-04.pdf

Rehab/Renovation

The requirements of this standard must be followed where central mechanical system, replacements in projects of five or more units are included within the scope of the renovation project.

Cost Implications

Additional costs contingent upon size and complexity of central mechanical systems.

3-R2: Blower door test

Standard

For each project a representative number of units must be “Blower Door” tested to verify effectiveness of air sealing. For new construction projects each building will be “Blower Door” tested. For moderate and substantial rehab projects this may vary depending on the cost effectiveness and actual feasibility of conducting full building (versus a representative unit) “Blower Door” tests.

Intent

Verify that the building meets VHFA requirements for effective air sealing to prevent heat loss and creation of cold surfaces that can cause condensation and mold growth.

Requirement

Blower Door test conducted with calibrated equipment operated by a trained and qualified technician to be performed before the drywall is installed if polyethylene is the air barrier & after installation if airtight drywall approach (ADA).

Verification

1. Blower Door test report(s) completed by a trained and qualified technician or other certification or summary report from testing agency that document that blower door tests were done
2. Verify that any unwanted leakage areas identified by the test are sealed after the test
3. Verify that test results demonstrate that the building meets the envelope leakage requirements of the International Energy Conservation (IECC) 2004 Supplement

Resources

The Energy conservatory:
<http://www.energyconservatory.com>

Infiltec: <http://www.infiltec.com/inf-bd.htm>

Home Energy Magazine:
<http://homeenergy.org/archive/hem.dis.anl.gov/eehem/94/940110.html>

Notes

Rehab/Renovation

The requirements of this standard must be followed where envelope air sealing is included within the scope of the renovation project.

Cost Implications

Blower Door tests cost \$150-\$200 / unit tested

3-R3: Duct sealing

Standard

A representative sampling of ducted air distribution systems, as determined by VHFA, must be tested to verify effectiveness of duct sealing.

Intent

Verify that the ductwork meets VHFA requirements for effective air sealing to optimize performance and prevent heat loss

Requirement

Duct test conducted with calibrated equipment conducted by a trained and qualified technician

Verification

Duct tightness test report(s) completed by a trained and qualified technician

Verify that the leakage areas identified by the test are sealed after the test

Resources

The Energy Conservatory:
<http://www.energyconservatory.com/>

Home Energy Magazine:
<http://homeenergy.org/archive/hem.dis.anl.gov/eehem/99/991114.html>

Testing Methodology:
<http://epb.lbl.gov/publications/lbnl-47308.pdf>

Rehab/Renovation

The requirements of this standard must be followed where ducted distribution systems are included in the project.

Cost Implications

Low additional cost

SECTION 4: INDOOR ENVIRONMENTAL QUALITY

4-R1: Natural Ventilation and Light

Standard

Position and size operable windows and glazing systems to take advantage of natural ventilation, cooling and daylighting

Intent

Optimize daylighting and passive ventilation opportunities

Requirement

1. Operable windows to the east and west to take advantage of summer ventilation
2. Shading to reduce overheating in summer

*Note casement window requirement in Appendix II

Verification

Review of 50% building plans

Resources

None.

Rehab/Renovation

The requirements of this standard must be followed to the extent possible where window & glazing system replacements are included within the scope of the renovation project.

Cost Implications

No to low additional cost

4-R2: Pigment & paint

Standard

Use low VOC pigment & paint

Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

Requirement

Volatile Organic Compound (VOC) emissions from paints & coatings must not exceed the VOC limits of Green Seal's standard GS-11 requirements:

1. Non-flat: 150 g/L
2. Flat: 50 g/L

Verification

Specifications

Resources

Sustainable ABC:

http://www.sustainableabc.com/m_p_f_a.html

Zero VOC Paint Guide:

<http://www.aqmd.gov/prdas/brochures/paintguide.html>

Green Seal: www.greenseal.org (Charge for publication)

Sourcebook for Green & Sustainable Building:

<http://www.greenbuilder.com/sourcebook/FinishesAdhesives.html>

Rehab/Renovation

The requirements of this standard must be followed where interior painting is included within the scope of the renovation project.

Cost Implications

No additional cost

4-R3: Adhesives & sealants

Standard

Use low VOC adhesives & sealants

Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

Requirement

Volatile Organic Compound (VOC) emissions from adhesives and sealants must not exceed VOC limits of South Coast Air Quality Management District Rule #1168 AND sealants used as fillers must meet the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51

(Attach tables)

Verification

Specifications

Resources

1. South Coast Air Quality Management District: www.aqmd.gov/rules/html/r1168.html
2. Bay Area Air Quality Management District: www.baaqmd.gov
3. South Coast Rule #1168 by the South Coast Air Quality Management District: www.aqmd.gov/rules/html/r1168.html

Limits on VOCs in grams per liter for adhesives and sealants used on interior of building are as follows:

Welding and installation	VOC limit (g/L)
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesive	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250
PVC Welding	510
CPVC Welding	490
ABS Welding	400
Plastic Cement Welding	350
Adhesive Primer for Plastic	650
Contact Adhesive	250
Special Purpose Contact Adhesive	250
Substrates	
Metal to metal	30
Plastic foams	50
Porous material except wood	50
Wood	30
Fiberglass	80

Limits on VOCs in grams per liter for sealants and sealant primers per South Coast Rule #1168 by the South Coast Air Quality Management District:

Sealants	VOC limit (g/L)
Architectural	250
Other	420
Sealant Primers	
Architectural — Porous	250
Architectural — Nonporous	775
Other	750

Limits on VOCs in grams per liter for Sealants used as Fillers per Bay Area Air Quality Management District, Reg. 8 Rule 51

Sealants	VOC limit (g/L)
Architectural	250
Other	420
Sealant Primers	
Architectural — Nonporous	250
Architectural — Porous	775
Other	750

Rehab/Renovation

The requirements of this standard must be followed where adhesives and sealants are included within the scope of the renovation project.

