WARNING !!

This edition (6th, updated to 19 Sept. 1997) of the Massachusetts State Building Code was bound incorrectly.

First comes the User's Guide (30p.) which is correct. The next section are the *amendments* and then the final section is the text of the Building Code itself.

Each section has been marked. To use effectively start by looking in the last section which is the Building Code (6th Edition, updated to 19 Sept. 1997) and then check the amendments (updated to 12 Dec. 1997) in the second section to see if there have been any changes.

Sorry for the confusion!

AMENDMENTS to this ed. (to 12-12-97)

The Commonwealth of Massachusetts

William Francis Galvin, Secretary of the Commonwealth
State Publications and Regulations

REGULATION FILING AND PUBLICATION

1. **Regulation Chapter, Number and Heading:** 780 CMR AMENDMENT

2. **Name of Agency:** STATE BOARD OF BUILDING REGULATIONS AND STANDARDS

3. **This document is reprinted from the Code of Massachusetts Regulations and contains the following:**

STATE BUILDING CODE

AMENDMENTS AS OF 10/31/97 (780 CMR R3)

AMENDMENTS AS OF 12/12/97

Under the provisions of Massachusetts General Laws, Chapter 30A, Section 6 and Chapter 233, Section 75, this document may be used as evidence of the original documents on file with the Secretary of the Commonwealth.

Compiled as in full force and effect: 08/28/97 (AMENDED 12/12/97)

A true copy attest:

William Francis Galvin

WILLIAM FRANCIS GALVIN

$5.00

The Commonwealth of Massachusetts

William Francis Galvin, Secretary of the Commonwealth
State Publications and Regulations

REGULATION FILING AND PUBLICATION

1. **Regulation Chapter, Number and Heading:** **780 CMR**
   The Massachusetts State Building Code
2. **Name of Agency:**
   State Board of Building Regulations and Standards
3. **This document is reprinted from the Code of Massachusetts Regulations and contains the following:**

This is the Sixth Edition of the Massachusetts State Building Code as adopted by the State Board of Building Regulations and Standards and filed with the Office of the Secretary of the Commonwealth.

Under the provisions of Massachusetts General Laws, Chapter 30A, Section 6 and Chapter 233, Section 75, this document may be used as evidence of the original documents on file with the Secretary of the Commonwealth.

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$30.00

REMOVE THESE PAGES:	INSERT THESE PAGES:
17 - 20	17 - 20
37, 38	37, 38
41 - 50	41 - 50
65, 66	65, 66
79 - 84	79 - 84
89 - 92	89 - 92
119, 120	119, 120
135, 136	135 - 136.2
147 - 154	147 - 154
157 - 170	157 - 170
175, 176	175, 176
185 - 190	185 - 190
197 - 200	197 - 200
203 - 206	203 - 206
211 - 214	211 - 214
219 - 228	219 - 228
231, 232	231, 232
245, 246	245, 246
257 - 260	257 - 260
321, 322	321, 322
345, 346	345 - 346.2
379, 380	379, 380
415, 416	415, 416
427, 428	427, 428
443, 444	443, 444
449, 450	449, 450
461, 462	461, 462
473 - 476	473 - 476
483, 484	483, 484
491 - 496	491 - 496
499 - 504	499 - 504
507 - 510	507 - 510
519 - 522	519 - 522
533, 534	533, 534
549 - 560	549 - 560
575, 576	575, 576
591 - 594	591 - 594
601 - 608	601 - 608
649 - 668	649 - 668
757, 758	757, 758
761 - 768	761 - 768
773, 774	773, 774
781, 782	781, 782
789 - 792	789 - 792
799, 800	799, 800

column 4 of Table 106. For example, if the building official issues a certificate valid for two years for a building in the R-2 use group, the fee charged would be 2/5 times the fee per maximum certification period as determined for the building in question using the formula in Note f.

Note a. For *buildings* or *structures*, or parts thereof, in the A-3 Use Group categories, with capacities over 400, the fee to be charged for the maximum certification period of one year is $75 for accommodations for up to 5,000 persons, plus $15 for the accommodations for each additional 1,000 persons or fraction thereof.

Note b. For all *buildings* or *structures*, or parts thereof, in A-5 use group, the fee to be charged for the maximum certification period of one year is $40 for seating accommodations for up to 5,000 persons, plus $8 for the accommodation for each additional 1,000 persons or fraction thereof.

Note c. For all *buildings* and *structures*, or parts thereof, in the I-3 use group, the fee to be charged for the maximum certification period of two years is $75 for each *structure* containing up to 100 beds, plus a $2 charge for each additional ten beds or fraction thereof over the initial 100 beds.

Note d. For hospitals, nursing homes, sanitariums, and orphanages in the I-2 use group, the fee to be charged for the maximum certification period of two years is $75 for each *structure* containing up to 100 beds, plus a $2 charge for each additional ten beds or fraction thereof over the initial 100 beds. All other *buildings* or *structures* or parts thereof in the I-2 use group classification shall be charged a fee of $75 for a two year maximum certification period.

Note e. For all *buildings* and *structures* or parts thereof in the R-1 use group, the fee to be charged for the maximum certification period of one year shall be $40 for up to five units plus $2 per unit for all over five units. A unit shall be defined as follows:

two hotel guest rooms;
two lodging house guest rooms;
two boarding house guest rooms; or
four dormitory beds

Note f. For all *buildings* and *structures* or parts thereof in the R-2 use group, the fee to be charged for the maximum certification period of five years shall be $75, plus $2 per dwelling unit.

Note g. For purposes of determining the required number of inspections, the maximum certification period, and the fees, as specified in Table 106, dormitories are included in the R-1 use group classification rather than the R-2.

Note h. Summer camps for children in use group R-2 shall be inspected and certified annually prior to the beginning of each season. The annual fee shall be $15 for the first 25 residential units: $8 for each additional 25 residential units; and $15 for each assembly building or use. (A residential unit for this purpose shall be defined as four beds).

106.6 Reports by the Building Official

106.6.1 Report to Appointing Authority: The building official shall submit to the appointing authority of the jurisdiction a written report of operations in a form and content and at intervals as shall be prescribed by the appointing authority.

106.6.2 Report to assessors: Pursuant to M.G.L. c. 143, § 61, the building official shall give to the assessors of the municipality written notice of the granting of permits for the construction of any *buildings* or *structures*, or for the removal or demolition, or for any substantial alteration or addition thereto. Such notice shall be given within seven days after the granting of each permit, and shall state the name of the person to whom the permit was granted and the location of the *building* or *structure* to be constructed, reconstructed, altered, demolished or removed.

106.6.3 Report to Local United States Postmaster: Pursuant to M.G.L. c. 143, § 3X the building official shall notify the local United States Postmaster of the issuance of a building permit authorizing the construction of any *building* containing ten or more residential units.

106.7 Department records: The building official shall maintain official records of applications received, permits and certificates issued, inspections performed fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records as long as the *building* or *structure* to which they relate remains in existence unless otherwise provided for by law.

780 CMR 107.0 DUTIES AND POWERS OF THE STATE INSPECTOR (M.G.L. c. 143, § 3A)

107.1 The State Inspector: In every city and town 780 CMR shall be enforced by the State Inspector of the Department of Public Safety, Division of Inspections, as to any *structures* or *buildings* or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies, or authorities of the Commonwealth. The state inspector shall have as to such *buildings* and *structures* all the powers of a building commissioner or inspector of buildings. All *buildings* and *structures* owned by any authority established by the legislature and not owned by the Commonwealth shall be regulated in accordance with 780 CMR 106.0.

107.2 Other responsibilities: The state inspector shall make periodic reviews of all local building inspection practices, provide technical assistance and advice to the local building officials in the implementation of 780 CMR, and report in writing his findings to the building officials.

107.3 Review by the Commissioner of Public Safety: The Commissioner of the Commonwealth of Massachusetts, Department of Public Safety shall establish districts which shall be supervised by a

state inspector of the Division of Inspections. The Commissioner may review, on his own initiative, or on the application of any state inspector, any action or refusal or failure of action by any building official the result of which does not comply with the uniform implementation of 780 CMR; and may reverse, modify or annul, in whole or in part, such action except with respect to the specialized codes, provided that an order or action of the Commissioner shall not reverse, modify, annul, or contravene any order, action, determination, interpretation or any decision by the BBRS or the State Building Code Appeals Board.

107.4 Reports: The state inspector shall file with the BBRS reports of his periodic reviews and recommendations for improvements of building inspection practices. The format and due dates for these reports shall be determined by the BBRS.

780 CMR 108.0 RULES AND REGULATIONS

108.1 Rule making authority: Under authority granted by St. 1984, c. 348, as amended, the BBRS is empowered in the interest of public safety, health and general welfare, to adopt and promulgate rules and regulations, and to interpret and implement the provisions of 780 CMR to secure the intent thereof.

108.2 Amendments and promulgation of rules: In accordance with the provisions of M.G.L. c. 143, § 97, any person may propose amendments to 780 CMR. Public hearings shall be held in the city of Boston in May and November of each year, and at such other times and places as the BBRS may determine, to consider petitions for such amendments. Amendments adopted by the BBRS shall be binding and have the full force and effect in all cities and towns.

108.3 Activities requiring licenses, registration or certification:

108.3.1 Testing laboratories: A testing laboratory, branch laboratory and/or project laboratory shall not test *concrete* and/or concrete materials for use in *structures* subject to construction control (780 CMR 116.0) and/or controlled materials (780 CMR 17) unless licensed by the BBRS in accordance with 780 CMR and 780 CMR R1: the Rules and Regulations for Licensing of Concrete Testing Laboratories.

108.3.2 Field technicians: A person shall not engage in the activities of field testing of *concrete* for use in *structures* subject to construction control (780 CMR 116.0) and/or controlled materials (780 CMR 17) unless such person is licensed by the BBRS in accordance with 780 CMR R2: the Rules and Regulations for Concrete Testing Personnel.

108.3.3 Manufactured buildings: No individual, organization or firm shall be engaged in the construction of *manufactured buildings* for use in the Commonwealth of Massachusetts unless approved to construct same by the BBRS in accordance with 780 CMR R3.

108.3.4 Native Lumber: No individual, organization or firm shall engage in the production of native lumber for use in *structures* within the Commonwealth of Massachusetts unless registered by the BBRS in accordance with 780 CMR and 780 CMR R4: the Rules and Regulations Controlling the Use of Native Lumber.

108.3.5 Licensing of Construction Supervisors:

108.3.5.1 Except for those *structures* governed by Construction Control in 780 CMR 116.0, effective July 1, 1982, no individual shall be engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by any provision of 780 CMR, unless said individual is licensed in accordance the Rules and Regulations for Licensing Construction Supervisors as set forth in 780 CMR R5.

No person shall be engaged in the supervision of the field erection of a *manufactured building* unless such person is licensed in accordance with 780 CMR R5: The Rules and Regulations for the Licensing of Construction Supervisors.

Exception: Any Home Owner performing work for which a building permit is required shall be exempt from the licensing provisions of 780 CMR 108.3.5; provided that if a Home Owner engages a person(s) for hire to do such work, that such Home Owner shall act as supervisor. This exception shall not apply to the field erection of a manufactured buildings constructed pursuant to 780 CMR 35 and 780 CMR R3. For the purposes of 780 CMR 108.3.5, a "Homeowner" is defined as follows: Person(s) who owns a parcel of land on which he/she resides or intends to reside, on which there is, or is intended to be, a *one or two family dwelling*, attached or detached structures accessory to such use and/or farm structures. A person who constructs more than one home in a two-year period shall not be considered a home owner.

108.3.5.2 Exemptions from Construction Supervisor License requirement; A construction supervisor's license is not required for: roofing, siding, erection of rooftop solar collectors, construction of swimming pools, the erection of signs, installation of replacement windows not involving structural modifications, the erection of tents nor for projects which are subject to construction control (780 CMR 116.0).

A construction supervisor's license is not required for agricultural buildings which are not open to the public or otherwise made available for public use.

108.3.5.3 No municipality shall be prohibited from requiring a license for those individuals

NON-TEXT PAGE

engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition in those categories of *building* and *structures* for which the BBRS does not require a license, provided that those municipalities which have established licensing requirements for construction supervisors prior to January 1, 1975, may maintain their existing licensing requirements.

108.3.6 Registration of Home Improvement Contractors: In accordance with the provisions of M.G.L. c. 142A, no home improvement contractor, or organization or firm shall be involved in the improvement of any existing owner occupied one to four family residential building unless said home improvement contractor has registered with the BBRS in accordance with the rules and regulations for the registration of Home Improvement Contractors as set forth in 780 CMR R6.

108.3.7 Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors; The rules and regulations for the Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors shall be as set forth in 780 CMR R7.

108.4 Enforcement: Whoever violates the provisions of 780 CMR 108.0 or any rules and regulations promulgated hereunder, or who falsifies or counterfeits a license, registration or certification issued by the BBRS, or who fraudulently issues or accepts such a license, registration or certification shall be punished as provided in 780 CMR 118.0 or shall be subject to any other penalty provided for by law.

780 CMR 109.0 APPROVAL

109.1 Approved materials and equipment: All materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

109.2 Used materials and equipment: Used materials, equipment and devices which meet the minimum requirements of 780 CMR for new materials, equipment and devices shall be permitted; however, the building official may require satisfactory proof that such materials, equipment and devices have been reconditioned, tested, and/or placed in good and proper working condition prior to approval.

109.3 Alternative materials and equipment:

109.3.1 General: The provisions of 780 CMR are not intended to limit the appropriate use or installation of materials, appliances, equipment or methods of design or construction not specifically prescribed by 780 CMR, provided that any such alternative has been approved. Alternative materials, appliances, equipment or methods of design or construction shall be approved when the building official is provided acceptable proof and has determined that said alternative is satisfactory and complies with the intent of the provisions of 780 CMR, and that said alternative is, for the purpose intended, at least the equivalent of that prescribed in 780 CMR in quality, strength, effectiveness, *fire resistance*, durability and safety. Compliance with specific performance based provisions of 780 CMR, in lieu of a prescriptive requirement shall also be permitted as an alternate.

