

## 780 CMR 13.00

### ENERGY EFFICIENCY

#### 780 CMR 1301.0 JURISDICTION

1301.1 Energy Efficiency. Energy Efficiency is to be met via compliance with the International Energy Conservation Code (IECC) 2006 with the 2007 Supplement or ASHRAE 90.1-2007.

1301.1.1 Amendments. To meet Massachusetts energy efficiency requirements, the IECC 2006 is amended as follows:

#### *Insert new sections:*

101.5.3 Compliance Alternative, Buildings with total floor area not greater than 10,000 square feet may be designed and constructed using the envelope requirements of 780 CMR 61.00.

101.5.4 **Heating, Pumping, Process Piping and Refrigeration Systems.** Heating, pumping, process piping and refrigeration systems shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts (Installing Contractor). Engineered designs and specifications prepared by Registered Professional Engineers shall identify systems requiring compliance with appropriate sections of M.G.L. c. 146 and 528 CMR, Shop drawings and design layout prepared by licensed installing contractors shall note the **name(s)**, license **number(s)** and license expiration **date(s)** of the contractor(s) installing the heating, pumping, process piping and refrigeration systems.

101.5.5 **Exempt Buildings.** Portions of aircraft hangars where aircraft are housed or stored and/or aircraft servicing, repairs or alterations may occur are exempt from the provisions of 780 CMR 13.00.

#### *Add these four Default Door U-Factors to TABLE 102.1.3(2)*

Glass	0.92
Air Lock Entry	0.50
Revolving	0.50
Overhead	1.45

#### *Add the following paragraphs to 104.2 Information on Construction Documents.*

The construction documents shall contain sufficient information to completely describe the heating, ventilation, and air conditioning (HVAC); lighting; and electric power distribution systems, including operational features and controls. The information required for each system shall include a summary of:

1. A description of the design intent providing a detailed explanation of the ideas, concepts and criteria that are defined by the owner to be important,
2. A description of the basis of design of the systems including all information necessary to prepare a design to accomplish the design intent.
3. A description of the sequence of operation of the systems and their interaction with other systems, including fire prevention and fire protection systems.
4. A description of the systems including the capacities of the equipment or systems.
5. A description of the testing requirements and the criteria for passing to be used for final systems acceptance.
6. A requirement for submittal of operation manuals and maintenance manuals as a condition of final acceptance, and a description of their format and content. The operation manual shall provide all relevant information needed for day-to-day operation and management of each system. The maintenance manual shall describe equipment inventory and support the maintenance program.
7. A requirement for submittal of record drawings and control documents as a condition of final acceptance, per 780 CMR 116.0.

#### *Add the following sections to 104 CONSTRUCTION DOCUMENTS*

104.3 Approval. Approval by the building official of the design concepts, testing procedures, and acceptance criteria of Section 104 is not required, but the building official shall reject the construction documents if these sections are incomplete, or if they specify any design elements that violate other requirements of 780 CMR.

104.4 Design. All HVAC, lighting, and electric power distribution systems including sequence of operation, controls and supporting documentation shall be designed and specified by a qualified Registered Professional Engineer except as provided in M.G.L. c. 143, § 54A and any profession or trade as provided in M.G.L. c. 112, § 60L and M.G.L. c. 112, § 81R. The Registered Professional Engineer(s) or other legally recognized professional (M.G.L. c. 112, § 81R) shall be responsible for the review and certification that all submittals and shop drawings conform to the approved HVAC, lighting, and electric power distribution construction documents as submitted for the building permit and approved by the building official, per 780 CMR 116.0.

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**104.5** Acceptance. In accordance with the provisions of 780 CMR 120.0, a certificate of occupancy shall not issue until the building official or his designees have witnessed a satisfactory test of all HVAC, lighting control, and electric power distribution systems installed in accordance with the construction documents. All systems shall be tested in accordance with the applicable standards of 780 CMR and documents. In addition, the following documents shall be simultaneously submitted to the building official prior to the issuance of a permanent certificate of occupancy.

1. Certification from the Registered Professional, as allowed in 780 CMR 116.2, stating that the HVAC, lighting, and electric power distribution systems have been installed in substantial accord with the approved construction documents.