Cost Implications

No additional cost

4-R4: Carpets

Standard

If carpet is installed it must meet CRI low emission label standard.

Intent

Protect installers and occupants from irritating and/or harmful indoor air contaminants

Requirement

Carpet systems must meet or exceed Carpet & Rug Institute (CRI) Green Label Indoor Air Quality Test Program

Verification

Manufacturers cut sheets & submittals verifying that carpet systems meet CRI Air Quality test requirements

Resources

Carpet & Rug Institute: www.carpet-rug.com

Vermont Department of Health:
http://healthvermont.gov/enviro/indoor_air/Carpet.aspx

Limits on VOCs in grams per liter for carpets, cushion, and adhesives per the Carpet and Rug Institute Green Label Testing Program:

Carpets	Emission factor limit (mg/m ² /hr)
Total VOCs	0.5
4— Phenylcyclohexane	0.05
Formaldehyde	0.05
Styrene	0.4
Cushion	
Total VOCs	1
4— Phenylcyclohexane	0.3
Formaldehyde	0.05
Styrene	0.05
Adhesives	
Total VOCs	10
Formaldehyde	0.05
2— Ethyl — 1 — Hexanol	3

Rehab/Renovation

The requirements of this standard must be followed where carpet installation is included within the scope of the renovation project.

Cost Implications

No additional cost

4-R5: Flooring requirements

Standard

No installed carpet in kitchens, bathrooms or within 3' of primary entry doors to the outside

Intent

Prevent the growth of mold and mildew in carpet systems

Requirement

Do not install carpet in kitchens, bathrooms or within 3 feet of primary-entry doors

Verification

1. Construction drawings highlighting carpet system installation requirements
2. Architect to issue certificate of compliance

Resources

Vermont Natural Coatings:
www.vermontnaturalcoatings.com/index.html

Building Green Guide:
www3.uwm.edu/Dept/shwec/publications/cabinet/reductionreuse/615.SG.0502%20Update%2011.pdf

Rehab/Renovation

The requirements of this standard must be followed in all rehab projects

Cost Implications

No additional cost

SECTION 5: MATERIALS

5-R1: Low impact materials

Standard

Use framing and finish lumber harvested from sustainable managed forests OR local / regional materials OR durable materials

Intent

Preserve resources by using 1) certified; 2) regional; or, 3) durable products

Requirement

Choose one of the following:

1. Use framing and finish lumber milled from logs harvested from sustainable managed forests - credit requires that 25% of wood products (as measured by dollar value) used in the project come from "certified forests".
2. Local / regional materials that are manufactured / harvested / extracted within a 300 mile radius of the project — credit requires 20% of building materials (measured by dollar value)
3. For durable materials — use at least two of the following products:
 - Long lasting, low maintenance siding made out of a renewable, sustainable or recyclable resource
 - Composite decking with high recycled content
 - Natural linoleum flooring
 - Ceramic tile bathroom or kitchen flooring
 - Roofing with a reasonable expected life of at least 40 years
 - Insulated glass with a reasonable expected life of at least 20 years
 - Siding with a reasonable expected life of at least 40 years
 - Wood, cork or bamboo flooring

Verification

- For certified wood — verify with: The contractor must verify sustainable forest management through a letter from the sawmill to the lumber yard that declares the percentage of saw logs harvested from certified forestland that were used in manufacturing lumber sold to the contractor. Certification of the forestland may be by the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), Certified Master Logger Program (MLP), or some other established standard, as approved by the State of Vermont; as such standards evolve over time.

- For local/regional materials: Declaration from product vendor or manufacturer stating where product is manufactured
- For durable materials: Manufacturer's product information and warranties

Resources

Vermont Department of Conservation:
<http://www.vtfpr.org/htm/forestry.cfm>

Rehab/Renovation

The requirements of this standard must be followed to the extent possible where framing or finish material replacement is included within the scope of the renovation project

Cost Implications

Additional costs, if any, for verification should be very low. FSC certified wood and most durable products will have higher first costs

SECTION 6: RESOURCE EFFICIENCY

6-R1: Site waste management

Standard

Provide space for recycling containers at convenient location(s) for storage of recyclables.

Intent

Encourage building occupants to recycle and reduce owner waste disposal costs.

Requirement

Provide recycling area for each unit and building. Provide recycling containers for each unit and building unless recycling services are not available in the municipality. Ensure that recycling containers are labeled properly to enable accurate disposal.

Verification

Verify recycling location on plans

Resources

Chittenden Solid Waste District: <http://www.cswd.net/>

Rehab/Renovation

The requirements of this standard must be met by all rehab projects

Cost Implications

Cost for additional Square Footage required for recycling area

6-R2: Non-mercury thermostats

Standard

Non-mercury thermostats

Intent

Prevent the release of mercury into the environment

Requirement

All thermostats must be non-mercury thermostats

Verification

1. Contractor submittals (cut sheets in O&M Manual)
2. Architect to issue certificate of compliance

Resources

Vermont Mercury Education & Reduction Campaign:
<http://www.mercvt.org/>

Rehab/Renovation

The requirements of this standard must be followed where thermostat replacements are included within the scope of the renovation project.