109.3.2 Evidence submitted: The building official may require that evidence or proof be submitted to substantiate any claims that may be made regarding the proposed alternate.

109.3.3 Tests: Determination of acceptance shall be based on design or test methods or other such standards approved by the BBRS. In the alternative, where the BBRS has not provided specific approvals, the building official may accept, as supporting data to assist in this determination, duly authenticated engineering reports, formal reports from nationally acknowledged testing/ listing laboratories, reports from other accredited sources. The costs of all tests, reports and investigations required under these provisions shall be borne by the applicant.

109.3.4 Approval by the Construction Materials Safety Board: The building official may refer such matters to the Construction Materials Safety Board in accordance with 780 CMR 123.0 for approval.

780 CMR 110.0 APPLICATION FOR PERMIT

110.1 Permit application: It shall be unlawful to construct, reconstruct, alter, repair, remove or demolish a *building* or *structure*; or to change the use or *occupancy* of a *building* or *structure*; or to install or alter any equipment for which provision is made or the installation of which is regulated by 780 CMR without first filing a written application with the building official and obtaining the required permit therefor.

110.2 Temporary Structures:

110.2.1 General: A building permit shall be required for temporary structures, unless exempted by 780 CMR 110.3. Such permits shall be limited as to time of service, but such temporary construction shall not be permitted for more than one year.

110.2.2 Special approval: All temporary construction shall conform to the structural strength, fire safety, *means of egress*, light,

ventilation, energy conservation and sanitary requirements of 780 CMR as necessary to insure the public health, safety and general welfare.

110.2.3 Termination of approval: The building official may terminate such special approval and order the demolition of any such construction at the discretion of the building official.

110.3 Exemptions: A building permit is not required for the following activities, such exemption, however, shall not exempt the activity from any review or permit which may be required pursuant to other laws, by-laws, rules and regulations of other jurisdictions (e.g. zoning, conservation, etc.).

1. One *story* detached accessory buildings used as tool or storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet.
2. Fences six feet in height or less.
3. *Retaining walls* which, in the opinion of the building official, are not a threat to the public safety health or welfare and which retain less than four feet of unbalanced fill.
4. Ordinary repairs as defined in 780 CMR 2. Ordinary repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam, column or other loadbearing support, or the removal or change of any required *means of egress*, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, mechanical system, *fire protection system*, energy conservation system or other work affecting public health or general safety.
5. Greenhouses: A building permit or notice to the building official is not required for the construction of greenhouses covered exclusively with plastic film (in accordance with St. 1983, c. 671). (This exemption does not apply if the greenhouse is to be used for large assemblies of people or uses other than normally expected for this purpose.)

110.4 Form of application: The application for a permit shall be submitted in such form as determined by the building official but in all cases shall contain, as a minimum, the information required on the appropriate sample uniform building permit application forms in *Appendix B*. The application for a permit shall be accompanied by the required fee as prescribed in 780 CMR 114.0 and the construction documents as required in 780 CMR 110.7 and 110.8, where applicable and as required by other sections of 780 CMR.

110.5 By whom application is made: Application for a permit shall be made by the owner or lessee of the *building* or *structure*, or agent of either. If application is made other than by the owner, the written authorization of the owner shall accompany the application. Such written authorization shall be signed by the owner and shall include a statement of ownership and shall identify the owner's authorized agent, or shall grant permission to the lessee to apply for the permit. The full names and addresses of the owner, lessee, applicant and the responsible officers, if the owner or lessee is a corporate body, shall be stated in the application.

Note: It shall be the responsibility of the registered contractor to obtain all permits necessary for work covered by the Home Improvement Contractor Registration Law, M.G.L. c. 142A. An owner who secures his or her own permits for such shall be excluded from the guaranty fund provisions as defined in M.G.L. c. 142A. Refer to 780 CMR R6 and M.G.L. c. 142A for additional information regarding the Home Improvement Contractor Registration Program.

110.6 The securing of a building permit by the owner, or the owner's authorized agent, to construct, reconstruct, alter, repair, demolish, remove, install equipment or change the use or *occupancy* of a *building* or *structure*, shall not be construed to relieve or otherwise limit the duties and responsibilities of the licensed, registered or certified individual or firm under the rules and regulations governing the issuance of such license registration or certification.

110.7 Construction documents: The application for permit shall be accompanied by not less than three sets of *construction documents*. The building official is permitted to waive, or modify the requirements for filing construction documents when the building official determines that the scope of the work is of a minor nature. When the quality of the materials is essential for conformity to 780 CMR, specific information shall be given to establish such quality, and 780 CMR shall not be cited, or the term "legal" or its equivalent used as a substitute for specific information.

110.8 Engineering Details, Reports, Calculations, Plans and Specifications: In the application for a permit for *buildings* and *structures* subject to construction control in 780 CMR 116.0, the *construction documents* shall contain sufficient plans and details to fully describe the work intended, including, but not limited to all details sufficient to describe the structural, *fire protection*, fire alarm, mechanical, light and ventilation, energy conservation, architectural access and egress systems. The building official may require such calculations, descriptions narratives and reports deemed necessary to fully describe the basis of design for each system regulated by 780 CMR. In accordance with the provisions of M.G.L. c. 143, § 54A all plans and specifications shall bear the original seal and original signature of a

release characteristics, where the top storage is greater than six feet in height.

Buttress: See 780 CMR 2102.0.

Cellar: that portion of a building which is partly or completely below grade and having at least ½ its height below grade.

Cementitious material: See 780 CMR 1902.0.

Central Station, Central Station Fire Alarm Systen and Central Station Services: See NFPA 72, as listed in Appendiz A.

Certificate of approval: A written document from the appropriate code official approving an action, type of material, and the like.

Certificate of use and occupancy: The certificate issued by the code official which permits the use of a building in accordance with the approved plans and specifications which certifies compliance with provisions of law for the use and occupancy of the building in its several parts together with any special stipulations or conditions of the building permit.

Certification: Any manufactured building or building component that meets the provisions of 780 CMR 35 and the rules and regulations pursuant thereto and which has been labeled accordingly. See also 780 CMR R7 for the certification of Building Code Enforcement Officials

Change of use: An alteration by change of use in a building heretofore existing to a new use group which imposes other special provisions of law governing building construction, equipment or means of egress.

Child day care center: Any facility operated on a regular basis whether known as a day nursery, nursery school, kindergarten, child play school, progressive school child development center, or preschool, or known under any other name, which receives children not of common parentage under seven years of age or under 16 years of age if such children have special needs for non-residential custody and care during part or all of the day separated from their parents. Child day care centers shall not include: any part of a public school system; any part of a private, organized educational system unless the services of such a system are primarily limited to a kindergarten, nursery or related preschool services; a Sunday school conducted by a religious institution; a facility operated by religious organization where children are cared for during short periods of time while persons responsible for such children are attending religious services; a family day care home, as defined by M.G.L. c. 28A, § 9; an informal cooperative arrangement among neighbors or relatives; or the occasional care of children with or without compensation therefor.

Chimney: See 780 CMR 2102.0.

Chimney, masonry: See 780 CMR 2102.0.

Closed system: See 780 CMR 307.2.

CMR: Code of Massachusetts Regulations; Appendix A contains a listing of various CMR's for Massachusetts specialized codes.

Code official: *See "Building Code Enforcement Official".*

Combination of municipalities: Any two or more cities and/or towns who have agreed to combine in order to share costs necessary for the administration and enforcement of 780 CMR in said cities and/or towns.

Collar joint: See 780 CMR 2102.0.

Combustible dusts: See 780 CMR 307.2.

Combustible fibers: See 780 CMR 307.2.

Combustible liquids: See 780 CMR 307.2.

Combustible material: A combustible material is a material which cannot be classified as non-combustible in accordance with 780 CMR 704.4.1.1.

Compliance assurance program: The system, documentation and methods for assuring that manufactured buildings, building components, building systems and manufactured homes, including their manufacture, storage transportation and assembly, and handling and installation, conform with 780 CMR 35 and the rules and regulations promulgated pursuant thereto.

Common path of travel: See 780 CMR 1002.0.

Compressed gas: See 780 CMR 307.2.

Concrete: See 780 CMR 1902.0.

Concrete, reinforced: See 780 CMR 1902.0.

Connector: See 780 CMR 2102.0.

Construction documents: All of the written, graphic and pictorial documents prepared or assembled for describing the design, location and

physical characteristics of the elements of the project necessary for obtaining a building permit. The construction drawings shall be drawn to an appropriate scale.

Construction, type of: See 780 CMR 602.0.
Type 1: See 780 CMR 603.0.
Type 2: See 780 CMR 603.0.
Type 3: See 780 CMR 604.0.
Type 4: See 780 CMR 605.0.
Type 5: See 780 CMR 606.0

Control area: See 780 CMR 307.2.

Corridor: See 780 CMR 1002.0.

Corrosive: See 780 CMR 307.2.

Court: See 780 CMR 1202.0.
Inner: See 780 CMR 1202.0.
Outer: See 780 CMR 1202.0.

Court width: See 780 CMR 1202.0.

Cryogenic liquids (flammable or oxidizing): See 780 CMR 307.2.

Curb level: See 780 CMR 3203.2.
Building or wall height: See 780 CMR 3203.2.

Damper, fire: See 780 CMR 702.0.

Day care center (child): See "Child day care center".

Deflagration: See 780 CMR 307.2.

Deluge system: See 780 CMR 902.0.

Department: (DPS): The Department of Public Safety, Division of Inspection.

Design earthquake: See 780 CMR 1612.3.

Designated seismic systems: See 780 CMR 1612.3.

Detached storage building: See 780 CMR 307.2.

Detector, heat: See 780 CMR 902.0.

Detector, smoke: See 780 CMR 902.0.

Detonation: See 780 CMR 307.2.

Detoxification facility: A facility licensed or operated by the Department of Public Health, Division of Alcoholism in accordance with 105 CMR 160.000: Acute Care Inpatient Substance Abuse Detoxification Treatment Services issued by the Department of Public Health, Division of Alcoholism, Commonwealth of Massachusetts, and shall be used to treat individuals acceptable to the program in accordance with 105 CMR 160.000.

Diaphragm: See 780 CMR 1612.3, 2102.0 and 2306.2.

Dimensions, nominal: See 780 CMR 2102.0.

Dispensing: See 780 CMR 307.2.

Door assembly, fire: See 780 CMR 702.0.

Door, fire: See 780 CMR 702.0.

DPS: See "Department".

Draftstopping: See 780 CMR 702.0.

Dumbwaiter: See 780 CMR 30.

Dwellings
Boarding house: See 780 CMR 310.2.
Dormitory: See 780 CMR 310.2.
Dwelling unit: See 780 CMR 310.2.
Hotel: See 780 CMR 310.2.
Motel: See 780 CMR 310.2.
Multiple-family dwelling: See 780 CMR 310.2.
Multiple single-family dwelling: See 780 CMR 310.2.
One-family dwelling: See 780 CMR 310.2.
Two-family dwelling: See 780 CMR 310.2.

Effective height: See 780 CMR 2102.0.

Elevator: 780 CMR 30 and 524 CMR.
Freight elevator: See 524 CMR 17.00
Hand elevator: See 524 CMR 18.00
Hydraulic elevator: See 524CMR
Passenger elevator: See 524CMR 17.00
Power elevator: See 524CMR.
Sidewalk elevator: See 524CMR 20.00

Elevator repairs: 780 CMR 30 and 524 CMR.

Emergency control station: See 780 CMR 416.2.

Equipment, existing: Any equipment regulated by 780 CMR which was legally installed prior to the effective date of 780 CMR, or for which a permit to install has been issued.

Escalator: 780 CMR 30 and 524 CMR.

Exit: See 780 CMR 1002.0.

Exit access: See 780 CMR 1002.0.

Exit discharge: See 780 CMR 1002.0.

Exit discharge, level of: See 780 CMR 1002.0.

Dead load: See 780 CMR 1602.0.
Duration of load: See 780 CMR 1602.0.
Earthquake load: See 780 CMR 1602.0.
Impact load: See 780 CMR 1602.0.
Internal load: See 780 CMR 1602.0.
Lateral soil load: See 780 CMR 1602.0.
Live load: See 780 CMR 1602.0.
Wind load: See 780 CMR 1602.0.

Loadbearing wall system: See 780 CMR 1612.3.

Local enforcement agency: A department or agency in a municipality charged with the enforcement of 780 CMR and appropriate specialized codes which include, but are not limited to, 248 CMR: The State Plumbing and Gas Fitting Code, and 527 CMR 12.00: the State Electrical Code.

Local inspector: A person in the municipality who assists the building commissioner or inspector of buildings in the performance of his or her duties and is charged with the enforcement of 780 CMR. All local inspectors shall meet or exceed the minimum qualifications defined by M.G.L. c. 143, § 3 and shall be certified in accordance with 780 CMR R7.

Lot: A portion or parcel of land considered as a unit.

Lot, corner: A lot with two adjacent sides abutting upon streets or other public spaces.

Lot, interior: A lot which faces on one street or with opposite sides on two streets.

Lot line: A line dividing one lot from another, or from a street or any public place.

Lot line, interior: Any lot line other than one adjoining a street or public space.

Lot line, street: The lot line dividing a lot from a street or other public way.

Main windforce-resisting system: See 780 CMR 16.

Mall: See 780 CMR 402.2.

Mall building, covered: See 780 CMR 402.2.

Manufactured building: Any building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation and other systems affecting health and safety, and which is manufactured and assembled in manufacturing facilities, on or off the building site. Also, any building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer.

Masonry: See 780 CMR 2102.0.
Ashlar facing masonry: See 780 CMR 2102.0.
Ashlar masonry: See 780 CMR 2102.0.
Solid masonry: See 780 CMR 2102.0.

Masonry unit
Clay: See 780 CMR 2102.0.
Concrete: See 780 CMR 2102.0.
Hollow: See 780 CMR 2102.0.
Solid: See 780 CMR 2102.0.

Means of egress: See 780 CMR 1002.0.

Member:
Primary: See 780 CMR 1902.0.
Secondary: See 780 CMR 1902.0.

Membrane: See 780 CMR 3103.2.

