

## **Vermont Consolidated Act 250 Energy Guidelines for Typical Commercial and Industrial (C&I) Buildings**

Prepared by the Vermont Department of Public Service

The Energy Guidelines for typical Commercial and Industrial (C&I) buildings will help many Act 250 applicants comply with Criteria 9(F) (energy conservation) and 9(J) (public utility services) when designing buildings for Act 250 review. The Consolidated Guidelines are prescriptive energy performance requirements which reflect typical building practices and technologies found to be cost-effective on a life-cycle basis for most C&I buildings in Vermont. The guidelines establish base efficiency levels for common energy systems and provide a simple, easy-to-use method for meeting the “best available technology” provision of criterion 9(F).

The Vermont Act 250 Guidelines are a consolidation of similar criteria developed by utility demand-side management (DSM) programs in recent years. The Consolidated Guidelines are fundamentally consistent with the current versions of the Act 250 recommendations used by Burlington Electric Department, Citizens Utilities Company, Central Vermont Public Service, Green Mountain Power, Ludlow Electric Department, Vermont Electric Cooperative, Vermont Gas Systems and other Vermont utilities. The Consolidated Guidelines combine the various minimum recommendations into a single document so applicants have a consistent statewide reference.

***The Guidelines will not cover all Act 250 applications.*** There will be instances where the Department of Public Service, which reviews Act 250 proposals under 9(F) and 9(J), will request applicants to analyze custom measures on a life-cycle cost basis. This typically occurs when more complex commercial and industrial buildings or energy-intensive systems are proposed. Applicants should check with the electric and natural gas utility during the pre-application phase to discern when custom analysis will likely occur (see attached contact list). Page 10 has more details about custom measures. Applicants should recognize that a utility review of their project prior to submitting an application typically expedites approval.

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In short, the Vermont Act 250 Consolidated Energy Guidelines establish a simplified means for owners, builders, developers and the building design community to comply with recognized building efficiency guidelines while providing a sound footing to incorporate higher levels of cost-effective energy efficiency in a manner which is simple and less burdensome to designers and Act 250 administrative staff.

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**Five steps for Act 250 compliance under criteria 9(F) and 9(J)  
using the Consolidated Energy Guidelines**

- 1) Contact the electric and natural gas (where available) utility(s) where the project or building is proposed.
- 2) Ask the utility to send you an “ability-to-serve” letter regarding Criterion 9(J).
- 3) Review the preliminary design of the facility with the utility(s) using the Consolidated Guidelines as a starting point to establish minimum efficiency levels for the project under Criteria 9(F). Request the utility to send you its evaluation in writing.
- 4) Identify custom efficiency measures to be analyzed during the building design process and incorporated into the project if determined cost-effective.
- 5) Document steps 1-4 in Schedule B of the Act 250 application. Include copies of utility correspondence and a proposed time frame for finalizing the building design and reporting back to the Public Service Department (DPS) regarding custom measures or variances to the Consolidated Energy Guidelines. An applicant seeking a variance should explain where the guidelines should not apply to specific measures or buildings.

Applicants following these five steps can expect to eliminate the time consuming procedure in which the DPS submits questions about the project through the Interagency Review process. The applicant then prepares a formal response to the questions and the DPS provides supplemental comments to the District Commission prior to the issuance of the Act 250 permit.

The Guidelines will be revised periodically by the Department of Public Service with input from utilities, building design and construction professionals, building owners/operators and other interested parties. Updates will consider factors such as advances in energy technology, construction costs, current building practices and user experience.

Contact your utility representative or the Act 250 Specialist at the DPS at 802-828-4056 (or toll-free in Vermont, 1-800-642-3281) if you have questions, comments, or require additional information about the Vermont Consolidated Act 250 Guidelines.

These Guidelines incorporate the standard definitions, rating and testing procedures used in ASHRAE-IES 90.1-1989.