Cost Implications

Some additional cost

6-R3: Deconstruction and Construction Waste Management

Standard

Utilize deconstruction and construction waste recycling services

Intent

To reduce the amount of construction debris entering landfills

Requirement

Provide an opportunity for a deconstruction company to bid on demolition work

All construction waste must be recycled when feasible

Verification

- Contract for deconstruction; and/or
- Construction waste management plan submitted to VHFA or Construction Inspector; and
- Architect to issue certificate of compliance

Resources

Agency of Natural Resources:
www.anr.state.vt.us/dec/wastediv/recycling/c&d.htm

Reuse and Recycling Markets Directory:
http://www.anr.state.vt.us/dec/cf/wm/CandD_SearchList.cfm

Vermont Business Materials
Exchange:<http://www.vbmex.net>

Rehab/Renovation

Same

Cost Implications

Nominal additional cost

SECTION 7: POST OCCUPANCY

7-R1: Post Occupancy Requirements

Standard

Provide tenants and facility managers with educational materials about green design, building operations, recycling and building maintenance

Intent

To maintain the 'green' goals of the project after occupancy by educating and involving occupants in the site and building operations and maintenance procedures

Requirement

1. Introductory presentation to facility managers describing design, operations, recycling, site and building maintenance goals
2. Owners/managers provide educational materials as applicable to tenants either in brochure form or tenant handbook regarding green practices or systems within project

Verification

1. Provide VHFA with sign-off from owner and manger on introductory presentation
2. Provide VHFA with copies of educational materials for tenants

Rehab/Renovation

The requirements of this standard are to educate tenants, building managers and maintenance staff about all relevant green design and construction measures included within the scope of the renovation project.

Cost Implications

Additional cost to purchase or produce, print and distribute educational materials

APPENDIX I: EFFICIENCY VERMONT ENERGY STANDARDS

I-1: General Information

Multi Family Comprehensive Design Checklist for Energy Efficiency

Changes to the Efficiency Vermont Checklist for Multifamily Housing are effective on projects enrolled on or after July 1, 2007.

Why change the checklist now?

In large part, the changes to the Multifamily Checklist are driven by the adoption of the 2005 Vermont Guidelines for Energy Efficiency Commercial Construction. Some areas of the Guidelines—particularly common area lighting—affect multifamily buildings and the new Multifamily Checklist reflects this. The changes to the Multifamily Checklist keep it current with respect to the relevant Code requirements articulated in the 2005 Guidelines, which went into affect January 1, 2007.

The Guidelines can be viewed at: www2.iccsafe.org/states/vermont/Energy/energy_frameset.htm

Additionally, other areas, such as the building air tightness goals, reflect actual results measured over the last 4 years, which was when the original Multifamily Checklist was developed. There has been a measurable improvement in some building practices and products, and the Multifamily Checklist reflects these changes as well. This is a good thing, when coupled with consideration for what fossil fuel prices have done in the last few years.

Finally, the removal of the \$50/bdrm for each bedroom over 1 reflects both an effort to simplify our incentives and manage some of our costs as we bring our services to an ever increasing customer base. We appreciate the efforts that housing developers are making in Vermont to increase the energy efficiency of their projects and will continue to provide the technical assistance that we know is the foundation of the value of our relationships.

The major changes to the Checklist are summarized as follows:

- Lighting Power Density as a design method for common space and parking garage lighting
- Variable Frequency Drive for heating loop circulation pump motors 3 HP and over

- Tighter air leakage standard for buildings
- AFUE of 90.0% for natural gas and propane-fired boilers
- Incentives of \$500/unit +\$500 per efficient common clothes washer/gas-fired clothes dryer pair
- An increase in clothes washer efficiency
- Minimum efficiencies for central air conditioning systems and water-source heat pump units
- “Thermal bypass checklist” needed for the ENERGY STAR® label

For new construction or gut rehab multifamily properties in Vermont that meet all aspects of this checklist, financial incentives will be \$500 for each unit and \$500 for each qualifying common laundry washer/dryer pair. If the building is served by Vermont Gas Systems (www.vermontgas.com), Efficiency Vermont and Vermont Gas incentives will, in combination, provide the \$500 per unit. Within Vermont Gas territory, technical assistance may be provided by staff from both Efficiency Vermont and Vermont Gas. Successful completion of this checklist is designed to ensure buildings meet ENERGY STAR® standards.

If your project involves less comprehensive changes than what is described in this checklist, we will work with you on a custom basis to identify the most cost-effective opportunities for your project.

How this checklist is designed to be used.

Developers and their design teams are encouraged to use this checklist as early in the design process as possible. This checklist should facilitate communication between you and the Efficiency Vermont representative with whom you will be working.

This checklist is designed in sections so that, at a Developer’s discretion, the pertinent information can be distributed to different members of a design team, or to different trades in the event of a design/build project.

When should I get Efficiency Vermont involved in a project?

Please contact us as early as possible. We can work with you and your design team in the conceptual phase, where a large number of decisions with energy impacts are often made. This checklist should help a design team. The details included here reflect many successful projects. Once construction begins, providing Efficiency Vermont with a chance to review electrical and mechanical submittals is recommended. In this review process, we can flag non-complying

products or equipment that does not meet our checklist prior to it being ordered.

What if I want more information?

A technical Efficiency Vermont staff person will be assigned to your project to address questions that arise, from planning through construction. This checklist will raise questions that the Efficiency Vermont representative should be able to address. This person can answer question related to your project and design.

Supporting reasoning and drawings of suggested approaches can be found in Building Science Corporation’s Builders Guide for Cold Climates, available from the Energy and Environmental Building Association (EEBA) by calling (952)-881-1098 or visiting www.eeba.org.

How do I sign up my project?

Please call Efficiency Vermont at (888)-921-5990. If your project will be served by the Burlington Electric Dept. (the only Vermont utility territory not served by Efficiency Vermont), please call BED at (802)-865-7362

I-2: Checklist

Heating & Hot Water Systems

Efficiency Vermont appreciates a chance to review boiler and control submittals prior to acceptance. Often, equipment issues can be flagged at this point through a submittal review.

- Where potential savings warrant, system commissioning for efficient operation may be required for buildings with large and/or complicated HVAC systems (such as both central heating and cooling) to ensure energy efficiency measures are installed and operating as engineered.
- There shall be no electric resistance heat in any location or application.
- Basement heat distribution is generally not recommended unless it is a living space. If basement heat is required, thermostats with low range set points of 45 degrees are recommended in this application so they are used only for freeze protection.