Membrane structures:
Air-inflated structure: See 780 CMR 3103.2.
Air-supported structure: See 780 CMR 3103.2.
Double skin: See 780 CMR 3103.2.
Single skin: See 780 CMR 3103.2.
Cable-restrained, air-supported structure: See 780 CMR 3103.2.
Membrane-covered cable structure: See 780 CMR 3103.2.
Membrane-covered frame structure: See 780 CMR 3103.2.
Noncombustible membrane structure: See 780 CMR 3103.2.
Tent: See 780 CMR 3103.2.

Mezzanine: See 780 CMR 502.0.

Mobile home: A structure transportable in one or more sections, which is eight body feet or more in width and is 32 body feet or more in length, and which is built on a permanent chassis, and designed to be used as a dwelling with permanent foundation, when connected to the required facilities, and includes the plumbing, heating, air-conditioning and electrical systems contained therein.

Mortar: See 780 CMR 2102.0.

Mortar, surface-bonding: See 780 CMR 2102.0.

Moving walk: See 780 CMR 30.

Native lumber: Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with 780 CMR R4. Such wood is ungraded but is stamped or certified in accordance with the requirements of 780 CMR R4. For the purpose of this definition, native lumber shall be restricted to the use in

one- and two-story dwellings, barns, sheds, agricultural and accessory buildings and other structures when permitted by 780 CMR R4.

Nominal dimension
Lumber: See 780 CMR 2302.0.

Noncombustible: This is a general, relative term. Its precise meaning is defined in 780 CMR for specific applications.

Noncombustible building material: See 780 CMR 704.4.1.1

Occupancy: The purpose for which a building or portion thereof is used.

Occupancy, change of: A change in the purpose or level of activity within a structure that involves a change in application of the requirements of 780 CMR.

Occupant load: See 780 CMR 1002.0.

Occupiable space: See 780 CMR 1202.0.

Occupied: As applied to a building, shall be construed as though followed by the words "or intended, arranged or designed to be occupied."

Official Interpretation: A written interpretation of any provision of 780 CMR, or to its referenced standards listed in Appendix A, except specialized codes, made by the BBRS, under authority of M.G.L. c. 143, § 94(e), or by the State Building Code Appeals Board under authority of M.G.L. c. 143, § 100.

Open system: See 780 CMR 307.2.

Organic peroxide: See 780 CMR 307.2.

Oriel window: See 780 CMR 3203.2.

Owner: ***Every person who alone or jointly or severally with others (a) has legal title to any building or structure; or (b) has care, charge, or control of any building or structure in any capacity including but not limited to agent, executor, executrix, administrator, administratrix, trustee or guardian of the estate of the holder of legal title; or (c) lessee under a written letter agreement; or (d) mortgagee in possession; or (e) agent, trustee or other person appointed by the courts. Each such person is bound to comply with the provisions of 780 CMR.***

Oxidizer: See 780 CMR 307.2.

P-Delta effect: See 780 CMR 1612.3.

Panel (part of a structure): See 780 CMR 1602.0.

Particleboard: See 780 CMR 2302.1.

Penthouse: See 780 CMR 1502.1.

Permit: An official document or certificate issued by the authority having jurisdiction which authorizes performance of a specified activity (see 780 CMR 111.1).

Person: Includes a corporation, firm, partnership, association, organization and any other group acting as a unit as well as individuals. It shall also include an executor, administrator, trustee, receiver or other representative appointed according to law. Whenever the word "person" is used in any section of 780 CMR prescribing a penalty or fine, as to partnerships or associations, the word shall include the partners or members thereof, and as to corporations, shall include the officer, agent or members thereof who are responsible for any violation of such section..

Physical hazard: See 780 CMR 307.2.

Physically disabled person: See 780 CMR 11.

Place of assembly: A room or space accommodating 50 or more individuals for religious, recreational, educational, political, social or amusement purposes, or for the consumption of food or drink, including all connected rooms or space with a common means of egress and entrance.

Place of outdoor assembly: Premises used or intended to be used for public gatherings of 200 or more individuals in other than buildings.

Plastic
Light-diffusing system: See 780 CMR 2602.0.
Plastic glazing: See 780 CMR 2602.0.
Plastic roof panels: See 780 CMR 2602.0.
Plastic wall panels: See 780 CMR 2602.0.
Reinforced plastic, glass fiber: See 780 CMR 2602.0.
Thermoplastic material: See 780 CMR 2602.0.
Thermosetting material: See 780 CMR 2602.0.

Platform: See 780 CMR 412.2.

Plenum: ***An enclosed portion of the building structure, so designed to allow the movement of air, that forms part of an air distribution system.*** See BOCA National Mechanical Code listed in Appendix A.

Pools, swimming, hot tubs and spas
Above-ground/on-ground pool: See 780 CMR 421.2.
Barrier: See 780 CMR 421.2.

Hot tub: See 780 CMR 421.2.
In-ground pool: See 780 CMR 421.2.

Private swimming pool: See 780 CMR 421.2.
Private swimming pool, indoor: See 780 CMR 421.2.
Private swimming pool, outdoor: See 780 CMR 421.2.

Public swimming pool:
Public outdoor inground swimming pool, Semi-public outdoor inground swimming pool: See 780 CMR 421.2.
Spa: See 780 CMR 421.2.

Preaction system: See 780 CMR 902.0.

Premises: A lot, plot or parcel of land, including any structure thereon.

Preservative treatment (treated material): See 780 CMR 2302.0.

Protected construction: See 780 CMR 702.0..

Public way: See 780 CMR 1002.0.

Pyrophoric: See 780 CMR 307.2.

Radioactive material: See 780 CMR 307.2.

Registered design professional: An architect or engineer registered or licensed to practice professional architecture or engineering, as defined by the statutory requirements of the professional registration laws of the ***Commonwealth of Massachusetts***.

Repair: The reconstruction or renewal of any part of an existing structure for the purpose of its maintenance.

Repairs, ordinary: Any maintenance which does not affect the structure, egress, fire protection systems, fire ratings, energy conservation provisions, plumbing, sanitary, gas, electrical or other utilities. A building permit is not required for ordinary repairs.

Required: Shall be construed to be mandatory by provisions of 780 CMR.

Resilient stable-mounting system: See 780 CMR 1612.3.

Restraining device: See 780 CMR 1612.3.
Elastic: See 780 CMR 1612.3.
Fixed: See 780 CMR 1612.3.
Seismic activated: See 780 CMR 1612.3.

Roof: See 780 CMR 1502.0.

Roof covering: See 780 CMR 1502.0.

Roof structure: See 780 CMR 1502.0.

Rubble masonry: See 780 CMR 2102.0.
Coursed rubble: See 780 CMR 2102.0.
Random rubble: See 780 CMR 2102.0.
Rough or ordinary rubble: See 780 CMR 2102.0.

Running bond: See 780 CMR 2102.0.

Seismic-resisting system: See 780 CMR 1612.3

Self-closing: See 780 CMR 702.0.

Sensitizer: See 780 CMR 307.2.

Service passage, HPM: See 780 CMR 416.2.

Shaft: See 780 CMR 702.0.

Shall: The term, where used in 780 CMR, shall be construed as mandatory.

Shear wall: See 780 CMR 1612.3.

Sign: See 780 CMR 3102.2.
Closed sign: See 780 CMR 3102.2.
Ground sign: See 780 CMR 3102.2.
Marquee sign: See 780 CMR 3102.2.
Open sign: See 780 CMR 3102.2.
Portable sign: See 780 CMR 3102.2.
Projecting sign: See 780 CMR 3102.2.
Roof sign: See 780 CMR 3102.2.
Temporary sign: See 780 CMR 3102.2.
Wall sign: See 780 CMR 3102.2.

Single membrane penetration: See 780 CMR 702.0.

Site: A parcel of land bounded by a lot line or a designated portion of a public right-of-way.

Slidescape: See 780 CMR 1002.0.

Smoke barrier: See 780 CMR 702.0.

Smoke compartment: See 780 CMR 702.0..

Smoke detector, multiple station: See 780 CMR 902.0.

Smoke detector, single station: See 780 CMR 902.0.

Smokeproof enclosure: See 780 CMR 1002.0.

Specialized code: All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition

promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts.

Sprinkler: See 780 CMR 902.0

Sprinkler system, automatic: See 780 CMR 902.0.

Sprinkler system, limited area: See 780 CMR 902.0.

Stack bond: See 780 CMR 2102.0.

Stage: See 780 CMR 412.2.

Stage, legitimate: See 780 CMR 412.2.

Stage, regular: See 780 CMR 412.2.

Stage, thrust: See 780 CMR 412.2.

Stairway: See 780 CMR 1002.0.

Standpipe system: See 780 CMR 902.0.

State Building Code: The Massachusetts State Building Code and amendments and rules and regulations thereto as promulgated by the State Board of Building Regulations and Standards, under M.G.L. c. 143 §§ 93 through 100.

State Inspector: An employee of the Division of Inspection, State Department of Public Safety, who is charged with administrating and enforcing 780 CMR relative to any structure or building or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies or authorities of the Commonwealth. The state inspector is also charged with supervising the enforcement of 780 CMR relative to all buildings and structures other than those owned by the Commonwealth. See also 780 CMR 107.0.

Steel construction, cold-formed: See 780 CMR 2202.0.

Steel joist: See 780 CMR 2202.0.

Steel member, structural: See 780 CMR 2202.0.

Stone masonry: See 780 CMR 2102.0.

Stone masonry, ashlar: See 780 CMR 2102.0.

Stone masonry, rubble: See 780 CMR 2102.0.

Storage room, HPM, separate inside: See 780 CMR 416.2.

HPM cutoff room: See 780 CMR 416.2.

HPM inside room: See 780 CMR 416.2.

Story: See 780 CMR 502.0.

Story above grade: See 780 CMR 502.0.

Story drift ratio: See 780 CMR 1612.3.

Story shear: See 780 CMR 1612.3.

Street: A public thoroughfare (such as a street, avenue or boulevard) which has been dedicated for public use.

Structure: A combination of materials assembled at a fixed location to give support or shelter, such as a building, framework, retaining wall, tent, reviewing stand, platform, bin, fences over six feet high, sign, flagpole, recreational tramway, mast for radio antenna, or the like. The word "structure" shall be construed, where the context requires, as though followed by the words, "or part or parts thereof."

Structure, existing: A structure erected prior to the date of adoption of the appropriate code or one for which a legal building permit has been issued. ***See 780 CMR 34 for further information regarding existing buildings.***

Supervisory device: See 780 CMR 902.0.

Through-penetration protection system: See 780 CMR 702.0.

Tie, wall: See 780 CMR 2102.0.

Tile: See 780 CMR 2102.0.

Tile, structural clay: See 780 CMR 2102.0.

Tires, bulk storage of: See 780 CMR 307.2.

Travel Trailer: A vehicular, portable structure built on a chassis and designed to be used for temporary occupancy for travel, recreational or vacational use; with the manufacturer's permanent identification "Travel Trailer," thereon; and when factory equipped for the road, being of any length provided its gross weight does not exceed 4500 pounds, or being of any weight provided its overall length does not exceed 28 feet.

Use group: The classification of an occupancy in accordance with 780 CMR 302.1.

Vapor retarder: See 780 CMR 1202.0.

Ventilation: See 780 CMR 1202.0.

Vertical opening: See 780 CMR 702.0.

Voice/alarm signaling system: See 780 CMR 902.0.

Wall

Apron wall: See 780 CMR 1402.0.
Cavity wall: See 780 CMR 2102.0.
Composite wall: See 780 CMR 2102.0.
Dry-stacked, surface-bonded walls: See 780 CMR 2102.0.
Faced wall: See 780 CMR 2102.0.
Fire separation wall: See 780 CMR 702.0.
Fire wall: See 780 CMR 702.0.
Foundation wall: See 780 CMR 1812.2.
Hollow wall: See 780 CMR 2102.0.
Loadbearing wall: See 780 CMR 1602.1.
Nonloadbearing wall: See 780 CMR 1602.1.
Parapet wall: See 780 CMR 2102.0.
Party wall: See 780 CMR 702.0.
Retaining wall: See 780 CMR 1812.2.
Skeleton or panel wall: See 780 CMR 1402.0.
Spandrel wall: See 780 CMR 1402.0.
Veneered Wall: See 780 CMR 1402.0

Water-reactive materials: See 780 CMR 307.2.

Water supply, automatic: See 780 CMR 902.0.

Winder: See 780 CMR 1002.0.

Wood shear panel: See 780 CMR 2304.2.

Writing (written): The term shall be construed to include hand-writing, typewriting, printing, photo offset or any other form of reproduction in legible symbols or characters.

Written notice: A notification in writing delivered in person to the individual or parties intended; or delivered at, or sent by certified or registered mail to the last residential or business address of legal record.

Wythe: See 780 CMR 2102.0.

Yard: See 780 CMR 1202.0.

Zoning: The reservation of certain specified areas within a community or city for buildings and structures, or use of land, for certain purposes with other limitations such as height, lot coverage and other stipulated requirements. (See M.G.L. c. 40A and St. 1956, c. 665, as amended.)

NON-TEXT PAGE

CHAPTER 3

USE OR OCCUPANCY

780 CMR 301.0 GENERAL

301.1 Scope: The provisions of 780 CMR 3 shall control the classification of all buildings and structures as to use group.

301.2 Application of other laws: The provisions of 780 CMR 3 shall not be deemed to nullify any provisions of the zoning law, ***ordinance of any municipality in the Commonwealth of Massachusetts,*** or any other statute of the jurisdiction pertaining to the location or occupancy of buildings, except as is specifically required by the provisions of 780 CMR.

780 CMR 302.0 CLASSIFICATION

302.1 General: All structures shall be classified with respect to occupancy in one or more of the use groups listed below. Where a structure is proposed for a purpose which is not specifically provided for in 780 CMR, such structure shall be classified in the use group which the occupancy most nearly resembles.