2. Confirmation by the building owner/developer or authorized representative that they have received all HVAC, lighting, and electric power distribution system record drawings from the installing contractors and that the Registered Professional Engineer or other legally recognized professional (M.G.L. c. 112, § 81R) has reviewed their reasonable accuracy.

3. Confirmation by the building owner/developer or authorized representative that they have received all construction documents required in Section 104 including reports, controls documentation, operation manual(s) and maintenance manual(s).

Exception. In lieu of witnessing a satisfactory functional test, the building official or their designees may accept a final performance acceptance test report from a Registered Professional Engineer or other legally recognized professional (M.G.L. c. 112, § 81R). Said report shall certify that the systems have been tested and satisfactorily meet their performance requirements.

**104.6** Unsafe Lighting and Ventilation. The building official may require or accept the documentation required in Section 104.5 in enforcing the provisions of 780 CMR 34.00.

**104.7** Conditional Acceptance. The requirements of 780 CMR 104.0 shall not preclude the issuance of a temporary certificate of occupancy by the Building Official in accordance with 780 CMR 120.3 as long as it can be demonstrated that compliance can be accomplished with the building occupied.

**Change 105.1 Compliance Materials to read:**

The Code official shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code. This includes, but is not limited to REScheck and COMcheck software with compliance to the IECC 2006 code.

**Add these two definitions to CHAPTER 2**

**CONTINUOUS AIR BARRIER.** The combination of interconnected material and assemblies joined and sealed together with flexible joints that provide the air-tightness of the building envelope above and below grade that separate conditioned from unconditioned space, or from space with temperature and/or humidity conditions that differ by more than 50%.

**OUTDOOR AIR.** Air taken from the outdoors, and therefore not previously circulated through the system.

**Add this exception to SECTION 302 DESIGN CONDITIONS**

Exception. Buildings or portions of buildings which require different temperatures and humidity, such as, but not limited to, hospitals, laboratories, museums, art galleries, supermarkets, thermally sensitive equipment rooms, archival storage facilities, and facilities for the elderly, may require the use of alternative indoor design conditions. Any such use of alternative indoor design conditions shall be documented by a licensed professional.

**Replace 502.2.4 Below-grade Walls with the following:**

The minimum thermal resistance of the insulating material installed in, or continuously on, below grade walls of conditioned spaces shall be specified in Table 502.2(1) and shall extend from the top of the wall to the depth of the bottom of the floor slab.

**Make the following changes to Table 502.2(1) BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES**

Walls, above Grade; Metal Framed: Add: or R10ci  
Walls, below Grade: Below Grade wall: Replace NR with R-5 ci.

Slab-on-Grade Floors; Unheated Slabs; Replace NR with R-5 for 24 inches below

**Add a second paragraph to 502.2.6 Slabs on Grade.**

The entire area of the slab on grade shall be insulated with a minimum of R-5 rigid insulation in the following buildings: schools K-12, including daycare; buildings of use groups R-1, R-2, I-1 and I-2, and; college and university buildings of B and A use groups.

**Delete entire content of 502.4 Air Leakage and replace with:**

**502.4 Air Leakage.**

**502.4.1 Air Barriers.** The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space and shall also be provided

for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The continuous air barrier shall have the following characteristics:

1. Materials used in the continuous air barrier shall have an air permeance not to exceed 0.004 cfm/ft<sup>2</sup> under a pressure differential of 0.3 in. water (1.57 psf) when tested in accordance with ASTM E 2178. Air barrier materials shall be taped or sealed in accordance with the manufacturer's instructions.
2. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
3. Air barrier materials shall be maintainable, or, if inaccessible, shall meet durability requirements for the service life of the envelope assembly.
4. The air barrier material of an envelope assembly shall be joined and sealed in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep. Connection shall be made between:
  - a. Foundation and walls.
  - b. Walls and windows or doors.
  - c. Different wall systems.
  - d. Wall and roof.
  - e. Wall and roof over unconditioned space.
  - f. Walls, floor and roof across construction, control and expansion joints.
  - g. Walls, floors and roof to utility, pipe and duct penetrations.