Boilers

- Oil-fired boiler(s) shall be ENERGY STAR® labeled* (www.energystar.gov) with an Annual Fuel Utilization Efficiency (AFUE) of 85.0% or greater.
- Propane- and natural gas-fired boilers shall have a minimum AFUE of 90.0%. Modulating output boilers are recommended, but not required.

- Low-mass (< 5 gallons of boiler water contents) cold-start boilers are recommended, but not required in small single-boiler installations (approximately 4 apartments or less) where circulating loops are not necessary.
- Heating system sizing is based on Manual J calculations or equivalent. Sizing calculations will be provided to Efficiency Vermont on request. Buildings with heating loads larger than 250,000 Btu/hr use staged multiple or modulating boilers.
- Boilers shall be provided with ducted combustion air, ducted directly from outdoors to the burner or to an “air-tight” boiler room as required by Vermont Residential Building Energy Standards (RBES). The combustion air requirements of the boiler are separate from the building and there is no chance of back drafting.

Microprocessor Boiler Controls

- Multiple- or single-boiler installations serving multiple units shall have microprocessor controls programmed to, as applicable, (1) stage boilers; (2) alternate lead/lag; (3) modulate boiler water temperature based on outside temperature (“outdoor reset”); and (4) shut off the primary circulator when outside temperature rises above a pre-set outdoor temperature (no higher than 70°F recommended).

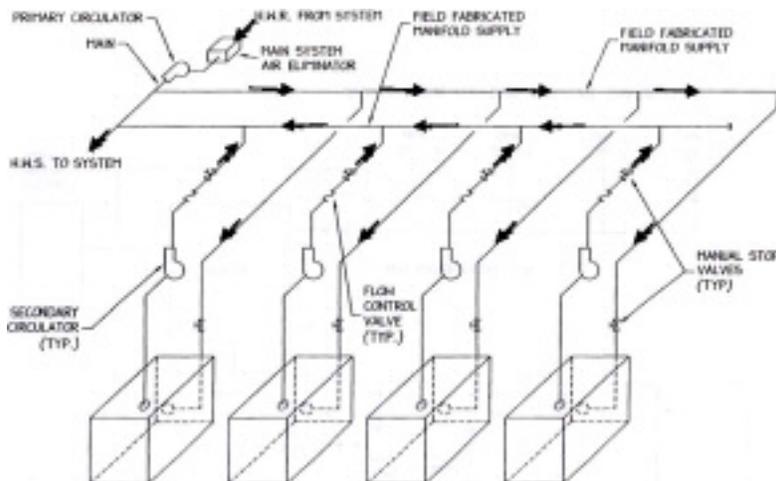
Thermostats

- All thermostats are recommended, but not required, to be non-mercury type to avoid charges at disposal time.
- Each residential unit shall be individually zoned, and apartments with two or more levels have individual zones per level.
- Common area heat shall be controlled with programmable setback thermostats protected with lock-boxes or remotely located.

Pumps & Piping

- In multiple boiler systems, boilers shall be piped with primary/secondary piping to prevent flow through “off line” boilers (see Figure 1). Most manufacturers recommend this piping with multiple boilers.
- In buildings of fewer than eight apartments, pumps shall be controlled to operate only when there is a call for heat (intermittent primary pump operation).

FIG. 1: PRIMARY/SECONDARY BOILER PIPING SCHEMATIC



- Motors of 1 hp or greater shall be “NEMA Premium Efficiency.” To see efficiency listings for different size motors, visit www.nema.org/gov/energy/efficiency/premium. Pumps for heating system loops are appropriately sized and sizing calculations with head and flow will be provided to Efficiency Vermont, if requested.
- Main circulating loop pump motors of 3 hp or greater shall be controlled with variable frequency drives (VFDs) and sensors are positioned to accurately sense loop pressures at periphery of main heating loop.
- All hot water hydronic distribution piping shall be insulated to the following ASHRAE standards:
 - Nominal pipe diameter ≤ 1.5 " has minimum 1" insulation
 - Nominal pipe diameter > 1.5 " has minimum 2" insulation
 - Pipe insulating values shall be based on material with insulating value of R-3.7 per inch (conductivity not exceeding 0.27 Btu per inch/h/ft 2 /°F)

Domestic Hot Water

- Domestic hot water shall be provided by either (1) central indirect-fired water heater(s) off the central boiler(s) or (2) very high-efficiency (greater than 80%) central standalone system. DHW tanks have insulation with a minimum R-value of R-14.
- Circulating domestic water heating loops shall be installed only when the run is greater than 50 feet to the furthest tap. Circulating loop is controlled with a 24-hour timer and/or aqua stat. All loop piping is insulated to the following ASHRAE standards:

- Nominal pipe diameter ≤ 1.5 " has minimum 1" insulation
- Nominal pipe diameter >1.5 " has minimum 2" insulation
- Pipe insulating values based on material with insulating value of R-3.7 per inch (conductivity not exceeding 0.27 Btu per inch/h/ft 2 /°F)
- Consider installing a shower drain water heat recovery system, which can reduce fuel consumption for hot water heating by 10-15% or more depending on how it is plumbed. If the project will have multiple stacked units sharing drain lines, this strategy may work well.

A listing of ENERGY STAR-labeled products can be found at www.energystar.gov. Not all products that meet ENERGY STAR criteria carry an actual label on the product. Efficiency Vermont considers any product with a make and model listed on the ENERGY STAR website to be "ENERGY STAR-labeled." If you have questions, please contact Efficiency Vermont at (888)-921-5990.

Air Conditioning

Efficiency Vermont appreciates a chance to review boiler and control submittals prior to acceptance. Often, equipment issues can be flagged at this point through a submittal review.