1. Assembly: (see 780 CMR 303.0) — Use Groups A-1, A-2, A-3, A-4 and A-5
2. Business: (see 780 CMR 304.0) — Use Group B
3. Educational: (see 780 CMR 305.0) — Use Group E
4. Factory and Industrial: (see 780 CMR 306.0) — Use Groups F-1 and F-2
5. High Hazard (see 780 CMR 307.0): — Use Groups H-1, H-2, H-3 and H-4
6. Institutional: (see 780 CMR 308.0) — Use Groups I-1, I-2 and I-3
7. Mercantile: (see 780 CMR 309.0) — Use Group M
8. Residential: (see 780 CMR 310.0) — Use Groups R-1, R-2, R-3, R-4 and *R-5*
9. Storage: (see 780 CMR 311.0) — Use Groups S-1 and S-2
10. Utility and Miscellaneous (see 780 CMR 312.0) — Use Group U

302.1.1 Specific occupancy areas: Specific occupancy areas which are incidental to the main use group shall be separated and protected in accordance with Table 302.1.1 and shall be classified in accordance with the main use group of the portion of the building in which the specific occupancy area is located. Where the building, or portion thereof, containing the specific occupancy area is required to be protected with an *automatic fire suppression system*, the separation alternative of Table 302.1.1 shall not apply.

Exception: Specific occupancy areas within and serving a dwelling unit are not required to comply with 780 CMR 302.1.1.

Table 302.1.1
SPECIFIC OCCUPANCY AREAS

Room or area[b]	Separation[a]/protection
All use groups:	
Paint shops in occupancies other than Use Group F employing hazardous materials in quantities less than those which cause classification as Use Group H	2 hours; or 1 hour and automatic fire suppression system
Waste and soiled linen collection rooms and chute termination rooms	1 hour and automatic fire suppression system
Waste and soiled linen chute access rooms	1 hour
Boiler and furnace rooms	1 hour; or automatic fire suppression system
Incinerator rooms	2 hours and automatic fire suppression system
Use Groups A, B, E, I-1, R-1, R-2:	1 hour; or automatic fire suppression system with smoke partitions
Storage rooms more than 50 square feet in area but not more than 100 square feet in area	
Storage rooms more than 100 square feet in area	Automatic fire suppression system with smoke partitions
Physical plant maintenance shop and workshop	2 hours; or 1 hour and automatic fire suppression system
Use Groups I-2, I-3:	
Boiler and furnace rooms	1 hour and automatic fire suppression system
Handicraft shops, kitchens, and employee locker rooms	1 hour; or automatic fire suppression system with smoke partitions
Laundries greater than 100 square feet in area	1 hour and automatic fire suppression system
Storage rooms more than 50 square feet in area but not more than 100 square feet in area	Automatic fire suppression system with smoke partitions
Storage rooms more than 100 square feet in area	1-hour and automatic fire suppression system
Physical plant maintenance shop and workshop	1 hour and automatic fire suppression system
Use Group I-2:	
Gift/retail shops and laboratories employing hazardous quantities less than those which cause classification as Use Group H	1 hour; or automatic fire suppression system with smoke partitions
Use Group I-3 padded cells	1 hour and automatic fire system

Note a. For requirements for fireresistance rated separations and smoke partitions see 780 CMR 302.1.1.1.
Note b. 1 square foot = 0.093 m^2.

302.1.1.1 Separation: Where Table 302.1.1 requires a fireresistance rated separation, the specific occupancy area shall be separated from the remainder of the building with *fire separation assemblies* (see 780 CMR 709.0). Where Table 302.1.1 requires smoke partitions, the smoke partitions shall be constructed of materials consistent with the type of construction and shall be capable of resisting the passage of smoke. The smoke partitions shall extend from the floor to the underside of the fireresistance rated floor/ceiling or roof/ceiling assembly or to the underside of the floor or roof deck above. All doors shall be self-closing or automatic-closing upon detection of smoke.

302.1.2 Accessory areas: Except for accessory areas of Use Group H in accordance with 780 CMR 302.1.2.1 and specific occupancy areas indicated in 780 CMR 302.1.1, where the area devoted to an accessory occupancy does not occupy more than 10% of any *fire area* nor more than 10% of the allowable area permitted by 780 CMR 503.0 based on the accessory use group, a *fire separation assembly* shall not be required between the main use group and accessory areas. The required type of construction and the automatic fire suppression requirements in 780 CMR 904.0 shall be based on the main use group of the *fire area*.

302.1.2.1 High-hazard uses: In buildings that are three stories or less in *height* and equipped throughout with an automatic suppression system in accordance with 780 CMR 9, an occupancy in Use Group F or S is permitted to have accessory areas of Use Group H-2, H-3 or H-4, provided that such areas do not occupy more than 10% of any *fire area* nor more than 10% of the allowable area permitted by 780 CMR 503.0 based on the use group of the accessory area. A *fire separation assembly* shall not be required between the F or S use group and the accessory H use group. The maximum quantity of *hazardous materials* within the accessory H use group shall not exceed twice the permitted exempt amount specified in Table 307.8(1) or Table 307.8(2). The required type of construction shall be based on the main use group of the *fire area*.

302.2 Mixed use: All buildings and structures that include more than one use group shall be further designated as a mixed use and shall comply with 780 CMR 313.0. Specific occupancy areas and accessory areas complying with 780 CMR 302.1.1 and 302.1.2, respectively, shall be classified in accordance with the main use group.

780 CMR 303.0 ASSEMBLY USE GROUPS

303.1 General: All structures which are designed or occupied for the gathering together of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption or awaiting transportation, shall be classified as Use Group A-1, A-2, A-3, A-4 or A-5. A room or space used for assembly purposes by less than 50 persons and which is accessory to another use group shall be included as a part of that main use group. Other buildings or structures which accomodate less than 50 but would otherwise qualify as places of assembly, shall be classified in Use Group B. The term "Use Group A" shall include Use Groups A-1, A-2, A-3, A-4 and A-5.

303.2 Use Group A-1, theaters: This use group shall include all theaters and all other buildings and structures intended for the production and viewing of performing arts or motion pictures; and which are usually provided with fixed seats-including theaters, motion picture theaters and television and radio studios admitting an audience. *Stages* and *platforms* shall comply with 780 CMR 412.0.

303.3 Use Group A-2 structures: This use group shall include all buildings and places of public assembly, without theatrical *stage* accessories, designed for occupancy as dance halls, nightclubs and for similar purposes, including all rooms, lobbies and other spaces connected thereto with a common *means of egress* and entrance.

303.4 Use Group A-3 structures: This use group shall include all buildings with or without an auditorium in which persons assemble for amusement, entertainment or recreation purposes as well as incidental motion picture, dramatic or theatrical presentations, lectures or other similar purposes without theatrical *stage* other than a raised *platform*; and which are principally occupied without permanent seating facilities, including art galleries, exhibition halls, museums, lecture halls, libraries, restaurants other than nightclubs, and recreation centers; and buildings designed for similar assembly purposes, including passenger terminals.

303.5 Use Group A-4 structures: This use group shall include all buildings and structures which are occupied exclusively for the purpose of worship or other religious services.

303.6 Use Group A-5, outdoor assembly: This use group shall include structures utilized for outdoor assembly intended for participation in or reviewing activities, including *grandstands* (780 CMR 1013.0), *bleachers* (780 CMR 1013.0), coliseums, stadiums, amusement park structures (780 CMR 413.0) and fair or carnival structures. Such structures shall comply with all pertinent provisions of 780 CMR.

780 CMR 304.0 BUSINESS USE GROUP

304.1 General: All buildings and structures which are occupied for the transaction of business, for the rendering of professional services, or for other services that involve stocks of goods, wares or merchandise in limited quantities which are incidental to office occupancies or sample purposes, shall be classified as Use Group B. (Also see 780 CMR 303.1.)

304.2 List of business occupancies: The occupancies listed in Table 304.2 are indicative of and shall be classified as Use Group B.

Table 304.2
BUSINESS OCCUPANCIES

Airport traffic control towers	Fire stations
Animal hospitals, kennels, pounds	Florists and nurseries
Automobile and other motor vehicle showrooms	Laboratories; testing and research
Banks	Laundries; pickup and delivery stations and self-service
Barber shops	Police stations
Beauty shops	Post offices
Car wash	Print shops
Civic administration	Professional services; attorney, dentist, physician, engineer, etc.
Clinic, outpatient	Radio and television stations
Dry-cleaning; pickup and delivery stations and self-service	Telecommunications equipment building
Electronic data processing	

780 CMR 305.0 EDUCATIONAL USE GROUP

305.1 General: All structures other than those occupied for business training or vocational training, which accommodate more than five persons for educational purposes through the 12th grade, shall be classified as Use Group E.

Exception: A room or space occupied for educational purposes by less than 50 persons, five years of age or more, and which is accessory to another use group shall be classified as a part of the main use group.

305.1.1 Day care facilities: ***A child day care center which provides care for children more than two years nine months shall be classified as use Group E.***

305.2 Business or vocational training: Structures occupied for business training or vocational training shall be classified in the same use group as the business or vocation taught.

780 CMR 306.0 FACTORY AND INDUSTRIAL USE GROUPS

306.1 General: All structures in which occupants are engaged in work or labor in the fabricating, assembling or processing of products or materials, shall be classified as Use Group F-1 or F-2. This includes, among others, factories, assembling plants, industrial laboratories and all other industrial and manufacturing occupancies. The term "Use Group F" shall include Use Groups F-1 and F-2.

306.2 Use Group F-1 structures: Factory and industrial occupancies which are not otherwise classified as low-hazard, Use Group F-2, shall be classified as a moderate-hazard factory and industrial occupancy, Use Group F-1. The manufacturing processes listed in Table 306.2 are indicative of and shall be classified as Use Group F-1.

Table 306.2
MODERATE-HAZARD FACTORY AND INDUSTRIAL OCCUPANCIES

Aircraft	Film, photographic
Appliances	Food processing
Athletic equipment	Furniture
Automobiles and other motor vehicles	Hemp and jute products
Bakeries	Laundries
Beverages, alcoholic	Leather and tanneries, excluding enameling or japanning
Bicycles	Machinery
Boat building	Millwork and woodworking, wood distillation
Boiler works	Motion picture and television filming
Brooms or brushes	Musical instruments
Business machines	Optical goods
Cameras and photo equipment	Paper mills or products
Canneries, including food products	Plastic products
Clothing	Printing or publishing
Condensed and powdered milk manufacture	Recreational vehicles
Construction and agricultural machinery	Refuse incinerators
Disinfectants	Shoes
Dry cleaning using other than flammable liquids in cleaning or dyeing operations or other than classified in 780 CMR 307.0	Soaps and detergents
	Sugar refineries
	Textile mills, including canvas, cotton, cloth, bagging, burlap, carpets and rags
Electric light plants and power houses	Tobacco
Electrolytic reducing works	Trailers
Electronics	Upholstery and manufacturing shops
Engines, including rebuilding	

306.3 Use Group F-2 structures: Factory and industrial occupancies which involve the fabrication or manufacturing of noncombustible materials that, during finishing, packing or processing, do not contribute to a significant fire hazard, shall be classified as Use Group F-2. The manufacturing processes listed in Table 306.3 are indicative of and shall be classified as Use Group F-2.

Table 306.3
LOW-HAZARD FACTORY AND INDUSTRIAL OCCUPANCIES

Beverages, nonalcoholic	Gypsum
Brick and masonry	Ice
Ceramic products	Metal fabrication and assembly
Foundries	Water pumping plants
Glass products	

780 CMR 307.0 HIGH-HAZARD USE GROUPS

307.1 General: All structures which are occupied for the manufacturing, processing, generation, storage or other use of *hazardous materials* in excess of the exempt quantities specified in 780 CMR 307.8 shall be classified as Use Group H-1, H-2, H-3 or H-4 in accordance with the hazards presented by each material as described in 780 CMR 307.3 through 307.6. The term "Use Group H" shall include Use Groups H-1, H-2, H-3 and H-4.

307.1.1 Information required: Separate floor plans shall be submitted for buildings and structures with an occupancy in Use Group H, identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure. A report identifying all *hazardous materials* including, but not limited to, materials of Use Group H to be stored or utilized, shall be submitted and the methods of protection from such hazards shall be indicated on the *construction documents*.

307.2 Definitions: The following words and terms shall, for the purposes of 780 CMR 3 and as used elsewhere in 780 CMR, have the meanings shown herein.

Aerosol: A product that is dispensed from an *aerosol* container by a propellant.

Aerosol container: Metal cans, glass or plastic bottles designed to dispense an aerosol. Metal cans shall be limited to a maximum size of 33.8 fluid ounces (1000 ml). Glass or plastic bottles shall be limited to a maximum size of four fluid ounces (118 ml).

Barricade: A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from *explosive* materials by a natural or artificial barrier.

Boiling point: The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch (psia) or 760 mm of mercury. Where an accurate *boiling point* is unavailable for the material in question, or for mixtures which do not have a constant *boiling point*, for the purposes of this classification, the 10% of a distillation performed in accordance with ASTM D86 listed in ***Appendix A*** shall be used as the *boiling point* of the liquid.

Closed system: The use of a solid or liquid hazardous material in a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of *compressed gases*. Examples of closed systems for solids and liquids include product conveyed through a piping system into a closed vessel, system or piece of equipment.

Combustible dusts: Dusts and any similar solid material sufficiently comminuted for suspension in still air which, when so suspended, is capable of self-sustained combustion.

Combustible fibers: Includes readily ignitable and free-burning fibers such as cotton, sisal, henequen, jute, hemp, tow, cocoa fiber, oakum, baled waste, baled wastepaper, kapok, hay, straw, excelsior, Spanish moss and other like material.

Combustible liquids: Any liquids having a *flash point* at or above 100°F (38°C) shall be known as Class II or III liquids. Combustible liquids shall be divided into the following classifications:

Class II: Liquids having *flash points* at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA: Liquids having *flash points* at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB: Liquids having *flash points* at or above 200°F (93°C).