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## UTILITY CONTACTS FOR ACT 250 CRITERIA 9(F) AND 9(J) ASSISTANCE

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**Vermont Consolidated Act 250 Energy Guidelines  
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**I. Building Envelope**

<b>Assembly</b>	<b>Minimum Thermal Resistance</b>
<b>Flat ceiling</b>	<b>R-38</b>
<b>Sloped ceiling</b>	<b>R-30</b>
<b>Wall</b>	<b>R-19</b>
<b>Glazing*</b>	<b>R-2.4 (u-0.42) double glazed, Low-E coating</b>
<b>Opaque doors, overhead doors</b>	<b>R-5 (u-0.2); R-10 (u-0.10)</b>
<b>Floor over unheated space</b>	<b>R-30</b>
<b>Foundation or Slab Edge on Grade</b>	<b>R-10 on foundation to footing</b>
<b>Slab with Radiant Heat</b>	<b>R-5 under slab</b>
<b>Vapor Barrier</b>	<b>Required on warm side of insulation</b>

\* Applies when fenestration is less than 20 percent of wall area. More glazing may require custom analysis.

- A. Vapor barrier on the warm (moist air) side of the insulation. All penetrations and construction joints associated with thermal envelope shall be caulked and/or sealed.
- B. Windows/glazing: At a minimum R-2.4, (u-0.42) double glazed, low 'E' . Air infiltration rates shall not exceed the rates specified in ASHRAE 90.1-1989, Section 8.4.5.1&.2.
- C. Entry Vestibules (complying with ADA) shall be incorporated in the design for all major entries and exits. Loading docks or delivery areas open to outside should be isolated from other interior spaces.
- D. Doors: Opaque, little-used doors, such as emergency exit doors not protected by a vestibule, shall have a minimum thermal resistance of R-5. Overhead doors shall have a minimum thermal resistance of R-10. All doors shall be insulated, weatherstripped, and shall comply with ASHRAE 90.1-1989, Section 8.4.5. 1. Exterior and vestibule doors should be equipped with automatic closers.
- E. Buildings with exceptionally high internal heat loads or atypical space temperature requirements may warrant site-specific custom analysis.

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## II. Lighting Systems

- A. **Lighting Power Densities.** Building lighting systems shall comply with ASHRAE 90.1-1989 (Vt. Modified) **Table - VCG 6-5, Prescriptive Unit Lighting Power Allowance for Gross Lighted Area of the Total Building** (attached).

Alternately, room-by-room compliance can be met with ASHRAE 90.1-1989 (Vt. Modified) **Tables - VCG 6-6a and VCG 6-6b, System Performance Unit Lighting Power Allowance Tables** (attached).

- B. **Illuminance Levels.** Maximum lighting levels should be designed for recommended levels of illuminance (foot candles) for various types of activities per the current Illuminating Engineering Society (IES) Handbook. In all cases, lighting levels shall meet OSHA or other applicable codes.
- C. **Lighting Technologies.** Lighting technologies for general interior lighting (offices, open areas, selling floors, lobbies, hallways, etc.) shall utilize high efficacy (lumens/watt) technologies, such as fluorescent systems using T8 lamps and electronic ballasts. T8 technology typically has the lowest life cycle cost (LCC) where lighting is in use more than approximately 25 hours/week. In areas with less usage, such as mechanical or storage rooms, where electronically ballasted T8 systems are not required for compliance with the lighting power budget, fluorescent systems with energy saving ballasts and T-12 lamps may be cost-effective. Less efficient lighting systems may be substituted only when shown to be more cost effective on a life-cycle cost basis.

Wall-mounted sconce, soffit and recessed canister and track lighting applications shall specify the use of compact fluorescent lamps, and electronic ballasts where usage is greater than 20 hours per week.

High-intensity discharge (HID) lighting specified in areas such as warehouses, production spaces, assembly halls and gymnasiums, shall utilize high pressure sodium or metal halide technologies. High efficiency fluorescent systems, such as T8 equipment, may also be suitable. While high pressure sodium is more efficient than metal halide, aesthetic concerns regarding color rendition may sometimes favor metal halide. Mercury vapor is not acceptable.

In limited circumstances where incandescent lamps are specified for specialized accent lighting, tungsten-halogen lamps (while considerably less efficient than compact fluorescent alternatives), are typically more cost-effective than standard incandescent lamps. Low-voltage systems may also be a viable low-energy light source for display and other similar applications.

- D. **Lighting Controls.** Lighting controls shall comply with ASHRAE 90.1-1989 Section 6.4.2. at a minimum. Appropriate switching capability to provide multi-level lighting for different uses in a space shall be provided by manual or automatic controls.

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E. **Daylighting.** When natural daylighting can be substituted for electrical lighting near windows during the day, lighting in those areas shall be circuited so that it can be controlled manually or automatically by switching or dimming.