- Building envelope and systems shall be designed to minimize air conditioning loads, including adequate space heating or domestic hot water distribution pipe insulation and window glazing with solar heat gain coefficient (SHGC) no higher than .55. We recommend, but do not require, avoiding expanses of west facing glass that exceed 12% of floor area to avoid substantial solar gain.
- If air conditioning will be installed, nominal central air conditioning system efficiency shall meet or exceed Consortium for Energy Efficiency (CEE) Tier 2 standards. (As specified by the Consortium for Energy Efficiency, www.cee1.org):
- If water source heat pumps will be installed, nominal heat pump efficiencies shall meet or exceed Consortium for Energy Efficiency (CEE) Tier 2 standards, as specified by the Consortium for Energy Efficiency, (www.cee1.org). Models with a capacity of up to 135,000 Btu/hr must have a minimum EER of 14.0 (with an entering water

temperature of 85.0°F) and a minimum COP of 4.6 (with an entering water temperature of 70.0°F).

- Seasonally installed window mounted units shall be ENERGY STAR labeled* (www.energystar.gov) and removed and replaced seasonally.

* A listing of ENERGY STAR-labeled products can be found at www.energystar.gov. Not all products that meet ENERGY STAR criteria carry an actual label on the product. Efficiency Vermont considers any product with a make and model listed on the ENERGY STAR website to be "ENERGY STAR-labeled." If you have questions, please contact Efficiency Vermont at (888)-921-5990.

Water Conservation

Water conserving faucet aerators and showerheads will be supplied by Efficiency Vermont, at no charge to property owner or tenants, to be installed by mechanical contractor meeting the following maximum flow specifications:

- Bathroom faucets at 1.5 gallons per minute (gpm)
- Kitchen faucets at 1.5 gpm
- Showerheads at 2.0 gpm
- Common area lavatories at 1.5 gpm
- Toilets shall be rated 1.6 gallons (maximum) per flush. For additional water savings, consider dual flush toilets.

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Thermal Shell

Upon successful completion of this checklist, Efficiency Vermont will provide a Vermont Residential Building Energy Standards Certificate for the project builder to sign and file with Vermont Department of Public Service and the town.

All aspects of a Thermal Bypass Checklist must be completed (to be coordinated between project builder and Efficiency Vermont project manager) for each ENERGY STAR-labeled building (see page 9).

Minimum Air Conditioning Efficiency Levels		
HVAC Unit Size		Minimum SEER/EER
Tons	BTU/Hr	
<5.4	<65,000	14.0 SEER/12 EER
<=5.4 to <11.25	>=65,000 to <135,000	11.5 EER/11.9 EER IPLV
>=11.25 to <20	>=135,000 to <240,000	11.5 EER/11.9 EER IPLV
>=20 to 30	>+240,000 to 375,000	10.5 EER/10.9 EER IPLV

A required pre-sheetrock site visit will be performed at no charge to help identify potential air leakage or insulation deficiencies. The most beneficial time to call is after internal framing is substantially complete and sheet rocking is just starting. If building has an insulated attic flat with an unconditioned attic space above, Efficiency Vermont needs to inspect air sealing details before attic insulation is installed.

Insulation

- If new construction, insulation levels shall meet or exceed the Vermont Residential Building Energy Standards listed below. If building cavities are insulated with cellulose or fiberglass insulation, they must have effective air sealing and wind protection provisions so that air movement through insulation material is eliminated. We recommend and encourage the use of 2 part spray-applied insulation foams for strategic and/or comprehensive air sealing and insulation.
- Flat ceilings shall be insulated to R-38 or better (minimum 12" of blown cellulose). We recommend, but do not require, installing at least 15" of blown cellulose after the attic has been effectively air sealed.
- For new construction, sloped ceilings shall be effectively insulated to R-30 or better. For major rehabilitation, install maximum insulation as cavity allows and consider strategies that allow for greater insulation values.
- If new construction, walls shall be insulated to R-19 or better. If major rehabilitation, walls shall be insulated to R-11 or better. For major gut rehabilitation, consider installing high density 2-part spray polyurethane foam to insulate existing 2x4 walls with 3" of foam. We recommend, but do not require, installing exterior rigid foam sheathing for building longevity and additional energy savings.
- No wet spray cellulose spray shall be used.
- Any floors over unheated spaces shall be insulated to R-30 or better.
- Foundation or frost wall for slab edge on grade shall be insulated to minimum R-10 from the top of the foundation to the footing. Slab edge insulation detail must provide complete thermal break. Detail must be approved by Efficiency Vermont. We recommend, but do not require, installing at least 1" of rigid extruded polystyrene foam (R-5) under non-radiant slab-on-grade foundations for condensation control and occupant comfort.
- If radiant heat slab is installed, insulation under slab shall be no less than 2" of rigid extruded polystyrene foam (R-10).

Air sealing

- All penetrations through exterior surfaces shall be sealed with effective, durable materials (often caulk or minimally expanding foam) per Vermont Residential Building Energy Standards.
- Thermal Bypass Checklist (see page 9) must be completed. Efficiency Vermont project manager will provide review and project site visits as needed to help builder meet the checklist requirements.
- New Construction Building Tightness: Air leakage rate is blower-door tested and shown to be no more than 0.40 cfm50/sq. ft. of external, above grade building shell surface area (not including basements). Blower door air leakage testing provided by Efficiency Vermont.
- Major rehabilitation Building Tightness: Air leakage rate is blower-door tested and shown to be no more than 0.60 cfm50/sq. ft. of external, above grade building shell surface area (not including basements). Blower door air leakage testing provided by Efficiency Vermont.
- In order to achieve the above levels of building tightness, air sealing shall include (but not be limited to) effective sealing with appropriate products in the following areas:
- All plumbing, electrical, electric box, dryer duct or bath fan duct penetrations in exterior walls and attic with caulk or minimally expanding foam. Consider foregoing ceiling vapor barrier (poly) installation to facilitate effective air sealing in open flat attics.
- Gap between the top plates of interior and exterior walls sealed to ceiling sheetrock in the top story with caulk or minimally expanding foam.
- Plumbing, electrical, mechanical and other chases open to attics.
- Rigid air barrier sealed and installed behind tubs or showers located on exterior walls before tub and shower are installed.
- If elevator shaft must be vented, install an elevator vent that has a leakage rate of no more than 3 cfm/sq. ft. at 1.0" of static pressure.
- Bottom edge of sheetrock sealed to subfloor or slab on exterior walls with minimally expanding foam.
- Metal bath fan housings sealed to sheetrock with caulk or minimally expanding foam.
- Avoid recessed can lighting in the thermal envelope. Any recessed lighting fixtures located in the thermal envelope must be "IC-rated" and meet ASTM-E287 ("Washington State approved" for air tightness) and installed with the gasket kits and related accessories needed to meet these standards.
- Around window rough opening, minimally expanding foam with bead size to seal window frame to rough opening, do not try to fill depth of gap.