Compressed gas: A gas or mixture of gases as contained having an absolute pressure exceeding 40 psi at 70°F (276 kPa at 21°C) or, regardless of the pressure at 70°F (21°C), having an absolute pressure exceeding 140 psi at 130°F (965 kPa at 54°C); or any liquid material having a vapor pressure exceeding 40 psi absolute at 100°F (276 kPa at 38°C) as determined by ASTM D323 listed in ***Appendix A***

Control area: Spaces within a building which are enclosed and bounded by exterior walls, *fire walls*, *fire separation assemblies* and roofs, or a combination thereof, where quantities of *hazardous materials* not exceeding the exempt amounts are stored, dispensed, used or handled.

Corrosive: A chemical that causes visible destruction of, or irreversible alterations in, living tissue at the point of contact. A chemical shall be considered a corrosive if, when tested on the intact skin of albino rabbits by the test method described by DOTn 49 CFR; Part 173 listed in ***Appendix A***, such chemical destroys or changes irreversibly the structure of the tissue at the point

except if the panel or sign is vertical, the height shall not exceed 96 inches (2438 mm) and the width shall not exceed 36 inches (914 mm).

402.14.3 Location: The panels and signs shall be located a minimum distance of 18 inches (457 mm) from adjacent tenants.

402.14.4 Encasement: All edges and the backs shall be fully encased in metal.

402.15 Kiosks: Kiosks and similar structures (temporary or permanent) shall meet the requirements of 780 CMR 402.15.1 through 402.15.4.

402.15.1 Construction: Combustible kiosks or other structures shall not be located within the mall unless constructed of fireretardant-treated wood throughout conforming to 780 CMR 2310.0.

402.15.2 Fire suppression: Kiosks and similar structures that are covered and are located within the mall shall be protected by an *automatic sprinkler system* installed in accordance with 780 CMR 9.

402.15.3 Horizontal separation: The minimum horizontal separation between kiosks and other structures within the mall shall be 20 feet (6096 mm).

402.15.4 Maximum area: Kiosks or similar structures shall have a maximum area of 300 square feet (27.90 m^2).

402.16 Parking structures: An attached *garage* for the storage of passenger vehicles that have a capacity of not more than nine persons, or an open parking structure, shall be considered as a separate building where it is separated from the covered mall building by a *fire separation assembly* having a fireresistance rating of not less than two hours or shall be considered as part of the covered mall building.

780 CMR 403.0 HIGH-RISE BUILDINGS

403.1 Applicability: The provisions of 780 CMR 403.0 shall apply to all buildings more than ***70 feet in height above the mean grade. See M.G.L. c. 148, § 26A.***

Exception: The provisions of 780 CMR 403.0 shall not apply to open parking structures (see 780 CMR 406.0 and M.G.L. c. 148, § 26G).

403.2 Sprinkler system: All buildings and structures shall be equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1 and M.G.L. c. 148, § 26A.

Exception: An *automatic sprinkler system* shall not be required in spaces or areas of:

1. Open parking structures complying with 780 CMR 406.0.
2. Telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an automatic fire detection system in accordance with 780 CMR 918.0 and are separated from the remainder of the building with *fire separation assemblies* consisting of one-hour fireresistance rated walls and two-hour fireresistance rated floor/ceiling assemblies.

403.3 Alternative sprinkler system: Alternatively, to qualify for the fireresistance rating reduction for certain building elements listed in 780 CMR 403.3.3, the *automatic sprinkler system* shall comply with 780 CMR 906.2.1 and the optional fire protection features listed in 780 CMR 403.3.1 and 403.3.2.

403.3.1 Control valves and water-flow devices: *Sprinkler* control valves equipped with supervisory initiating devices and water-flow initiating devices shall be provided for each floor.

403.3.2 Secondary water supply: In addition to the main *water supply*, for buildings located where the effective peak velocity-related acceleration (A_v) is equal to or greater than 0.20 in accordance with 780 CMR 1612.1, a secondary on-site *water supply* equal to the hydraulically calculated *sprinkler* design demand plus 100 gallons per minute (0.0063 m^3/s) shall be provided. This *water supply* shall have a duration of 30 minutes.

403.3.3 Automatic sprinkler system alternative: Where a complete *automatic sprinkler system* with additional system features listed in 780 CMR 403.3.3.1 and 403.3.3.2 is installed throughout, modifications to this code are permitted as described in 780 CMR 403.3.3.1 and 403.3.3.2.

403.3.3.1 Type of construction: Other than in buildings with an occupancy in Use Groups F-l, H-3, M and S-l, the minimum type of construction required by 780 CMR shall be modified as indicated in Table 403.3.3.1.

Exception: The Type 1A to 1B modification shall be permitted for buildings with an occupancy in Use Groups F-1, M and S-1.

Table 403.3.3.1
TYPE OF CONSTRUCTION MODIFICATIONS PERMITTED FOR HIGH-RISE BUILDINGS

Type of Construction set forth in Table 602	Modified type of construction permitted hereunder
1A	1B
1B	2A[a]
2A	2B

Note a. The minimum fireresistance rating floor construction shall be two hours.

403.3.3.2 Shaft enclosures: The required fireresistance rating of the *fire separation assemblies* enclosing vertical *shafts*, other than stairway enclosures and elevator hoistway enclosures, shall be reduced to one hour where automatic *sprinklers* are installed within the *shafts* at the top and at alternate floor levels.

403.4 Automatic fire detection: A smoke detector suitable for the intended application shall be installed in each of the following rooms: mechanical equipment; electrical; transformer; telephone equipment; elevator machine; or similar room. The actuation of any detector shall sound an alarm at a constantly attended location.

403.5 Voice/alarm signaling systems: A voice/alarm signaling system shall be provided in accordance with 780 CMR 917.9 and activated in accordance with 780 CMR 917.7.1.

403.6 Fire department communication system: A two-way fire department communication system shall be provided for fire department use. The communication system shall operate between the *fire command station* and every elevator, elevator lobby and enclosed *exit stairway*. Acceptable types of fire department communications shall include:

1. Telephone or fire department radio in lieu of a dedicated system, where approved by the fire department; and
2. Intercom or two-way public address system complying with NFiPA 72 listed in ***Appendix A***.

403.7 Fire command station: A *fire command station* for fire department operations shall be provided in a location approved by the fire department. The *fire command station* shall contain: the voice/alarm signaling system controls; the fire department communication system controls; the automatic fire detection and protective signaling system annunciator panels; an annunciator that visually indicates the floor location of elevators and whether they are operational; status indicators and controls for air-handling systems; controls for unlocking all *stairway* doors simultaneously; *sprinkler* valve and water-flow detector display panels; emergency and standby power; status indicators; and a telephone for fire department use with controlled access to the public telephone system.

403.8 Elevators: Elevator operation and installation shall be in accordance with ***524 CMR***. Elevator service shall be provided for fire department emergency access to all floors. Elevator cab dimensions shall conform to the applicable requirements of 524 CMR.

Except for the main entrance level, all elevators shall open into a lobby separated from the remainder of the building by one hour fireresistance rated construction.

Exit stairways, chutes, janitor closets, tenant spaces in Use Group R and service rooms shall not open into the elevator lobby. In Use Groups other than R, tenant spaces opening into the elevator lobby shall be provided with other means of exit access that do not require passage through the elevator lobby.

Exception: elevator lobbies are not required when a smoke control system is installed in accordance with 780 CMR 921.7.

403.9 Standby power, light and emergency systems: Standby power, light and emergency systems shall comply with the requirements of 780 CMR 403.9.1 through 403.9.3.

403.9.1 Standby power: A standby power system conforming to the requirements of ***527 CMR as listed in Appendix A***. If the standby system is a generator set inside a building, the system shall be located in a separate room enclosed with two-hour fireresistance rated *fire separation assemblies*. System supervision with manual start and transfer features shall be provided at the *fire command station*.

403.9.1.1 Fuel supply: An on-premises fuel supply, sufficient for not less than two-hour full-demand operation of the system, shall be provided.

Exception: Where the system is supplied with pipeline natural gas and is approved.

403.9.1.2 Capacity: The standby system shall have a capacity and rating that supplies all equipment required to be operational at the same time. The generating capacity is not required to be sized to operate all of the connected electrical equipment simultaneously.

403.9.1.3 Connected facilities: All power and lighting facilities for the *fire command station* and elevators specified in 780 CMR 403.7 and 403.8, as applicable, and electrically powered fire pumps required to maintain pressure, shall be transferable to the standby source. Standby power shall be provided for at least one elevator to serve all floors and be transferable to any elevator.

office spaces incidental to tower operation and lounges for employees, including restrooms.

414.2 Type of construction: Air traffic control towers shall be constructed to conform to the *height* and *area* limitations of Table 414.2.

Table 414.2
HEIGHT AND AREA LIMITATIONS FOR AIRPORT TRAFFIC CONTROL TOWERS

Type of construction	Height[a,b]	Maximum area (square feet)[b]
1A, 1B	Unlimited	1,500
2A	240 feet	1,500
2B	100 feet	1,500
2C	85 feet	1,500

Note a. Height to be measured from grade to cab floor.

Note b. 1 foot - 304.8 mm; 1 square food = 0.093m^2.

414.3 Egress: A minimum of one exit *stairway* shall be permitted for airport traffic control towers of any *height* provided that the occupant load per floor does not exceed 15. The *stairway* shall conform to the requirements of 780 CMR 1014.0 and 1015.0. The *stairway* shall be separated from elevators by a minimum distance of ½ of the diagonal of the area served.

Exception: *Smokeproof enclosures* as set forth in 780 CMR 1015.0 are not required where required *stairways* are pressurized to a minimum of 0.15 inch of water column (37.33 P) and a maximum of 0.35 inch of water column (87.10 P) in the *shaft* relative to the building with all *stairway* doors closed.

414.4 Automatic fire detection systems: Airport traffic control towers shall be provided with an automatic fire detection system installed in accordance with 780 CMR 918.0.

414.5 Standby power: A standby power system that conforms to 780 CMR 403.9 and ***527 CMR 12.00 as listed in Appendix A*** shall be provided in airport traffic control towers more than 65 feet (19812 mm) in *height*. Power shall be provided to mechanical equipment servicing *smokeproof enclosures* and stairway pressurization systems, *means of egress* lighting, elevator operational equipment and the automatic fire detection system.

780 CMR 415.0 OUTDOOR PROCESSING FACILITIES

415.1 Industry standards: Outdoor processing facilities such as chemical plants, refineries and grain elevators shall be constructed in accordance with the accepted engineering practice of the specific industry and the fire prevention code listed in ***Appendix A***, subject to the approval of the ***the building code enforcement official and the fire prevention officer***.

780 CMR 416.0 HPM FACILITIES

416.1 Scope: The provisions of 780 CMR 416.0 shall apply to buildings and structures using *hazardous production materials* (*HPM*), such as in semiconductor fabrication facilities and areas of comparable research and development. Except as specifically required by 780 CMR 416.0, such buildings shall comply with the applicable requirements of 780 CMR. The specific code provisions of 780 CMR 307.0, 506.3 and Table 1009.2 applicable to high-hazard use groups shall not apply unless stated herein.

416.2 Definitions: The following words and terms shall, for the purposes of 780 CMR 416.0 and as used elsewhere in 780 CMR, have the meanings shown herein.

Emergency control station: An approved location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

Fabrication area: A fabrication area is one in which there are processes involving *hazardous production materials* (*HPM*), and includes ancillary rooms or areas, such as dressing rooms and offices, which are supplemental to the area processes.

Hazardous production material (HPM): A solid, liquid or gas that has a degree of hazard rating in health, flammability or reactivity of Class 3 or 4 as ranked by NFiPA 704 listed in ***Appendix A*** and which is used directly in research, laboratory or production processes which have as their end product, materials which are not hazardous.

Service passage, HPM: A passage in which *hazardous production materials* (*HPM*) are transported from a *separate inside HPM storage room* or the exterior of the building to the perimeter wall of the *fabrication area*, for purposes other than required *means of egress*.

Storage room, HPM, separate inside: A room in which *hazardous production materials* (*HPM*) are stored in containers, tanks, drums or other means, and which is separated from other occupancies. Such rooms include:
HPM cutoff room: An *HPM* storage room within a building and having at least one exterior wall.
HPM inside room: An *HPM* storage room totally enclosed within a building and not having exterior walls.

416.3 Allowable heights, stories and area: The allowable *height*, number of stories and basic *areas* permitted for HPM buildings and structures shall not exceed the limitations specified in Table 416.3. The provisions of 780 CMR 507.0 shall not apply. The

area limitations are for one- or two-story buildings facing on a street or public space not less than 30 feet (9144 mm) wide. The increases permitted in 780 CMR 506.2 and 506.3 shall apply.

Table 416.3
HEIGHT, NUMBER OF STORIES AND AREA LIMITATIONS FOR HPM USE FACILITIES

Type of construction	Number of stories	Height (feet)[a]	Area (square feet/floor)[a]
1A and 1B	3	55	Unlimited
2A	3	55	34,200
2B	3	55	22,500
2C	3	40	14,400
3A	3	50	19,800
3B	3	40	14,400
4	3	55	21,600
5A	3	40	15,300
5B	2	30	7,200

Note a. 1 foot = 304.8 mm; 1 square foot = 0.093 m^2

416.4 Fire suppression: *HPM* facilities shall be equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 9. The design for the *fabrication areas*, *service passages*, *separate inside HPM storage rooms* without dispensing, and *means of egress corridors* shall meet the requirements for Ordinary Hazard Group 2 in NFiPA 13 listed in ***Appendix A***. The design for *separate inside HPM storage rooms* with dispensing shall meet the requirements for Extra Hazard Group 2 in NFiPA 13 listed in ***Appendix A***.

416.5 Amount of HPM in a fabrication area: The total amount of *HPM* permitted in a single *fabrication area* shall be based on the densities in Table 416.5(2), or the quantities in Table 416.5(1), whichever is the larger amount.