F. **Ballasts/Tandem Wiring.** Comply with ASHRAE 90.1-1989 Section 6.4.4 for minimum performance characteristics of ballasts, and to Section 6.4.4.3 regarding the tandem wiring of lamps. This is especially important where three-lamp fixtures are anticipated involving high/low switching.

Ballasts shall meet utility specifications for power factor and harmonic distortion.

G. **Exit Lighting.** Internally illuminated exit signs as may be required by NFPA, shall be either light emitting diodes (LED) or electro-illuminiscent.

H. **Exterior Lighting.** Exterior area lighting shall be high- or low-pressure sodium, metal halide, or low-starting-temperature fluorescent. Low-pressure sodium is most efficient, has the lowest life-cycle cost and is preferred wherever its monochromatic color rendering is acceptable. High-pressure sodium is more efficient than metal halide, but if color rendition is an aesthetic consideration, metal halide is an acceptable choice. Fluorescent luminaires featuring low-starting temperature ballast for outdoor applications are readily available. Mercury vapor is not acceptable.

Exterior lighting power densities shall not exceed the allowances contained in ASHRAE 90.1-1989 table 6-1. These lighting allowances should be considered absolute maximums for built-up areas with high ambient lighting levels. The ASHRAE levels may exceed local or regional exterior lighting standards. See the *The Outdoor Lighting Manual for Vermont Municipalities* published by the Chittenden County Regional Planning Commission for general information on suitable exterior lighting systems (available from Public Service Department).

Exterior lighting controls shall be automatically switched by a combination of timer and photo-cell with a specific control strategy for lit areas or uses such as walkways, parking areas, roadways and security lighting. Timer controls shall be equipped with back-up provisions per ASHRAE 90.1-1989 Section 6.4.2.8.

Fixture designs including fully shielded (sharp cut-off fixtures) should be specified to eliminate glare and light trespass.

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**III. HVAC (heating, ventilation and air conditioning) Systems**

- A. **Ventilation.** Mechanical ventilation shall be designed to meet ASHRAE 62-1989. Low leakage dampers should be utilized to minimize infiltration. Ventilation system controls shall be capable of minimizing energy use during unoccupied periods.
- B. **System and Equipment Sizing.** HVAC equipment shall be sized to meet the design load, consistent with ASHRAE 90.1-1989 Section 9.4. 1 & 9.5.1, except that procedures should be those of the current edition of the ASHRAE Handbook Fundamentals Volume, or a similar procedure.
- C. **Cooling Performance.** Cooling equipment shall meet or exceed the EER or SEER (energy efficiency rating or seasonal energy efficiency rating) contained in **Table - VCG 10-1, HVAC - Cooling Minimum Performance Standards** (attached). Automatic economizer controls shall be included unless the Act 250 applicant documents that an economizer cycle is not cost effective on a life-cycle cost basis, nor practicable for a particular application or that a ventilation heat recovery system is included in the HVAC system design. Selection of chillers shall be made by life-cycle cost analysis, with consideration granted for environmentally-preferred (non-CFC or non-HCFC) refrigerants when they are available.
- D. **Heating Performance.** Heating equipment shall meet or exceed the minimum efficiency levels contained in **Table - VCG 10-2, HVAC - Heating Minimum Performance Standards** (attached). Heat Recovery systems shall be incorporated into HVAC system designs for facilities with high ventilation requirements when determined to be cost effective on a life-cycle cost basis.

Generally, electric resistance heat is not acceptable. This includes use of electric space heat as a backup for heat pumps.

- E. **Controls.** Automatic temperature controls shall, at minimum, allow for seven-day programming with multiple set-up/set-back capability with a minimum deadband of 5 degrees Fahrenheit for each HVAC system. Individual controls shall be provided for each thermal zone. System design and zone controls shall be consistent with Section 9.5 of ASHRAE 90.1-1989, including Section 9.5.1, 9.5.2 & 9.5.3 regarding equipment sizing, zone and economizer controls. Requirements include integrated zone controls, outdoor temperature reset (or variable flow) controls for large hot and chilled water systems. Buildings larger than 40,000 square feet shall have installed a central DDC energy management system unless the applicant documents a DDC system is not cost-effective on a life-cycle-cost basis.
- F. **Insulation.** Duct Insulation: Ducts and HVAC piping shall be insulated to the R-value specified in ASHRAE 90.1-1989, Table 9.1, Table 9-2 and Section 9.4.8. Alternately, ducts may be insulated to R-5 in an unconditioned space and R-8 outside the building envelope.