Energy Star Homes Thermal Bypass Checklist	
Thermal Bypass	Inspection Guidelines
1. Air Barrier and Thermal Barrier Alignment	Insulation is installed in full contact with the air barrier to provide continuous alignment of the insulation with the air barrier.
2. Shower/Tub at Exterior Wall	Exterior walls have been enclosed on all six sides. Exterior walls have been fully insulated.
3. Insulated Floor Above Garage	Air barrier is installed at any exposed edges of insulation. Insulation is installed to maintain permanent contact with the underside of the sub floor decking.
4. Attic Knee Walls	Continuous top and bottom plates are installed with an air barrier on the attic side of insulated walls, including exposed edges of insulation at joists and rafters.
	Insulation is in complete alignment with interior wall finish and the attic side air barrier.
5. Attic Access Panel / Drop-Down Stair	Attic access panel or stair is covered with insulation that is attached and fits snugly in the framed opening. Attic access panel or stair is fully gasketed for an air-tight fit.
6. Cantilevered Floor	Floor framing is completely filled with insulation or insulation is installed to maintain permanent contact with the sub-floor decking. Air barrier spans cantilever and any exposed edges of insulation.
7. Duct Shaft / Piping Shaft and Penetrations	Openings to unconditioned space are sealed with solid blocking and any remaining gaps are sealed with caulk or foam.
8. Flue Shaft	Opening around flue is fully sealed with flashing and any remaining gaps are sealed with fire-rated caulk or sealant.
	Combustion clearance between flue and combustible materials (e.g., OSB) are properly closed with UL- approved metal collars.
9. Attic Eaves	Solid baffles are provided at framing bays to avoid wind washing of attic insulation.
10. Dropped Ceiling / Soffit	Air barrier is fully aligned with insulated framing, and any gaps are fully sealed with caulk, foam or tape.
11. Fireplace Wall	Air barrier is fully aligned with insulated framing in framed shaft behind fireplace, and any gaps are fully sealed with caulk, foam or tape.
12. Staircase Framing at Exterior Wall / Attic	Air barrier is fully aligned with insulated framing, and any gaps are fully sealed with caulk or foam.
13. Recessed Lighting	Airtight IC-rated recessed light fixtures are sealed to drywall with gasket, caulk or foam.
14. Porch Roof	Air barrier is installed at the intersection of the porch roof and exterior wall.
15. Whole-House Fan Penetration at Attic	An insulated cover is provided that is gasketed or sealed to the opening from either the attic side or ceiling side of the fan.
16. Common Walls Between Dwelling Units	Air barrier is installed to seal the gap between a gypsum shaft wall (i.e., common wall) and the structural framing between units in duplex and townhouse construction.

Doors & Windows

- All windows shall have an NFRC U value rating of .35 or less, and a Solar Heat Gain Coefficient (SHGC) of .55 or less and are ENERGY STAR labeled* for Northern climate. Typical energy features include double glazing, low-E coating, argon filling, and warm edge spacers. These features do not guarantee a window qualifies for the ENERGY STAR label.

- All rough openings shall be air-sealed with minimally expanding foam between rough opening and window or doorframe. (Foam bead should seal gap between window frame and rough opening to form an air seal. Do not try to fill the depth of the gap as window can bow.)
- Doors shall be exterior rated with polystyrene or urethane core. Glass sections of exterior doors shall have Low-E coating.

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Mechanical Ventilation for Living Spaces

Efficiency Vermont appreciates a chance to review ventilation submittals prior to acceptance. Often, equipment issues can be flagged at this point through a submittal review.

- Each unit shall have, at minimum, an exhaust-only ventilation system (ENERGY STAR qualified low wattage bath fan with 24-hour control), per the Vermont Residential Building Energy Code. Electrically efficient central ventilation and heat recovery ventilation systems are encouraged.
- All bedroom and bathroom doors shall be undercut by a minimum of 1" clear space after carpet installation to allow free airflow. Transfer grilles to allow free airflow are also acceptable.
- Ducted kitchen range hoods are recommended for health and safety reasons, but not required. Kitchen range hoods are properly ducted per manufacturer's specifications.

Mechanical ventilation fans and controls

- All fans (in unit and in common spaces) are low-noise, meet ENERGY STAR criteria (no less than 2.8 cfm/watt) and have a split capacitor or "brushless DC" (sometimes referred to as "electrically commutated") motor designed for continuous duty operation.
- All fans are sized to be capable of providing 0.35 air changes per hour or 15 cfm per person, whichever is larger. Number of persons assumed for a unit is number of bedrooms plus one.
- Continuous ventilation in multifamily buildings is recommended to provide adequate ventilation and reduce potential odor migration from apartment to apartment.
- At a minimum, each unit shall meet the Residential Building Energy Standards ventilation requirement that all fans are controlled by a 24-hour timer programmed to operate consistently while residents are home. Controls are programmed so that fans shall operate a minimum of 8 hours per day while residents are home.
- Using a fan with integral speed control and a local override wall switch is recommended, but not required.

Ventilation system ducting

- All ventilation ducting shall be sealed smooth-wall rigid metal or PVC with a minimum of elbows.
- All ductwork in unconditioned spaces shall be effectively insulated to minimize condensation of water vapor and pitched to the outside.
- All venting joints shall be sealed with mastic or PVC glue. No duct tape shall be used.
- Ducting shall terminate at exterior wall of building at a dampered terminus (dryer vent style cap).