**502.4.2 Air Barrier Penetrations.** All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made air tight.

**502.4.3 Fenestration and Doors.** Air leakage for fenestration and doors shall be determined in accordance with NFRC 400 or ASTM E 283 @ 1.57 psf (75 Pa.). Air leakage shall be determined by an independent laboratory accredited by a nationally recognized accreditation organization and shall be certified by the manufacturer. Air leakage shall not exceed 0.5 cfm/ft<sup>2</sup> for glazed swinging entrance doors and for revolving doors, and 0.3 cfm/ft<sup>2</sup> for all other produce under a pressure differential of 0.3 inches of water (1.57 psf).

Exceptions:

1. Field fabricated fenestration and doors that are weather-stripped.
2. For garage doors, air leakage determined by

test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

**502.4.4 Doors and Access Openings to Shafts, Chutes, Stairwells, and Elevator Lobbies:** These doors and access openings shall either meet the requirements of 780 CMR 502.4.3 or shall be equipped with weatherseals.

Exception. Weatherseals on elevator lobby doors are not required when a smoke control system is installed in accordance with 780 CMR 909.0

**502.4.5 Loading Dock Weatherseals.** Cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.

**502.4.6 Vestibules.** A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than seven ft (2.1 m) when in the closed position.

Exceptions:

1. doors not intended to be used as a building entrance door, such as doors for mechanical or electrical equipment rooms;
2. doors opening directly from a dwelling unit;
3. doors that open directly from a space less than 3000 ft<sup>2</sup> (200 m<sup>2</sup>) in area
4. revolving doors or doors adjacent to revolving doors;
5. doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

**502.4.7 Air-tight Dampers.** Air-tight operable dampers shall be installed where the air barrier is penetrated by:

1. fixed open louvers such as in elevator shafts and machine rooms;
2. mechanical system components which allow infiltration or exfiltration of air when the systems are inactive, such as atrium smoke exhaust systems and make up air louvers;
3. outside air intakes, exhaust outlets, relief outlets, stair shaft, elevator shaft smoke relief openings, and other similar elements.

Such dampers shall have a leakage no greater than 3cfm/ft<sup>2</sup> at 1.0 in w.g. when tested in accordance with AMCA Standard 500. They shall be set in the closed position, and shall automatically open upon:

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1. the activation of any fire alarm initiating device of the building's fire alarm system;
2. the interruption of power to the damper.

**502.4.8 Recessed Lighting Fixtures.** When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations through the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC rated, in accordance with ASTM E 283 no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 Pa or 1.57 lbs./ft.<sup>2</sup> pressure difference and shall be labeled.

**502.4.9 Envelope Gaps and Cavities.:** All gaps and cavities between rough framing and door and windowheads, jamps, and sills shall be filled with insulation and the window and door frames sealed to the air barrier of adjacent assemblies.

*Add these exceptions to 502.5 Moisture Control.*

4. Materials to the exterior of a ventilated rainscreen cavity may have any permeability.
5. Envelope systems that maintain the temperature of potential condensing surfaces (typically the interface of exterior sheathing with cavity insulation) above the dewpoint temperature of the interior air.
6. Envelope systems that maintain the moisture content of all building materials that comprise the assembly to the interior of the water-resistive barrier below the equilibrium moisture content the

materials would achieve when exposed to relative humidity of 80%.

7. Buildings with unusual interior design conditions (such as continually refrigerated buildings, ice rinks, cold storage) shall demonstrate compliance by the method in Exception 6.

**Insert new section 505.8 TRANSFORMERS**

**505.8 Transformers.** Standards for liquid-immersed and medium-voltage, dry type distribution transformers will be superseded by federal rules effective January 1, 2010. See 10 CFR 431 - "Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards: Final Rule"

**505.8.1 Liquid Immersed Transformers.**

Liquid immersed transformers shall comply with the minimum efficiencies in Table 505.8.1 as tested and rated in accordance with Section 313 of the Electric Utility Industry Restructuring Act of November 25, 1997 ("NEMA TP1.")