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#### **IV. Service Water Systems**

- A. Domestic hot water heating equipment shall meet or exceed the minimum efficiency levels contained on **Table - VCG 10-3, Domestic Hot Water Heating Minimum Performance Standards** (attached). Generally, electric resistance hot water heating is not acceptable. However, low-volume (6-10 gallon) and instantaneous electric water heaters may be installed in low-use locations (i.e. rest rooms) if demonstrated to be cost effective on a life-cycle cost basis.
- B. Pipe insulation for domestic hot water piping systems shall be insulated per ASHRAE 90.1-1989, Table 9-1 and Section 11.4.3-4.
- C. Conservation of hot water: Domestic hot water systems shall conform with ASHRAE Section 11.4.5 except that showers used for other than safety reasons shall limit the maximum water discharge to 2.5 gallons per minute.

#### **V. Motor Systems**

- A. 3-phase motors rated one horsepower or greater, which operate more than approximately 2,000 hours per year, shall meet or exceed the nominal efficiency ratings contained on **Table - VCG MTR-1, Three Phase Motor Performance Standards** (attached).
- B. Motors shall be sized to optimally match capacity with load and must meet utility requirements for power factor and reduced voltage starting.
- C. Adjustable speed motor drives shall be incorporated into motor system designs when determined to be cost effective on a life-cycle cost basis.

#### **VI. Refrigeration Systems**

- A. Refrigeration systems should be designed to optimally match capacities with loads. Refrigeration systems for various sized facilities shall include the equipment contained in **Table - VCG REF-1, Refrigeration Performance Standards** (attached).

#### **VII. Commercial Cooking and Other Appliances**

- A. Kitchen exhaust hoods shall be designed to utilize outdoor make-up air.

Note: Alternatives to electric resistance fuel sources for general purpose cooking equipment and appliances such as dryers, pools heaters, saunas and hot tubs should be specified when cost-effective and compatible with operational requirements. Energy efficient residential size appliances and office equipment including products carrying the Energy Star label should be

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specified where applicable.

**VIII. Operation and Maintenance Instructions:**

- A. The building owner or operator shall be provided with construction documents for HVAC, lighting, motor equipment and associated control systems. The documents shall include operation and maintenance procedures, system schematics and sequence of operations. Results of testing, adjusting and calibration of mechanical equipment and control systems shall be provided to the building owner and operator.

**IX. Custom Energy Efficiency Measures that may Warrant Further Consideration during the Project Design Process**

Many commonly available technologies and systems may be cost-effective depending on the specific design, use and siting of the proposed facility. These measures are often cost-effective on a life-cycle cost basis for larger, more complex commercial buildings, manufacturing facilities and industrial processes. Potentially cost-effective measures should be analyzed early in the building design process to take advantage of system interactions which can result in reduced construction, operation and maintenance costs for mechanical equipment and related building components.

Examples of custom measures include: optimized building orientation, passive heating and cooling, energy recovery, high efficiency HVAC and VAV systems, integrated DDC energy management systems, specialized adjustable speed motor drives, co-generation and renewable on-site generation, thermal storage, system commissioning and a host of process optimization measures for manufacturing facilities. Custom lighting controls, e.g. continuous dimming daylighting and occupancy sensors are other examples.

Building design professionals, energy service providers and utility personnel can assist applicants in evaluating the economic and operational aspects of custom measures on a site specific basis and can provide life cycle cost studies to support Act 250 applications for individual projects. The VT Department of Public Service provides information on life-cycle costing and distributes the NIST *Building Life-Cycle Cost* computer software program and *Users Guide* through its web site at: [http://www.state.vt.us/psd/Energy Efficiency Division](http://www.state.vt.us/psd/Energy%20Efficiency%20Division).