Fan housing perimeter shall be sealed to bathroom sheetrock for air leakage control and more efficient fan performance.

Resident Controlled Lighting

Efficiency Vermont appreciates a chance to review lighting submittals prior to acceptance. Often, lighting issues or incorrect products can be flagged at this point through a submittal review.

Interior Lighting

- Hard-wired energy-efficient fluorescent lighting fixtures (High Performance or regular T-8, compact fluorescent or circline) shall be installed in all rooms or areas, including:
 - All kitchens
 - All dining rooms or dining areas
 - All living rooms or living areas
 - All bedrooms
 - All lit hallways and entryways
- High Performance T-8's (high lumen lamp/low ballast factor ballast combination) are strongly recommended for use in common hallways. If High Performance T-8 fixtures are used in common hallway areas, they are highly recommended for in-unit lighting (kitchens and bathrooms) to reduce possible confusion resulting from multiple lamp and ballast types.
- High Performance T-8 fixtures are highly recommended in kitchens and bathroom (vanities) for their superior light levels and tested long-term performance.
- We highly recommend that all compact fluorescent fixtures meet ENERGY STAR criteria. If magnetically ballasted fixtures are installed, they must use "instant on" lamps to avoid flicker on starting. An ENERGY STAR-labeled* fixture will meet Efficiency Vermont criteria. Fixtures that carry the ENERGY STAR label* have the following characteristics:
 - All lamps in residential spaces shall have a minimum color-rendering index (CRI) of 80.
 - All lamps in residential spaces shall have a color temperature in the range of 2700-3500K.

- All lamps within a room have a similar color temperature for aesthetics.
- Recessed light fixtures installed in the thermal boundary shall be:
 - Certified for insulation contact (“IC-rated”).
 - Airtight design compliant with the Washington State Energy Code (meets ASTM E283).
 - Lamped with pin-style base compact fluorescent lamps (no screw-ins).

If recessed fixtures are installed to protrude into attic, attic insulation details need special attention to ensure proper insulation values.

Lamps for Resident Controlled Lighting

- Electrical specifiers are encouraged to minimize the number of different replacement lamp types required at a property (e.g., use all circline and Super T-8, or all PL style and Super T-8.)
- Efficiency Vermont recommends that bid and contract documents specify that the electrical contractor provides a minimum of 15% replacement lamps for each installed lamp at the project. (Example: If project has 20 T-8s and 40 pin based 3x13w fixtures, then electrical contractor provides 3 T-8s and 18 PL13 lamps as replacements.) Replacement lamps are the same color and CRI rating as originals. Developer should ensure that lamps are stored properly and that the project manager and/or maintenance staff knows their location.

Resident-Owned Lighting

- Rental agreements/leases should prohibit halogen torchiere floor lamps for reasons of both safety and energy efficiency.
- For qualifying low-income multifamily apartments, Efficiency Vermont will provide efficient compact

fluorescent lamps for resident-owned fixtures once project is fully tenanted. The compact fluorescent screw-in lamps will be provided at no cost to owner, management or residents.

Exterior Resident Controlled Lighting

- Resident-controlled exterior lighting shall be compact fluorescent and properly rated for exterior conditions and starting characteristics in cold temperatures. Efficiency Vermont recommends installing fixtures with an integrated photocell for both savings and security, by preventing daytime operation.

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Common Area Lighting

Interior Lighting

- Exit signs shall be LED or electroluminescent.
- All lighting fixtures shall be hard-wired energy-efficient fluorescent lighting fixtures (High Performance T-8, or ENERGY STAR-labeled compact fluorescent or circline).
- Total common area lighting energy shall be no more than 0.63 watts/sq. ft., which is 10% less than the level called for in the 2005 Vermont Guidelines for Energy Efficient Commercial Construction (see www2.iccsafe.org/states/vermont/Energy/energy_frameset.htm). Resident portions of the building are excluded from the watts/sq. ft. calculation. In order to assist designers, the efficient watts/sq. ft. are summarized in the following table by area:

Interior Space	Buildings up to 3 stories		4+ story buildings after Jan. 1, 2007	
	ASHRAE 90.1 Watts/SF	Efficient Watts/SF	ASHRAE 90.1 Watts/SF	Efficient Watts/SF
Corridor	0.7	0.60	0.5	0.45
Stairs	0.9	0.77	0.6	0.54
Lobby	1.7	1.45	1.1	0.99
Lounge	—	1.08	1.2	1.08
Common Restroom	—	0.81	0.9	0.81
Food Preparation	—	1.08	1.2	1.08
Common Dining Area	—	1.26	1.4	1.26
Active Storage	1.1	0.89	0.8	0.72
Inactive Storage	0.3	0.30	0.3	0.30
Electrical/Mechanical	1.3	1.11	1.5	1.35
Offices (Enclosed)	—	0.99	1.1	0.99
Parking Garage	—	0.18	0.2	0.18

Elevator lighting

- Consider specifying High Performance T-8 lighting (high lumen lamp/low ballast factor ballast) for elevator lighting. Standard elevator lights, which never shut off, are often T-12 fixtures, so each single lamp strip fixture replaced with a High Performance T-8 saves an average of \$17/year at current average electric rates. This is recommended, but not required.

Lighting Controls

Common spaces, particularly hallways, have bi-level switching options to reduce lighting during low use periods (commonly midnight to 5am). Common space hallway lighting is efficiently controlled with lighting control panels, time clocks, photocells and/or motion sensors. Other common space lighting (non-hallway) requiring manual controls must have means to reduce the connected lighting load by at least 50% per Sections 805.2.2.1 and 805.2.2.2 in the 2005 Vermont Guidelines for Energy Efficient Commercial Construction. Go to www.iccsafe.org/states/vermont/Energy/energyframeset.htm for a link to read the actual language of the VT Guidelines.