Table 416.5(1)
PERMITTED AMOUNTS OF HPM IN A SINGLE FABRICATION AREA-QUANTITY BASIS

Material	Maximum quantity[a]
Flammable liquids	
Class I-A	90 gallons
Class I-B	180 gallons
Class I-C	270 gallons
Combination flammable liquids containing not more than the exempt amounts of Class I-A, I-B or I-C flammable liquids	360 gallons
Combustible liquids	
Class II	360 gallons
Class III-A	750 gallons
Flammable gases	9,000 cubic feet at one atmosphere of pressure at 70°F
Liquefied flammable gases	180 gallons
Flammable solids	1,500 pounds
Corrosive liquids	165 gallons
Oxidizing material - gases	18,000 cubic feet
Oxidizing material - liquids	150 gallons
Oxidizing material - solids	1,500 pounds
Organic peroxides	30 pounds
Highly toxic material and poisonous gas	Included in the aggregate for flammables as noted above

Note a. 1 gallon - 0.00379 m^3; 1 cubic foot = 0.028 m^3; 1 pound = 0.454 kg; degrees C = {(degrees F)-32}/1.8.

Table 416.5(2)
PERMITTED AMOUNTS OF HPM IN A SINGLE FABRICATION AREA—DENSITY BASIS[a, c]

State	Units[d]	Flammable	Oxidizer	Corrosive
Solid	Pounds per aquare foot	0.001	0.003	0.003
Liquid	Gallons per square foot	0.04[b]	0.03	0.08
Gas	Cubic feet per square foot	1.250	1.250	3.000

Note a. HPM within piping shall not be included in the calculated quantities.

Note b. The maximum permitted quantities of flammable and combustible liquids shall not exceed the following quantities:

Class (I-A) + (I-B) + (I - C) (combination flammable liquids) = .025
However Class I-A shall not exceed = .0025
Class II = .01
Class III-A = .02

Note c. Highly toxic materials and poisonous gases shall be limited by the maximum quantities specified in Table 416.5(1).

Note d. One pound per square foot = 4.882 kg/m^2; 1 gallon per square foot = 0.0407 m^3/m^2; 1 cubic foot per square foot = 0.301 m^3/m^2.

416.6 Egress: There shall not be less than two *means of egress* provided for any *fabrication area* or any *HPM* facility subdivision thereof larger than 200 square feet (18.62 m^2). The maximum length of *exit access* travel in *HPM* facilities shall be 100 feet (30480 mm).

416.7 Separation: *Fabrication areas* shall be separated from each other, from *means of egress corridors*, and from other parts of the building by not less than one-hour *fire separation assemblies* in compliance with 780 CMR 709.0, with *fire doors* complying with 780 CMR 716.0. Floors forming part of the required separation shall be liquid tight.

416.8 Floors: Floors within *fabrication areas* shall be of approved noncombustible construction. Unprotected openings through floors of *fabrication areas* are permitted where the interconnected levels are used solely for mechanical equipment directly related to such *fabrication areas*.

Mechanical, duct and piping penetrations within a *fabrication area* shall not extend through more than two floors. Penetrations shall be effectively *firestopped* in accordance with 780 CMR 720.6.4 at the floor level. The *fabrication area*, including the areas through which ductwork and piping extend, shall be considered a single conditioned space or *fire area*.

416.9 Ventilation, general: *Ventilation* systems shall comply with the mechanical code listed in ***Appendix A*** except as otherwise provided herein. *Ventilation*, including recalculated air, shall be provided throughout the *fabrication area* at the rate of not less than 1cfm per square foot (5074 $cm^3/s/m^2$) of floor area.

416.9.1 Interconnection: The exhaust system of one *fabrication area* shall not connect to another exhaust system outside that *fabrication area* within the building. The return air system from one *fabrication area* shall not connect to any other system.

416.9.2 Smoke detectors: Smoke detectors shall be installed in the recirculating air stream and shall initiate a signal at the *emergency control station.*

416.9.3 Shutoff switches: Automatic shutoffs are not required to be installed on air-moving equipment. A manually operated remote switch to shut off the *fabrication area* supply or the recirculation air system, or both, shall be provided at an approved location outside the *fabrication area.*

416.9.4 Gas detection: Where *HPM* gas is used or dispensed and the physiological warning properties for the gas are at a higher level than the accepted permissible exposure limitation for the gas, a continuous gas-monitoring system shall be provided to detect the presence of a short-term hazard condition. Where dispensing occurs and *flammable* gases or vapors are liberated in quantities exceeding 20% of the lower explosive limitation, a continuous gas-monitoring system shall be provided. The monitoring system shall be connected to the *emergency control station.*

416.10 Transporting HPM: *HPM* shall be transported to *fabrication areas* through enclosed piping or tubing systems which comply with 780 CMR 416.15, through *service passages*, or in *means of egress corridors* as permitted in the exception to 780 CMR 416.12.

416.11 Electrical: Electrical equipment and devices within the *fabrication area* shall comply with 527 CMR listed in ***Appendix A***. The requirements for hazardous locations are not required to be applied where the average rate of air change is at least four cfm per square foot (20300 $cm^3/s/m^2$) of floor area and where the rate of air change at any location is not less than three cfm per square foot (15200 $cm^3/s/m^2$).

416.12 Means of egress corridors: *Means of egress corridors* shall comply with 780 CMR 1011.4 and shall be separated from *fabrication areas* as specified in 780 CMR 416.7. *Means of egress corridors* shall not be used for transporting *HPM* except as provided for in 780 CMR 416.12.1 and 416.15.2.

416.12.1 Existing facilities: In existing *HPM* facilities, when there are alterations or modifications to existing *fabrication areas*, the transportation of *HPM* in *means of egress corridors* shall be permitted provided that all of the requirements of 780 CMR 416.12.1.1 and 416.12.1.2 are met.

416.12.1.1 Corridors: *Corridors* adjacent to the *fabrication area* under *alteration* shall comply with Table 602, item 4, for a length determined as follows:

1. The length of the common wall of the *corridor* and that *fabrication area*; and
2. For the distance along the *corridor* to the point of entry of *HPM* into the *corridor* serving that *fabrication area.*

416.12.1.2 Openings: There shall not be openings between the *corridor* and an *HPM* storage cabinet in a *fabrication area* other than those in compliance with all of the following:

1. one-hour *fire doors* are installed between the *corridor* and the cabinet;
2. The cabinet is separated from the *corridor* with a one-hour fireresistance rated *fire partition*; and
3. Automatic sprinklers shall be provided inside the cabinets

416.13 Service passages: *Service passages* shall be considered as *HPM* facilities. *Service passages* shall be separated from *means of egress corridors* as required by 780 CMR 416.7.

416.13.1 Ventilation: *Service passages* shall be *ventilated* as required by 780 CMR 416.9.

416.13.2 Egress: There shall not be less than two *means of egress* from a *service passage*. Not more than one-half of the required *means of egress* shall be into the *fabrication area*. Doors from *service passages* shall be self-closing and swing in the direction of *means of egress* travel.

416.13.3 Travel distance: The maximum distance of travel from any point in a *service passage* to an *exit* or door into a *fabrication area* shall not exceed 75 feet (22860 mm). Dead ends shall not exceed four feet (1219 mm) in length.

416.13.4 Alarms: Alarms shall be provided for in accordance with 780 CMR 416.14.5.

416.14 Storage of HPM, general: Rooms used for the storage of *HPM* in quantities greater than those set forth in Tables 307.8(1) and 307.8(2), except for those quantities permitted within a *fabrication area*, shall comply with the provisions of NFiPA 30 listed in ***Appendix A***, provided that the area of an HPM *cutoff room* shall not exceed 6,000 square feet (558 m^2). The storage area for any liquid *HPM* shall be provided with drains.

416.14.1 Location within building: Where *HPM cutoff rooms* are provided, such rooms shall not be less than 30 feet (9144 mm) from *lot lines*.

416.14.2 HPM drainage systems: Drainage systems shall be provided to direct liquid leakage and fire protection water to a safe location away from the building, important valves or adjoining property. *HPM flammable liquid* drains shall be separated from other *HPM* liquid drains Other *HPM* liquids in drains that are not compatible shall be separated from each other, provided that the liquids are permitted to be combined when such liquids have been rendered acceptable for discharge by an approved means into the public sewers.

416.14.3 Egress: There shall be two *means of egress* from a *separate inside HPM storage room* where the room exceeds 200 square feet (186 m^2) in area. Where two *means of egress* are required from *HPM cutoff rooms*, one shall be directly to the outside of the building. All storage room *means of egress* doors shall be self-closing and swing in the direction of *means of egress* travel

416.14.4 Ventilation: Exhaust *ventilation* shall be provided for in accordance with 780 CMR 416.9 for all categories of *HPM*.

416.14.5 Emergency alarm: An emergency telephone system or local fire protective signaling system station shall be installed outside of each interior egress door from *HPM cutoff rooms*. The signal shall be relayed to the *emergency control station* and a local signaling device provided.

416.14.6 Electrical: *HPM cutoff rooms* containing *flammable liquids* or gases shall be classified as Class I, Division 1, hazardous locations in accordance with 527 CMR listed in ***Appendix A***.

416.14.7 Gas detection: Gas detection shall be provided for in accordance with 780 CMR 416.9.4.

416.15 Piping and tubing: *HPM* piping and tubing shall comply with 780 CMR 416.15 and shall be installed in accordance with ASME B31.3 listed in ***Appendix A***.

416.15.1 General: Piping and tubing systems shall be metallic unless the material being transported is incompatible with such system. Systems supplying gaseous *HPM*, having a *health hazard* of 3 or 4 as ranked by NFiPA 704 listed in ***Appendix A***, shall be welded throughout, except for connections, valves and fittings which are within an exhausted enclosure. *HPM* supply piping or tubing in *service passages* shall be exposed to view.

416.15.2 Installation in egress corridors or above other use groups: *HPM* shall not be located within *means of egress corridors* or above areas not containing *HPM* facilities except as permitted by 780 CMR 416.15. *HPM* piping and tubing shall be permitted within the space defined by the *walls* of *means of egress corridors* and the floor or roof above, or in concealed spaces above other use groups under the following conditions:

1. Automatic *sprinklers* shall be installed within the space unless the space is less than six inches (152 mm) in least dimension.
2. *Ventilation* at not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.
3. All *HPM* supply piping and tubing and HPM non-metallic waste lines shall be separated from the *means of egress corridor* and from any use group other than an *HPM* use facility by a *fire separation assembly* having a fireresistance rating of not less than one hour. Where gypsum wallboard is used, joints on the piping side of the enclosure are not required to be taped, provided that the joints occur over framing members.
4. Where piping or tubing is used to transport *HPM* liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect and drain any discharge or leakage to an approved location. The one-hour enclosure required by 780 CMR

416.15.2, item 3 shall not be used as part of the receptor.

5. Manual or automatic remotely activated fail-safe emergency shutoff valves, with ready access thereto, shall be installed on piping and tubing, other than waste lines, at branch connections into the *fabrication area*, and at entries into *means of egress corridors*.

6. Where *HPM* supply gas is carried in pressurized piping, a fail-safe system for excess flow control shall shut off flow due to a rupture in the piping.

7 Electrical wiring and equipment located in the piping space shall be approved for Class I, Division 2, hazardous locations in accordance with 527 CMR listed in ***Appendix A***.

8. Gas detection shall be as provided for in 780 CMR 416.9.4

Exception: Conditions 1 through 8 shall not apply to transverse crossings of the *corridors* by supply piping that is coaxially enclosed within a ferrous pipe or tube for the width of the *corridor*. An enclosing pipe or tube open to an *HPM* use facility is permitted.

416.15.3 Identification: Piping, tubing and *HPM* waste lines shall be identified in accordance with ASME A13.1 listed in ***Appendix A***.

780 CMR 417.0 HAZARDOUS MATERIALS

(See also 780 CMR 426.0 for the design and constriction of Bulk Merchandising Retail Buildings.)

417.1 General: The provisions of 780 CMR 417.0 shall apply to all buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of *hazardous materials*. All buildings and structures with an occupancy in Use Group H shall also comply with the applicable provisions of 780 CMR 418.0 and the fire prevention code listed in ***Appendix A***.

Note: The safe design of *hazardous material* occupancies is material dependent. Individual material requirements are also found in 780 CMR 307.0 and 418.0, and in the mechanical and fire prevention codes listed in ***Appendix A***. Since the fire department is responsible for inspection of these occupancies for proper utilization and handling of *hazardous materials*, the administrative authority shall cooperate with the fire department in the discharge of the responsibility to enforce 780 CMR 417.0

417.2 Control areas/exempt amounts: *Control areas* shall be those spaces within a building where quantities of *hazardous materials* not exceeding the allowable exempt amounts are stored, dispensed, utilized or handled. *Control areas* shall be separated from all adjacent interior spaces by *fire separation assemblies* in accordance with 780 CMR 709.0. The number of permitted *control areas* and degree of fire separation shall be in accordance with Table 417.2. The floor construction and supporting structure for all floors within the *control area* shall require a minimum two-hour fireresistance rating.

Table 417.2
PERMITTED CONTROL AREAS[a, b]

Floor level	Percent of allowable exempt quantities per control area	Control areas per floor	Vertical fire separation walls (hours)
1	100	4	1
2	75	3	1
3	50	2	1
4	12.5	2	2
5	12.5	2	2
6	12.5	2	2
7-9	5	2	2
Higher than 9	5	1	2

Note a. The number of floor levels below grade shall not exceed two. The first floor level before grade shall be limited to 75% of the maximum allowable exempt quantity per control area with a maximum of three control areas. The second floor level below grade shall be limited to 50% of the maximum allowable exempt quantity per control area with a maximum of two control areas.

Note b. In mercantile occupancies, a maximum of two control areas per floor shall be permitted in retail sales rooms.

417.2.1 Hazardous material in mercantile display areas: ***Except as modified by 780 CMR 426***, the aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid *hazardous materials* permitted within a single *control area* of a retail sales occupancy is permitted to exceed the exempt amounts specified in Tables 307.8(1) and 307.8(2) without classifying the building as a high-hazard use group, provided that the materials are stored in accordance with the fire prevention code listed in ***Appendix A***.

417.3 Equipment rooms: Heating and ventilating equipment in occupancies involving fire hazards from *flammable* vapors, dusts, *combustible fibers* or other highly combustible substances shall be installed and protected against fire and explosion hazards in accordance with the mechanical code and the fire prevention code listed in ***Appendix A***.

417.4 Hazardous material systems: Systems involving *hazardous materials* shall be suitable for the intended application and shall be designed by persons competent in such design. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls, where provided, shall be designed to be fail safe.