**Table VCG 6-5**  
**PRESCRIPTIVE UNIT LIGHTING POWER ALLOWANCE (UPLA), W/ft<sup>2</sup>**  
**GROSS LIGHTED AREA OF TOTAL BUILDING**

Building Type Or Space Activity	0 to 2,000 ft <sup>2</sup>	2,0001 to 10,000 ft <sup>2</sup>	10,001 to 25,000 ft <sup>2</sup>	25,001 to 50,000 ft <sup>2</sup>	50,001 250,000 ft <sup>2</sup>	>250,000 ft <sup>2</sup>
Food Service						
Fast Food Cafeteria	0.92	0.85	0.82	0.81	0.81	
0.80						
Leisure Dining Bar	1.60	1.56	1.52	1.48	1.44	
1.40						
Offices	1.40	1.34	1.27	1.22	1.16	
1.11						
Retail (1)	2.70	2.52	2.32	2.05	1.87	
1.72						
Mall Concourse						
Multi-store service	1.69	1.68	1.65	1.63	1.61	
1.60						
Service Establishment	2.81	2.03	1.78	1.65	1.54	
1.46						
Garages	0.25	0.24	0.23	0.22	0.21	
0.20						
Schools						
Preschool/Elementary	1.33	1.33	1.27	1.22	1.16	
1.11						
Jr. High/High School	1.40	1.40	1.39	1.35	1.30	
1.26						
Technical/Vocational	1.77	1.72	1.60	1.49	1.36	
1.26						
Warehouse/Storage	0.60	0.50	0.42	0.36	0.32	
0.30						

Notes:

(1) Includes general, merchandise, and display lighting.

This prescriptive table is for use in conjunction with Section 8 or 13 of ASHRAE/IES 90.1-1989 and is for compliance only. Its use is intended primarily for core and shell (i.e. speculative) buildings or during the preliminary design phase. (i.e. when the space uses are less than 80% defined). The values in this table are not intended to represent the needs of all buildings within the types listed. This table shall not be used without the option of using the System Performance method in 6.6 of ASHRAE/IES 90.1-1989.

Vermont Department of State Buildings, Standard E/1991 Table 6-5

**Table VCG 6-6a**  
**SYSTEM PERFORMANCE UNIT LIGHTING POWER ALLOWANCE**  
**COMMON ACTIVITY AREAS**

Area/Activity	UPD W/ft <sup>2</sup>	Note	Area/Activity	UPD W/ft <sup>2</sup>	Note
Auditorium	1.4	a	<i>Office Category 1</i>		
Corridor	0.8	b	Enclosed offices, all open plan offices without partitions or with partitions* lower than 4.5 ft. below the ceiling.		
Classroom/Lecture Hall	1.5		Reading, Typing and Filing	1.3	d
Electrical/Mechanical Equipment Room			Drafting	2.2	d
General	0.7	b	Accounting	1.8	d
Control Room	1.5	b			
			<i>Office Category 2</i>		
Food Service			Open plan offices 900 ft <sup>2</sup> or larger with partitions * 3.5 to 4.5 ft below the ceiling. Offices less than 900 ft <sup>2</sup> shall use category 1.		
Fast Food/Cafeteria	0.8		Reading, Typing and Filing	1.5	b
Leisure Dining	1.4	c	Drafting	2.6	b
Bar/Lounge	1.3	c	Accounting	2.1	b
Kitchen	1.4				
Recreation/Lounge	0.5				
			<i>Office Category 3</i>		
Stair			Open plan offices 900 ft <sup>2</sup> or larger with partitions* higher than 3.5 ft below the ceiling. Offices less than 900 ft <sup>2</sup> shall use category 1.		
Active Traffic	0.6		Reading, Typing and Filing	1.7	b
Emergency Exit	0.4		Drafting	3.0	b
Toilet & Washroom	0.5		Accounting	2.4	b
Garage			Common Activity Areas		
Auto & Pedestrian Circulation Area	0.25		Conference/Meeting Room	1.3	a
Parking Area	0.2		Computer/Office Equipment	2.1	
Laboratory	2.2		Filing, Inactive	1.0	
			Mail Room	1.3	
Library			Shop (Non-Industrial)		
Auto Visual	1.1		Machinery	2.5	
Stack Area	1.5		Electrical/Electronic	2.5	
Card File & Cataloging	0.8		Painting	1.6	
Reading Area	1.0		Carpentry	2.3	
			Welding	1.2	
Lobby (General)			Storage & Warehouse		
Reception & Waiting	0.55		Inactive Storage	0.2	
Elevator Lobbies	0.4		Active Storage, Bulky	0.3	
Atrium (Multi-Story)			Active Storage, Fine	0.9	
First 3 Floors	0.4		Material Handling	1.0	
Each Additional Floor	0.15				
Locker Room & Shower	0.6		Unlisted Space	0.2	

Notes for table 6-6

- a. A 1.5 power adjustment factor is applicable for multi-functional spaces.
- b. Area factor of 1.0 shall be used for these spaces.
- c. UPD includes lighting power required for clean-up.

d. Area factor shall not exceed 1.55

e. See section 11.0 - Definitions for Classifications of Retail Facilities.

