

# 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](http://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](http://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](http://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](http://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).

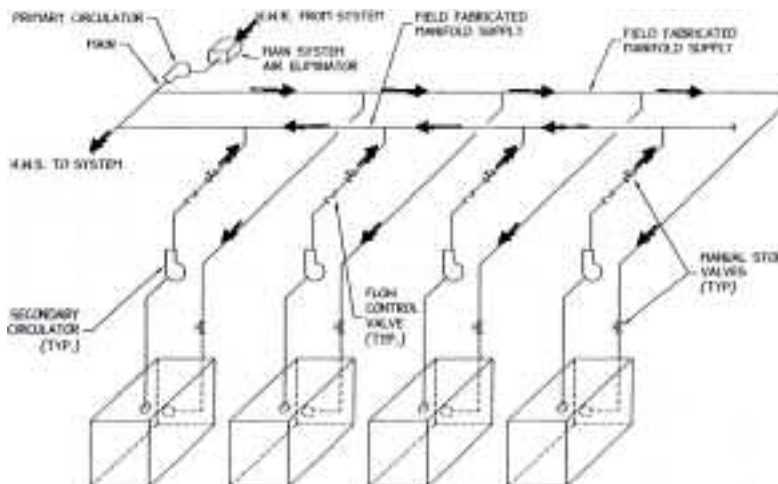
### Thermostats

- 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](http://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  $\leq 1.5$ " 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  $\leq 1.5$ " 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](http://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](http://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](http://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](http://www.energystar.gov)) and removed and replaced seasonally.

\* A listing of ENERGY STAR-labeled products can be found at [www.energystar.gov](http://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.

\* A listing of ENERGY STAR-labeled products can be found at [www.energystar.gov](http://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.

### 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.

\* A listing of ENERGY STAR-labeled products can be found at [www.energystar.gov](http://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.

### **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.

\* A listing of ENERGY STAR-labeled products can be found at [www.energystar.gov](http://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.

### 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](http://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	<b>0.60</b>	0.5	<b>0.45</b>
Stairs	0.9	<b>0.77</b>	0.6	<b>0.54</b>
Lobby	1.7	<b>1.45</b>	1.1	<b>0.99</b>
Lounge	—	<b>1.08</b>	1.2	<b>1.08</b>
Common Restroom	—	<b>0.81</b>	0.9	<b>0.81</b>
Food Preparation	—	<b>1.08</b>	1.2	<b>1.08</b>
Common Dining Area	—	<b>1.26</b>	1.4	<b>1.26</b>
Active Storage	1.1	<b>0.89</b>	0.8	<b>0.72</b>
Inactive Storage	0.3	<b>0.30</b>	0.3	<b>0.30</b>
Electrical/Mechanical	1.3	<b>1.11</b>	1.5	<b>1.35</b>
Offices (Enclosed)	—	<b>0.99</b>	1.1	<b>0.99</b>
Parking Garage	—	<b>0.18</b>	0.2	<b>0.18</b>

### 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](http://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	<b>0.18</b>
Uncovered Parking Area	0.15	<b>0.14</b>
Walkways < 10 feet wide	1.0 watt/linear foot	<b>0.9 watts/linear foot</b>
Walkways, plazas > 10 feet wide	0.2	<b>0.18</b>
Exterior stairways	1.0	<b>0.9</b>
Main entries	30 watts/linear foot door width	<b>27 watts/linear foot door width</b>
Other exterior doorways	20 watts/linear foot door width	<b>18 watts/linear foot door width</b>
Canopies	1.25	<b>1.13</b>
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](http://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](http://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.

\* A listing of ENERGY STAR-labeled products can be found at [www.energystar.gov](http://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.

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
<b>Unit amenities</b>			
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
<b>Site Selection</b>			
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