- Ceiling-mounted motion sensors are recommended where there are concerns about resident intervention.
- Time clocks shall be located in remote locations not accessible by residents.
- Exterior lighting shall be controlled by a photo sensor or astronomical time switch to turn off when there is sufficient daylight or when lighting is not required.
- Stairwells with windows shall have photocell controls to prevent unnecessary daytime operation.

Exterior Lighting

- Common area lighting greater than 100 watts shall have a minimum efficacy of 60 lumens/watt. Fluorescent and metal halide lighting meets this standard and offer superior color rendition over high pressure sodium.
- Common area exterior lighting fixtures shall be high-intensity discharge (HID) pulse-start metal halide or compact fluorescent and meet the efficient lighting power densities in the following chart:

Exterior Space	ASHRAE 90.1 Watts/SF	Efficient Watts/SF (10% less)
Parking Garage	0.2	0.18
Uncovered Parking Area	0.15	0.14
Walkways < 10 feet wide	1.0 watt/linear foot	0.9 watts/linear foot
Walkways, plazas > 10 feet wide	0.2	0.18
Exterior stairways	1.0	0.9
Main entries	30 watts/linear foot door width	27 watts/linear foot door width
Other exterior doorways	20 watts/linear foot door width	18 watts/linear foot door width
Canopies	1.25	1.13
Building facades	0.2 for walls; 5.0 watts/linear foot for signs	0.2 for walls; 5.0 watts/linear foot for signs

Appliances

Refrigerators

- Each apartment shall be equipped with an ENERGY STAR-labeled* refrigerator.
- All refrigerators installed in any central kitchen facilities or common areas shall be ENERGY STAR labeled.*
- If rehab, all old refrigerators shall be permanently removed from service (disposal receipt required) and not re-sold.

Dishwashers

- Dishwashers (in unit or common area) must be ENERGY STAR labeled.*

In-Unit Laundry Equipment

- In-unit laundry appliances provided by owner shall be ENERGY STAR labeled* AND have a Modified Energy Factor (MEF) of 2.0 or higher (CEE Tier 2). Qualifying models can be found here: www.cee1.org/resid/seha/rwsh/rwsh-prod.pdf.
- In-unit dryer hook-ups shall provide the option for natural gas, where available. Propane-fired dryer hook-ups are encouraged for in-unit dryers if propane will be centrally purchased and stored in a large tank or multiple large tanks.
- Dryers shall be ducted outdoors with smooth-walled rigid ducting and backflow dampers at wall terminus.

Commercial Kitchens

- ENERGY STAR labeled* equipment is highly recommended for Commercial Kitchens. Contact your Efficiency Vermont technical staff person for other opportunities.

Common Laundry Facilities

- Common laundry facilities are equipped with ENERGY STAR-labeled* front-loading washing machines that have a Modified Energy Factor (MEF) of 2.0 or higher (CEE Tier 2). Qualifying models can be found here: www.cee1.org/com/cwsh/cwshspec.pdf.
- Common laundry facilities shall be equipped with natural gas or propane dryers.

- Dryers shall be ducted outdoors with smooth-walled rigid metal ducting and backflow dampers at wall terminus.

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APPENDIX II: DESIGN STANDARDS

Project Design will be reviewed to assess both site and livability issues including but not limited to: universal design and accessibility, pedestrian access, access to transportation, recreation and community space amenities, appropriate unit size and configuration, and consistency and appropriateness with the surrounding neighborhood. To the extent that other funding sources have conflicting design standards, the more stringent requirements will take precedence. In addition, design that enhances the safety and security of residents and helps to prevent crime is encouraged. Quality design shall be a prerequisite for an allocation of credits.

Project Amenities	Under 20 Units	20-50 Units	Over 50 Units
Furnished accessible community room with a bathroom and kitchen area	N/A	Recommended	Required
Elevator (Required for all garden-style buildings {i.e. single-level apartments, or “flats”} three-stories or greater, and for all buildings for senior occupancy of two or more stories. Grade changes can negate this requirement, which is intended to eliminate the need to walk up more than one flight of stairs.)	N/A	N/A	N/A
Designated exterior playground area adequate for the size of the project (not applicable for units designated for senior occupancy). The requirement for a playground may be modified or waived based on site considerations and proximity to an available public playground or other public recreational facilities.	Recommended	Required	Required
Covered parking	Recommended	Recommended	Recommended
Adequate storage area for each unit	Recommended	Recommended	Recommended
Management Office	N/A	Recommended	Required
Unit amenities			
All units three-bedroom or larger must have at a minimum 1 & 1/2 bathrooms (required for new construction and “adaptive reuse” rehab, recommended for rehab of existing housing units)	Required	Required	Required
All units must have an easily reachable area designated for a microwave (such as a microwave shelf or a combination microwave/fan hood) in addition to adequate counter space.	Required	Required	Required
All units must be constructed with wall soundproofing having a Sound Transmission Classification (STC) Rating of a minimum of 50 which can be achieved with either method: 1) UL Section #U311; or 2) 2x4 studs 16” OC, 5/8” X GWB on one side, RC-1 Channel 12” OC with 5/8” X GWB on opposite side, the cavity filled with sound batts.	Required	Required	Required
All units must have at least two phone outlets wired with CAT 5e to a central location (where available) installed by qualified installers. All units must also have two RG 6 coax cable outlets.	Required	Required	Required
Casement Windows — No casement windows are permitted except with prior review and approval by the Agency.	Required	Required	Required
Site Selection			
Site Amenities — Proposed site(s) should be in proximity to schools, churches, shopping (grocery stores), recreational facilities and public transportation.	Recommended	Recommended	Recommended
Site Evaluation — The Purchase and Sales Contract should contain a contingency which provides for adequate site evaluation, testing and feasibility analysis.	Recommended	Recommended	Recommended



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