\*Not less than 90% of all work stations shall be individually enclosed with partitions of at least the height described.

**Table VCG 6-6b**  
**SYSTEM PERFORMANCE UNIT LIGHTING POWER ALLOWANCE**  
**SPECIFIC BUILDINGS**

Area/Activity	UPD W/ft <sup>2</sup>	Note	Area/Activity	UPD W/ft <sup>2</sup>	Note
Airport, Bus and Rail Station			Hotel/Conference Center		
Baggage Area	0.75		Banquet Room/Multipurpose	1.4	a
Concourse/Main Thruway	0.45		Bathroom/Powder Room	0.6	
Ticket Counter	1.3		Guest Room	0.7	
Waiting & Lounge Area	0.6		Public Area	0.8	
Bank			Exhibition Hall	1.3	
Customer Area	0.8		Conference/Meeting	1.5	a
Banking Activity Area	2.2		Lobby	1.3	
Barber & Beauty Parlor	1.6		Reception Desk	2.4	
Church, Synagogue, Chapel			Laundry		
Worship/Congregational	1.3		Washing	0.6	
Preaching & Sermon/Choir	1.8		Ironing & Sorting	1.3	
Dormitory			Museum & Gallery		
Bedroom	0.6		General Exhibition	1.2	
Bedroom with Study	1.3		Inspection/Restoration	3.0	
Study Hall	0.9		Storage (Artifacts)		
Fire & Police Department			Inactive	0.25	
Fire Engine Room	0.7		Active	0.5	
Jail Cell	0.4		Post Office		
Hospital/Nursing Home			Lobby	0.8	
Corridor	0.9	b	Sorting & Mailing	2.1	
Dental Suite/Exam./Treatment	1.4		Service Station/Auto Repair	0.8	
Emergency	2.0		Theater		
Laboratory	1.7		Performing Arts	1.1	
Lounge/Waiting Room	0.6		Motion Picture	0.75	
Medical Supplies	2.4		Lobby	1.0	
Nursery	1.6		Retail Establishments (Merchandise & Circulation Area)		
Nurse Station	1.8		Applicable to all lighting, including accent and display lighting,		
Occupational/Physical Therapy	1.4		installed in merchandise and circulation areas.		
Patient Room	0.9		Type A Jewelry Display	5.0	e
Pharmacy	1.5		Type B Merchandise Display	2.9	e
Radiology	1.8		Type C Mass Merchandise	2.7	e
Surgical & O.B. Suites			Type D General Merchandise	2.3	e
General Area	1.8		Type E Food & Miscellaneous	2.4	e
Operating Room	7.0		Type F Service Establishments	2.6	e
Recovery	2.0		Mall Concourse	1.6	
			Retail Support Areas		
			Tailoring	2.1	
			Dressing/Fitting Room	1.1	

Notes for table 6-6

a. A 1.5 power adjustment factor is applicable for multi-functional spaces.

b. Area factor of 1.0 shall be used for these spaces.

c. UPD includes lighting power required for clean-up purpose.

d. Area factor shall not exceed 1.55.

e. See section 3.4 ASHRAE/IES 90.1-1989 - Definitions for Classifications of Retail Facilities.

**Table VCG 10-1  
HVAC Minimum Performance Standards**

System Type	Minimum Performance	
	Cooling	Heating

*Air Conditioners, - Air Cooled*

Split System < 65,000 Btu/h	12.0 SEER	N/A
Single Package < 65,000 Btu/h	11.0 SEER	N/A

*Split System and Single Package*

>65,000 and <135,000 Btu/h	10.3 EER 10.6 IPLV	N/A
>135,000 Btu/h and <240,000 Btu/h	9.7 EER 9.9 IPLV	N/A
>240,000 Btu/h and <760,000 Btu/h	9.5 EER 9.7 IPLV	N/A

*Heat Pump, Air Source*

Split System < 65,000 Btu/h	12.0 SEER	7.0 HSPF
Single Package < 65,000 Btu/h	11.0 SEER	6.8 HSPF

*Split System and Single Package*

>65,000 and <135,000 Btu/h	10.1 EER 10.4 IPLV	3.2 COP (High Temp.) 2.2 COP (Low Temp.)
>135,000 Btu/h and < 240,000 Btu/h	9.3 EER 9.5 IPLV	3.1 COP (High Temp.) 2.0 COP (Low Temp.)