**505.8.2 Low Voltage Dry-Type Transformers:**

Low Voltage Dry-type transformers shall comply with the minimum efficiencies in Table 505.8.2 as tested and rated in accordance with NEMA TP 1.

**505.8.3 Medium Voltage Dry-Type Transformers:**

Medium Voltage Dry-type transformers shall have efficiencies not less than the applicable values in Table 505.8.3 when tested at 50% of the rated output power and at 75°C (Table 505.8.3 copies Table 4-2 of NEMA TP 1-2002, but adds 3/10 point for each value per M.G.L.c. 25B).

**TABLE 505.8.1 NEMA CLASS 1 EFFICIENCY LEVELS FOR LIQUID-FILLED DISTRIBUTION TRANSFORMERS**

Reference Condition	Temperature		% of Nameplate Load
Load Loss	85°C		50%
No Load Loss	20°C		50%
kVA	Single Phase Efficiency	kVA	Three Phase Efficiency
10	98.3	15	98.0
15	98.5	30	98.3
25	98.7	45	98.5
37.5	98.8	75	98.7
50	98.9	112.5	98.8
75	99.0	150	98.9
100	99.0	225	99.0
167	99.1	300	99.0
250	99.2	500	99.1
333	99.2	750	99.2
500	99.3	1000	99.2
667	99.4	1500	99.3
833	99.4	2000	99.4
		2500	99.4

TABLE 505.8.2 NEMA CLASS 1 EFFICIENCY LEVELS FOR LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition Low Voltage		Temperature 75° C	% of Nameplate Load 35%	
Single Phase Efficiency		Three Phase Efficiency		
kVa	Low Voltage	kVa	Low Voltage	
15	97.7	15	97.0	
25	98.0	30	97.5	
37.5	98.2	45	97.7	
50	98.3	75	98.0	
75	98.5	112.5	98.2	
100	98.6	150	98.3	
167	98.7	225	98.5	
250	98.8	300	98.6	
333	98.9	500	98.7	
500	--	750	98.8	
667	--	1000	98.9	
833	--	1500	--	
		2000	--	
		2500	--	

TABLE 505.8.3 NEMA CLASS 1 EFFICIENCY LEVELS FOR MEDIUM VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition Medium Voltage		Temperature 75°C		% of Nameplate Load 50%	
Single Phase			Three Phase		
Rated power output in kVa	Minimum efficiency %		Rated power output in kVa	Minimum efficiency %	
	≤ 60kV BIL	> 60kV BIL		≤ 60kV BIL	> 60kV BIL
≥15 <25	97.9	97.9	≥15 <30	97.1	97.1
≥25 <37.5	98.2	98.2	≥30 <45	97.6	97.6
≥37.5 <50	98.4	98.4	≥45 <75	97.9	97.9
≥50 <75	98.5	98.5	≥75 <112.5	98.2	98.2
≥75 <100	98.7	98.7	≥112.5 <150	98.4	98.4
≥100 <167	98.8	98.8	≥150 <225	98.5	98.5
≥167 <250	99.1	99	≥225 <300	98.7	98.7
≥250 <333	99.2	99.1	≥300 <500	99.1	98.8
≥333 <500	99.3	99.2	≥500 <750	99.1	99
≥500 <667	99.4	99.3	≥750 <1000	99.2	99.1
≥667 <833	99.5	99.3	≥1000 <1500	99.3	99.2
833	99.5	99.4	≥1500 <2000	99.4	99.3
			≥2000 <2500	99.5	99.3
			2500	99.5	99.4

kVa = kilovolt amperes  
 kV = kilovolts  
 BIL = basic impulse insulation level

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*Insert or edit these references in Chapter 6*  
**REFERENCED STANDARDS:**

**Add to ANSI:**

105 -1992 (R2004)           ANSI/DASMA Test Method for Thermal Transmittance and  
Air Infiltration of Garage Doors ..... 13

*Change the year from 2004 to 2007 on this*  
*ASHRAE standard*

~~90.1-2007~~               Energy Standard for Buildings Except Low-rise Residential Buildings  
(ANSI/ASRAE/IESNA 90.1-2007)

**Add to ASTM**

E 2178-03                 Standard Test Method for Air Permeance of Building Materials ..... 13

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