417.5 Inside storage, dispensing and utilization: The inside storage, dispensing and utilization of *hazardous materials* in excess of the allowable exempt amounts of Tables 307.8(1) and 307.8(2) shall be in accordance with 780 CMR 417.5.1 through 417.5.5 and the fire prevention code listed in ***Appendix A***.

417.5.1 Explosion control: Every structure, room or space occupied for purposes involving explosion hazards shall be provided with explosion venting, explosion suppression systems, *barricades* or equivalent explosion protective devices in accordance with 780 CMR 417.0 and NFiPA 495 listed in ***Appendix A*** where required by 780 CMR 418.0 and the fire prevention code listed in ***Appendix A***.

Exception: Explosion venting shall not be utilized as a means to protect buildings from *detonation* hazards.

417.5.1.1 Explosion venting: Areas which are provided with explosion venting to relieve *deflagration* shall comply with the following:

1. Walls, ceilings and roofs exposing surrounding areas shall be designed to resist a minimum internal pressure of 100 pounds per square foot (psf).
2. Explosion venting shall be permitted only in exterior walls or roofs or through specially designed *shafts* to the exterior of the building.
3. Venting shall be designed to prevent serious structural damage and the production of lethal projectiles.
4. The aggregate clear vent relief area shall be governed by the pressure resistance of the nonrelieving portions of the building.
5. Vents shall be designed to relieve at a maximum internal pressure of 20 pounds per square foot (psf) and shall consist of any one or any combination of the following:
   - 5.1. Walls of lightweight material.
   - 5.2. Lightly fastened hatch covers.
   - 5.3. Lightly fastened, outward-opening swinging doors in exterior walls.
   - 5.4. Lightly fastened walls or roofs.
6. Venting devices shall discharge directly to the open air or to an unoccupied space not less than 50 feet in width on the same *lot*.
7. Relieving devices shall be so located that the discharge shall not be less than ten feet vertically and 20 feet horizontally from window openings or *exits* in the same or adjoining buildings or structures.
8. Discharge shall be in the direction of least exposure and not into the interior of the building.

417.5.1.2 Explosion suppression systems: Explosion suppression systems shall be of an approved type and installed in accordance with the provisions of 780 CMR and NFiPA 69 listed in ***Appendix A***.

417.5.2 Monitor control equipment: Monitor control equipment shall be provided where required by the fire prevention code listed in ***Appendix A***.

417.5.3 Detection systems: All occupancies in Use Group H shall be provided with an automatic fire detection system in accordance with NFiPA 72 listed in ***Appendix A*** where required by the fire prevention code listed in ***Appendix A***. The detection system shall be provided in the areas where the high-hazard materials are utilized and stored.

417.5.4 Standby power: Where mechanical *ventilation*, treatment systems, temperature control, alarm, detection or other electrically operated systems are required, such systems shall be connected to an emergency electrical system in accordance with ***527 CMR 12.00 as listed in Appendix A*** or a standby power system in accordance with ***527 CMR 12.00 as listed in Appendix A***. Such systems shall be independent of the public supply.

417.5.5 Spill control, drainage and containment: Rooms, buildings or areas occupied for the storage of solid and liquid *hazardous materials* shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in 780 CMR 418.0 and the fire prevention code listed in ***Appendix A***.

417.6 Outside storage, dispensing and utilization: The outside storage, dispensing and utilization of *hazardous materials* in excess of the exempt amounts shall be in accordance with 780 CMR 417.6.1 through 417.6.6 and the fire prevention code listed in ***Appendix A***.

417.6.1 Location: In addition to the general requirements of 780 CMR 417.6.2 through 417.6.5, the outside storage of *hazardous materials* as listed in 780 CMR 307.0 shall be separated from buildings and *lot lines* and into individual areas as specified in the fire prevention code listed in ***Appendix A***.

417.6.2 Protection from vehicles: Guard posts or other means shall be provided to protect outside storage tanks from vehicular damage.

417.6.3 Fire lanes and water supply: Fire lanes and approved water supplies shall be provided for outside storage areas as required by the code official.

1. Fire lanes. Fire lanes shall be provided to within 150 feet (45720 mm) of all portions of an outside storage area. Such fire lanes shall

421.1 General: Swimming and bathing pools shall conform to the requirements of 780 CMR 421.0 provided that 780 CMR 421.0 shall not be applicable to any such pool less than 24 inches (610 mm) deep or having a surface area less than 250 square feet (23.25 m^2), except where such pools are permanently equipped with a water-recirculating system or involve structural materials. For the purposes of 780 CMR, pools are classified as private swimming pools, public swimming pools ***or semi-public swimming pools***, as defined in 780 CMR 421.2. Materials and constructions used in swimming pools shall comply with the applicable requirements of 780 CMR.

421.2 Definitions: The following words and terms shall, for the purposes of 780 CMR 421.0 and as used elsewhere in 780 CMR, have the meanings shown herein.

Pools, swimming, hot tubs and spas

Above-ground/on-ground pool: See definition of private swimming pool.

Barrier: A fence, a wall, a building wall or a combination thereof which completely surrounds the swimming pool and obstructs access to the swimming pool. ***(Refer to M.G.L. c. 140, § 206 for required enclosure of public or semi-public, outdoor, inground swimming pools.)***

Hot tub (special purpose pool): A unit designed for recreational and therapeutic use which is shallow in depth and not meant for swimming or diving. These pools are not drained, cleaned or refilled for each user. It may include, but not be limited to hydrojet circulation, hot water, cold water mineral baths, air induction bubbles, or any combination thereof. Industry terminology for such a pool includes but is not limited to, therapeutic pool, hydrotherapy pool, whirlpool, hot spa, hot tubs, float tanks, etc. This standard excludes residential units and facilities used or under the direct supervision and control of licensed medical personnel.

In-ground pool: See definition of private swimming pool.

Private swimming pool: Any structure that contains water over 24 inches (610 mm) in depth and which is used, or intended to be used, for swimming or recreational bathing in connection with an occupancy in Use Group R-3 ***or R-4*** and which is available only to the family and guests of the householder. This includes in-ground, above-ground and on-ground swimming pools, hot tubs and spas.

Private swimming pool, indoor: Any private swimming pool that is totally contained within a private structure and surrounded on all four sides by walls of said structure.

Private swimming pool, outdoor: Any private swimming pool that is not an indoor pool.

Public *outdoor, inground* swimming pool: Any swimming pool ***which is used, or intended to be used, for swimming or recreational bathing by the general public. Refer to M.G.L. c. 140, § 206 for requirements pertaining to public or semi-public, outdoor, inground swimming pool enclosures, safety equipment, inspection, and penalties for violations.***

Public swimming pool, outdoor: Any public swimming pool that is not defined as an outdoor, inground swimming pool.

Semi-public outdoor, inground swimming pool: (as defined by M.G.L. c. 140, § 206) any swimming or wading pool on the premises of, or used in connection with, a hotel, motel, trailer court, apartment house, country club, youth club, school, camp, or similar establishment where the primary purpose of the establishment is not the operation of the swimming facilities. Semi-public outdoor, inground swimming pool shall also mean a pool constructed and maintained by groups for the purposes of providing bathing facilities for members and quests only. Refer to M.G.L. c. 140, § 206 for requirements pertaining to public or semi-public, outdoor, inground swimming pool enclosures, safety equipment, inspection, and penalties for violations.

Semi-public swimming pool, outdoor: Any semi-public swimming pool that is not defined as a semi-public outdoor, inground swimming pool.

Spa: See definition of private swimming pool.

Wading Pool: Aa pool of water in a basin having a maximum depth of less than two feet intended chiefly as a wading place for children. It does not include any residential pool as herein defined.

421.3 Permits and construction documents: A swimming pool or appurtenances thereto shall not be constructed, installed, enlarged or *altered* until *construction documents* have been submitted and a permit has been obtained from the code official. The approval of all city, county and state authorities having jurisdiction over swimming pools shall be obtained before applying to the code official for a permit. Certified copies of these approvals shall be filed as part of the supporting data for the permit application.

421.3.1 Construction documents: *Construction documents* shall accurately show dimensions and construction of the pool and appurtenances and properly established distances to *lot lines*, buildings, walks and fences, as well as details of the water supply system, drainage and water disposal systems, and all appurtenances pertaining to the swimming pool. Detailed *construction documents* of structures, vertical elevations and sections through the pool showing depth shall be included.

421.4 Locations: Private swimming pools shall not encroach on any front or side yard required by 780 CMR or by the governing zoning law, unless in accordance with specific rules of the jurisdiction in which the pool is located. A wall of a swimming pool shall not be located less than six feet (1829 mm) from any rear or side property line or ten feet (3048 mm) from any street property line, unless in accordance with specific rules of the jurisdiction in which the pool is located.

421.5 Structural design: The pool structure shall be engineered and designed to withstand the expected forces to which the pool will be subjected.

421.5.1 Wall slopes: To a depth up to two feet nine inches (838 mm) from the top, the wall slope shall not be more than one unit horizontal in five units vertical (1:5).

421.5.2 Floor slopes: The slope of the floor on the shallow side of the transition point shall not exceed one unit vertical to seven units horizontal (1:7). For public pools greater than 1,200 square feet (111.6 m^2), the slope of the floor on the shallow side of the transition point shall not exceed one unit vertical to ten units horizontal (1:10). The transition point between shallow and deep water shall not be more than five feet (1524 mm) deep.

421.5.3 Surface cleaning: All swimming pools shall be provided with a recirculating skimming device or overflow gutters to remove scum and foreign matter from the surface of the water. Where skimmers are used for private pools, there shall be at least one skimming device for each 1,000 square feet (93 m^2) of surface area or fraction thereof. For public pools where water skimmers are used, there shall be at least one skimming device for each 500 square feet (55.8 m^2) of surface area or fraction thereof. Overflow gutters shall not be less than three inches (76 mm) deep and shall be pitched to a slope of one unit vertical to 48 units horizontal (1:48) toward drains, and constructed so that such gutters are safe, cleanable and that matter entering the gutters will not be washed out by a sudden surge of entering water.

421.5.4 Walkways: All public *and semi-public* swimming pools shall have walkways not less than four feet (1219 mm) in width extending entirely around the pool. Curbs or sidewalks around any swimming pool shall have a slip-resistant surface for a width of not less than four foot (305 mm) at the edge of the pool, and shall be so arranged as to prevent return of surface water to the pool.

421.5.5 Steps and ladders: At least one *means of egress* shall be provided from private pools. *All* public *and semi-public* pools shall provide ladders to other *means of egress* at both sides of the diving section and at least one *means of egress* at the shallow section; or at least one *means of egress* in the deep section and the shallow section if diving boards are not provided. Treads of steps and ladders shall have slip-resistant surfaces and handrails on both sides, except that handrails are not required where there are not more than four steps or where the steps extend the full width of the side or end of the pool. ***(Refer to 521 CMR 19.00, the Architectural Access Board's rules and regulations, for requirements pertaining to the accessibility of all public and semi-public swimming pools.)***

421.6 Water supply: All swimming pools shall be provided with a potable water supply, free of cross connections with the pool or its equipment.

421.6.1 Water treatment: ***See 105 CMR 935.000 Minimum Standards for Swimming Pools.***

421.6.2 Drainage systems: The swimming pool and equipment shall be equipped to be emptied completely of water and the discharged water shall be disposed of in an approved manner that will not create a nuisance to adjoining property.

421.7 Appurtenant structures: All *appurtenant structures*, installations and equipment, such as showers, dressing rooms, equipment houses or other buildings and structures, including plumbing, heating and air conditioning systems, shall comply with all applicable requirements of 780 CMR, ***applicable zoning laws and requirements, 105CMR 435.000: Minimum Standards for Swimming Pools (State Sanitary Code: Chapter V), 248 CMR 2.00 : the State Plumbing Code, and 527 CMR 12.00: the State Electrical Code.***

421.7.1 Accessories: All swimming pool accessories shall be designed, constructed and installed so as not to be a safety hazard. Installations or structures for diving purposes shall be properly anchored to insure stability.

421.8 Equipment installations: Pumps, filters and other mechanical and electrical equipment for public swimming pools shall be enclosed in such a manner as to provide access only to authorized persons and not to bathers. Construction and drainage shall be arranged to avoid the entrance and accumulation of water in the vicinity of electrical equipment.

421.9 Enclosures for *outdoor, inground* public *and semi-public* swimming pools: *Outdoor, inground* public and *semi-public* swimming pools shall be provided with an enclosure *in accordance with M.G.L. c. 140, § 206.*

421.9.1 Enclosure *for public and semi-public outdoor, inground swimming pools: Every public and semi-public outdoor, inground swimming pool shall be enclosed by a fence six feet in height and firmly secured at ground level provided that any board or stockade fence or structure shall be at least five feet in height, but if over five feet in height, the fence shall be chain link. Such enclosure, including gates therein, shall not be less than six feet above the ground, and any gate shall be self-latching with latches placed four feet above the ground or otherwise made inaccessible from the outside to children up to eight years of age. Such enclosure shall be constructed of such material and maintained so as not to permit any opening in said enclosure, other than a gate, wider than three inches at any point along the enclosure. Any such pool shall be equipped with at least one life ring and rescue hook.*

421.9.1.1 Enclosure for all other public and semi-public swimming pools: The enclosure shall extend not less than four feet (1219 mm) above the ground. All gates shall be self-closing and self-latching with latches placed at least four feet (1219 mm) above the ground.

421.9.2 Construction *of enclosure for all other public and semi-public swimming pools*: Enclosure fences shall be constructed so as to prohibit the passage of a sphere larger than four inches (102 mm) in diameter through any opening or under the fence. Fences shall be designed to withstand a horizontal concentrated load of 200 pounds (91 kg) applied on a one-square-foot (0.093 m2) area at any point of the fence.

421.10 Enclosures for private swimming pools, spas and hot tubs: *In lieu of any zoning laws or ordinances to the contrary,* private swimming pools, spas and hot tubs shall be enclosed in accordance with 780 CMR 421.10.1 through 421.10.4 or by other approved barriers.