*Heat Pump, Water Source*

<135,000 Btu/h	12.0 EER (85° E.W.T.)	4.1 COP (70° E.W.T.)
<135,000 Btu/h	13.0 EER (75° E.W.T.)	4.2 COP (75° E.W.T.)

*Chillers*

All Types Refer to ASHRAE/IES 90.1-1989, Table 10-7
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*Condensing Units & Misc. HVAC Equipment*

All Types Refer to ASHRAE/IES 90.1-1989, Table 10 series
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For further details, refer to Tier 1, High Efficiency Commercial Air Conditioning Initiative, Consortium for Energy Efficiency, Inc.

**Table VCG 10-2**  
**HVAC - Heating Minimum Performance Standards**

**Warm Air Furnaces and Combination Warm Air Furnaces/Air Conditioning Units**

Category	Minimum Efficiency
<140,000 Btu/h	AFUE 83%
>140,000 <225,000 Btu/h	AFUE 78%
>225,000 Btu/h	Thermal Efficiency 80%

**Warm Air Duct Furnaces**

Category	Minimum Efficiency
Maximum Rated Capacity Provided and Allowed by Controls	Thermal Efficiency 78%
Minimum Rated Capacity Provided and Allowed by Controls	Thermal Efficiency 75%

**Warm Air Unit Heaters**

Category	Minimum Efficiency
Maximum Rated Capacity Provided and Allowed by Controls	Thermal Efficiency equal to or greater than 81%*
Minimum Rated Capacity Provided and Allowed by Controls	Thermal Efficiency equal to or greater than 78%*

\* All unit heaters shall be power vented with electronic ignition unless proven non-cost effective.

*Table VCG 10-2* continued

**Hot Water Boilers**

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Category	Minimum Efficiency
< 175,000 Btu/h	AFUE 83%
>175,000 Btu/h -- < 300,000 Btu/h	AFUE 80%
=>300,000 Btu/h	Combustion Efficiency 83%

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**Steam Boilers**

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Category	Minimum Efficiency
< 300,000 Btu/h	Combustion Efficiency 80%
=>300,000 Btu/h	Combustion Efficiency 83%

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**Infrared Radiant Heaters**

Radiant heating systems should be considered for heating areas which experience infiltration loads in excess of two air changes per hour at design heating conditions, areas with high ceilings that need spot heating, and for any other applications where radiant heating may be more energy efficient than convective or all-air heating systems.

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Category	Minimum Efficiency
All	Combustion Efficiency 75%

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Note: Heating system efficiency ratings reflect the standard definitions and testing procedures used in ASHRAE-IES 90.1-1989.

**Table VCG 10-3**  
**Domestic Hot Water Heating Minimum Performance Standards**

Class	Capacity	Input Rating	Minimum Efficiency
Storage Water Heater	=< 100 gallons	=< 75,000 Btu/h	Energy Factor => 0.62
Storage Water Heater	> 100 gallons	> 75,000 Btu/h	Combustion Efficiency 80%
Unfired Storage Tanks	All Volumes	-----	Heat Loss of Tank Surface, < 6.5 Btu/h/ft <sup>2</sup>
Non-Storage Water Heaters	-----	All Input Ratings	Combustion Efficiency 80%
Pool Heaters (pool cover recommended)	-----	All Input Ratings	Thermal Efficiency 78%

Note: DHW heating system efficiency ratings reflect the standard definitions and testing procedures used in ASHRAE-IES 90.1-1989.

*Table MTR-1*

**Three-Phase Motor Performance Standards**

Motors must meet or exceed the efficiencies listed below depending on hours of operation. The minimum efficiency levels listed below meet the Consortium for Energy Efficiency (CEE) Standards. Efficiencies to be determined in accordance with IEEE Standard 112 Method B.

HP	1200 RPM OPEN DRIP PROOF	1200 RPM TOTAL ENCLOSED FAN COOLED OR EXPLOSION PROOF	1800 RPM OPEN DRIP PROOF	1800 RPM TOTAL ENCLOSED FAN COOLED OR EXPLOSION PROOF	3600 RPM OPEN DRIP PROOF	3600 RPM TOTAL ENCLOSED FAN COOLED OR EXPLOSION PROOF
	Minimum Nominal Efficiency	Minimum Nominal Efficiency	Minimum Nominal Efficiency	Minimum Nominal Efficiency	Minimum Nominal Efficiency	Minimum Nominal Efficiency
1	82.5	82.5	85.5	85.5	80.0	78.5
1.5	86.5	87.5	86.5	86.5	85.5	85.5
2	87.5	88.5	86.5	86.5	86.5	86.5
3	89.5	89.5	89.5	89.5	86.5	88.5
5	89.5	89.5	89.5	89.5	89.5	89.5
7.5	91.7	91.7	91.0	91.7	89.5	91.0
10	91.7	91.7	91.7	91.7	90.2	91.7
15	92.4	92.4	93.0	92.4	91.0	91.7
20	92.4	92.4	93.0	93.0	92.4	92.4
25	93.0	93.0	93.6	93.6	93.0	93.0
30	93.6	93.6	94.1	93.6	93.0	93.0
40	94.1	94.1	94.1	94.1	93.6	93.6
50	94.1	94.1	94.5	94.5	93.6	94.1
60	95.0	94.5	95.0	95.0	94.1	94.1
75	95.0	95.0	95.0	95.4	94.5	94.5
100	95.0	95.4	95.4	95.4	94.5	95.0
125	95.4	95.4	95.4	95.4	95.0	95.4
150	95.8	95.8	95.8	95.8	95.4	95.4
200	95.8	95.8	95.8	96.2	95.4	95.8

*Contact your utility for information regarding motors over 200 HP.*

# Refrigeration Minimum Performance Standards

*Table REF-1*

Refrigeration

up to 10,000 square feet

	Equipment	Comments
ALL COMMERCIAL including INSTITUTIONAL & INDUSTRIAL APPLICATIONS	individual split systems should have condensers located outdoors with floating head pressure controls  economizer systems may be considered as an alternative for floating head pressure controls for refrigeration systems	permanent split capacitor fan motors  minimum insulation: R-29 - 40 in walls & ceiling, R-10 - 30 in floor  doors, strip curtains, or coverings to minimize heat gain  cooler display doors with frame and door heaters must use either zero energy doors (for air conditioned space) or controls to minimize energy use

Refrigeration

10,001 to 50,000 square feet

	Equipment	Comments
ALL APPLICATIONS WITH 10 HP OR MORE COMBINED REFRIGERATION & FREEZER LOAD	Unequal parallel multiplex compressor racks w/air cooled  condenser & floating head pressure control. 3 phase freezer units should consider discuss technology	permanent split capacitor fan motors  minimum insulation: R-29 - 40 in walls & ceiling, R-10 - 30 in floor  doors, strip curtains, or coverings to minimize heat gain
LESS THAN 10 HP COMBINED LOAD	Individual split systems w/outdoor condensers and floating head pressure controls. Economizer systems may be considered as an alternative for floating head pressure controls for refrigeration systems.	cooler display doors with frame and door heaters must use either zero energy doors (for air conditioned space) or controls to minimize energy use

Supermarkets larger than 50,000 square feet see Supermarket Refrigeration Standards on next page

*Table REF-1 continued*

**Supermarket and Commercial Refrigeration Performance Recommendations  
for buildings with gross area greater than 50,000 sq. ft.**

**Equipment must meet or exceed the following recommended levels:**

Individual rack type refrigeration systems for medium, low and very low temperature applications;

- For high and medium deck display cases, either:
  1. High efficiency cooler doors (i.e., triple or low-E glazing).  
For > 11.5 sq. ft. door size: Glass area > R-2.9 BTU/sq. ft./hr; Door heater < 5.2 watts/sq.ft., Lighting < 116 total watts.or,
  2. Humidistat type controls for anti-sweat door heaters. Settings to limit operation to > 55 % relative humidity and >75 degrees (F) ambient temperature.
- Remote, electronic ballasts for display cases.
- Vinyl curtain doors in walk-in coolers.

**The following recommended efficiency applications should be evaluated for cost effectiveness:**

- Variable speed drives for one of the compressors in each rack type refrigeration system.
- Variable speed drives for one of the condenser fans for each separate refrigeration system.
- Electronic demand control defrost for evaporators on low temperature and very low temperature applications.
- Ambient or mechanical sub-cooling.
- Desiccant dehumidification

end