421.10.1 Outdoor private swimming pool: An outdoor private swimming pool, including an in-ground, above ground or on-ground pool, hot tub or spa shall be provided with a barrier which shall comply with the following.

1. The top of the barrier shall be at least 48 inches (1219 mm) above finished ground level measured on the side of the barrier which faces away from the swimming pool. The maximum vertical clearance between finished ground level and the barrier shall be two inches (51 mm) measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above finished ground level, such as an above-ground pool, the barrier shall be at finished ground level, such as the pool structure, or shall be mounted on top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be four inches (102 mm).
2. Openings in the barrier shall not allow passage of a four-inch (102 mm) diameter sphere.
3. Solid barriers shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.
4. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall not exceed 1¾ inches (44 mm) in width. Decorative cutouts shall not exceed 1¾ inches (44 mm) in width.
5. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall not exceed four inches (102 mm). Decorative cutouts shall not exceed 1¾ inches (44 mm) in width.
6. Maximum mesh size for chain link fences shall be a 1¼-inch (32 mm) square unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to not more than 1¾-inches (44 mm).
7. Where the barrier is composed of diagonal members, such as a lattice fence, the maximum opening formed by the diagonal members shall be not more than 1¾ inches (44 mm).
8. Access gates shall comply with the requirements of 780 CMR 421.10.1 items 1 through 7, and shall be equipped to accommodate a locking device. Pedestrian access gates shall open outwards away from the pool and shall be self-closing and have a self-latching device. Gates other than pedestrian access gates shall have a self-latching device. Where the release mechanism of the self-latching device is located less than

54 inches (1372 mm) from the bottom of the gate: (a) the release mechanism shall be located on the pool side of the gate at least three inches (76 mm) below the top of the gate; and (b) the gate and barrier shall not have an opening greater than ½ inch (13 mm) within 18 inches (457 mm) of the release mechanism.

9. Where a wall of a dwelling serves as part of the barrier, one of the following shall apply:

9.1. All doors with direct access to the pool through that wall shall be equipped with an alarm which produces an audible warning when the door and its screen, if present, are opened. The alarm shall sound continuously for a minimum of 30 seconds immediately after the door is opened. The alarm shall have a minimum sound pressure rating of 85 dBA at ten feet (3048 mm) and the sound of the alarm shall be distinctive from other household sounds such as smoke alarms, telephones and door bells. The alarm shall automatically reset under all conditions. The alarm shall be equipped with manual means, such as touchpads or switches, to deactivate temporarily the alarm for a single opening from either direction. Such deactivation shall last for not more than 15 seconds. The deactivation touchpads or switches shall be located at least 54 inches (1372 mm) above the threshold of the door.

9.2. The pool shall be equipped with an approved power safety cover.

10. Where an above-ground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a fixed or removable ladder or steps, the ladder or steps shall be surrounded by a barrier which meets the requirements of 780 CMR 421.10.1 items 1 through 9. A removable ladder shall not constitute an acceptable alternative to enclosure requirements.

421.10.2 Indoor private swimming pool: All walls surrounding an indoor private swimming pool shall comply with 780 CMR 421.10.1, item 9.

421.10.3 Prohibited locations: Barriers shall be located so as to prohibit permanent structures, equipment or similar objects from being used to climb the barriers.

421.10.4 Exemptions: The following shall be exempt from the provisions of 780 CMR 421.0.

1. A spa or hot tub with an approved safety cover.
2. Fixtures which are drained after each use.

421.11 Diving boards: Minimum water depths and distances for diving hoppers for pools, based on board height above water, shall comply with Table 421.11(1) for public pools and Table 421.11 (2) for private pools.

The maximum slope permitted between point D_2 and the transition point shall not exceed one unit vertical to three units horizontal (1:3) in private and public pools. D_1 is the point directly under the end of the diving boards. D_2 is the point at which the floor begins to slope upwards to the transition point. See Figure 421.11.

Figure 421.11
MINIMUM WATER DEPTHS AND DISTANCES BASED ON BOARD HEIGHT FOR *ALL* PUBLIC, *SEMI PUBLIC* AND PRIVATE POOLS

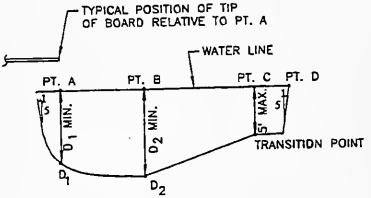


Table 421.1 1(1)
MINIMUM WATER DEPTHS AND DISTANCES BASED ON BOARD HEIGHT FOR *ALL* PUBLIC POOLS

Board height	Minimum depth[a] at D_1 directly under end of board	Distance[a] between D_1 and D_2	Minimum depth[a] at D_2
2'2" (⅔ meter)	7'0"	8'0"	8'6"
2'6" (¾ meter)	7'6"	9'0"	9'0"
1 meter	8'6"	10'0"	10'0"
3 meter	11'0"	10'0"	12'0"

Note a. 1 foot = 304.8 mm.

Table 421.11(2)
MINIMUM WATER DEPTHS AND DISTANCES BASED ON BOARD HEIGHT FOR PRIVATE POOLS

Board height	Minimum depth[a] at D_1 directly under end of board	Distance[a] between D_1 and D_2	Minimum depth[a] at D_2
1'8" (½ meter)	6'0"	7'0"	7'6"
2'2" (⅔ meter)	6'10"	7'6"	8'0"
2'6" (¾ meter)	7'5"	8'0"	8'0"
3'4" (1 meter)	8'6"	9'0"	9'0"

Note a. 1 foot = 304.8 mm.

780 CMR 422.0 EXISTING BUILDINGS

422.1 Existing Buildings: *See 780 CMR 34.*

422.2 Places of assembly

422.2.1 Change of use: *An existing building or structure or part thereof shall not be altered or*

CHAPTER 6

TYPES OF CONSTRUCTION

780 CMR 601.0 GENERAL

601.1 Scope: The provisions 780 CMR 6 shall control the classification of all buildings as to type of construction.

601.2 Application of other laws: The provisions of 780 CMR 6 shall not be deemed to nullify any provisions of the *zoning* law or any other statute of the jurisdiction pertaining to the location or type of construction of buildings, except as is specifically required by the provisions of 780 CMR.

601.3 Hospitals: Pursuant to M.G.L. c. 111, § 51, hospitals other than college and school infirmaries shall be constructed of at least Type 1B construction.

780 CMR 602.0 CONSTRUCTION CLASSIFICATION

602.1 General: All buildings and structures erected or to be erected, altered or extended in *height* or *area* shall be classified in one of the five construction types defined in Table 602 and 780 CMR 603.0 through 606.0.

602.2 False designation: A building shall not be designated as a given type of construction unless it conforms to the minimum requirements for that type.

602.3 Minimum requirements: Where a type of construction is used that is superior to the minimum herein required for any specified use, *height* and area of the building, nothing in 780 CMR shall be construed to require full compliance with the specifications for the higher type; but the designated construction classification of the building shall be that of the lesser type, unless all of the requirements for the higher type are fulfilled.

602.4 Noncombustibility requirements: Where a structure or a part of a structure is required to be constructed of noncombustible construction, the use of combustible elements shall be permitted subject to the limitations of 780 CMR 602.0 without altering the construction classification.

602.4.1 Roofs, floors and walls: Combustible elements in roofs, floors and walls are permitted to be used for the following components:

1. Interior finish and trim materials as regulated by 780 CMR 803.0, 804.0 and 806.0.
2. Light-transmitting *plastics* as permitted by 780 CMR 26.
3. Fireretardant-treated wood complying with 780 CMR 2310.0 as permitted by Table 602.
4. Mastics and caulking materials applied to provide flexible seals between components of exterior wall construction.
5. Roof covering materials as regulated by 780 CMR 15.
6. Thermal and sound insulation as permitted by 780 CMR 707.4.722.0. 1509.0. 2309.4 and 2603.0.
7. Exterior veneer and trim as permitted by 780 CMR 1406.0.
8. Nailing or furring strips as permitted by 780 CMR 804.0.
9. Windows and doors as permitted by 780 CMR 706.4.
10. Heavy timber as permitted by 780 CMR 1006.3.1, 714.2 and 714.4.
11. Partitions as permitted by 780 CMR 603.2.
12. Roof structures as permitted by 780 CMR 1510.0.
13. Platforms as permitted by 780 CMR 412.4.1.

602.4.2 Ducts: The use of nonmetallic ducts is permitted in accordance with the mechanical code listed in ***Appendix A***.

602.4.3 Piping: The use of combustible piping materials is permitted in accordance with the mechanical and plumbing codes listed in ***Appendix A***.

602.4.4 Electrical: The use of insulated electrical wiring and related components is permitted in accordance with 527 CMR listed in ***Appendix A***.

Table 602
FIRE RESISTANCE RATINGS OF STRUCTURE ELEMENTS[k]

Structure element		Type of construction 780 CMR 602.0									
		Noncombustible					Noncombustible/Combustible			Combustible	
		Type 1 780 CMR 603.0		Type 2 780 CMR 603.0			Type 3 780 CMR 604.0		Type 4 780 CMR 605.0	Type 5 780 CMR 606.0	
		Protected		Protected		Unprotected	Protected	Unprotected	Heavy timber Note c	Protected	Unprotected
Note a		1A	1B	2A	2B	2C	3A	3B	4	5A	5B
1 Exterior walls	Loadbearing	4	3	2	1	0	2	2	2	1	0
		– Not less than the rating based on fire separation distance (see 780 CMR 705.2) –									
	Nonloadbearing	– Not less than the rating based on fire separation distance (see 780 CMR 705.2) –									
2 Fire walls and party walls (780 CMR 707.0)		4	3	2	2	2	2	2	2	2	2
		–Not less than the fireresistance rating required by Table 707.1 –									
3 Fire separation assemblies (780 CMR 709.0)	Fire enclosure of exits (780 CMR 1014.11, 709.0 and Note b)	2	2	2	2	2	2	2	2	2	2
	Shafts (other than exits) & elevator hoistway (780 CMR 709, 710.0 & Note b)	2	2	2	2	2	2	2	2	1	1
	Mixed use & fire area separations (780 CMR 313.0)	– Not less than the fireresistance rating required by Table 313.1.2 –									
	Other Separation assemblies (Note i)	1	1	1	1	1	1	1	1	1	1
		–Note d –									
4 Fire partitions (780 CMR 711.0)	Exit access corridors (Note g)	– Not less then the fireresistance rating required by 780 CMR 1011.4 –									
		–Note d –									
	Tenant spaces separations (Note f)	1	1	1	1	0	1	0	1	1	0
		–Note d –									
5 Dwelling unit separations (780 CMR 711.0, 713.0 & Notes f & j)		1	1	1	1	1	1	1	1	1	1
		–Note d –									
6 Smoke barriers (780CMR 712.0 & Note g)		1	1	1	1	1	1	1	1	1	1
7 Other nonloadbearing partitions		0	0	0	0	0	0	0	0	0	0
		–Note d–									
8 Interior load-bearing walls, loadbearing partitions, columns, girders, trusses (other than roof trusses) & framing (780 CMR 715.0)	Supporting more than one floor	4	3	2	1	0	1	0	See 780 CMR 605.0	1	0
	Supporting one floor only or a roof only	3	2	1½	1	0	1	0	See 780 CMR 605.0	1	0
9 Structural members supporting wall (780 CMR 715.0 & Note g)		3	2	1½	1	0	1	0	1	1	0
		–Not less than fireresistance rating of wall supported –									
10 Floor construction including beams (780 CMR 713.0 & Note h)		3	2	1½	1	0	1	0	See 780 CMR 605.0, Note c	1	0
11 Roof construction, including beams, trusses and framing, arches & roof deck (780 CMR 714.0 & Notes e, i)	15' or less in height to lowest member	2	1½	1	1	0	1	0	See 780 CMR 605.0, Note c	1	0
		–Note d –									
	More than 15' but less than 20' in height to lowest member	1	1	1	0	0	0	0	See 780 CMR 605.0	1	0
		–Note d –									
	20' or more in height to lowest member	0	0	0	0	0	0	0	See 780 CMR 605.0	0	0
		–Note d –									

a *shaft* enclosure that complies with 780 CMR 710.0.

Exceptions: A *shaft* enclosure is not required for any of the following floor openings:

1. A floor opening serving and contained within a single *dwelling unit* and connecting four stories or less.
2. A floor opening which:
   2.1. Is not part of the required *means of egress*;
   2.2. Is not concealed within the building construction;
   2.3. Does not connect more than two stories;
   2.4. Is separated from other floor openings serving other floors by construction conforming to 780 CMR 710.3; and
   2.5. Is not open to a *corridor* in occupancies in Use Groups I and R, or is not open to a *corridor* on a floor not equipped throughout with an approved *automatic fire suppression system* in other use groups.
3. A floor opening in a mall that complies with 780 CMR 402.0.
4. A floor opening between a *mezzanine* that complies with 780 CMR 505.0, and the floor below.
5. An atrium that complies with 780 CMR 404.0.
6. A floor opening in an open parking structure that complies with 780 CMR 406.0.
7. An approved masonry chimney where annular space protection is provided for in accordance with 780 CMR 720.6.4.
8. A *shaft* enclosure for an *escalator* floor opening is not required where a *shaft* enclosure is not required for floor openings in accordance with 780 CMR 713.3 or where the building is equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1 and the *escalator* opening is protected in accordance with 780 CMR 713.4.3.4 or 713.4.3.5.
9. A floor opening that complies with 780 CMR 410.5 in an occupancy in Use Group I-3.
10. Noncombustible *shafts* connecting communicating floor levels in an occupancy in Use Group I-3 where the area complies with 780 CMR 410.5. Where additional stories are located above or below, the *shaft* shall be permitted to continue with fire and smoke damper protection provided at the fireresistance rated floor/ceiling assembly between the noncommunicating stories.
11. A single floor opening containing a *stairway* which is not a required *means of egress* in an occupancy in Use Group B and complying with the following parameters:
   11.1. The *stairway* does not connect more than six floor levels.
   11.2. The *stairway* does not connect with an *exit access corridor*.
   11.3. The *stairway* floor opening shall not exceed 160 square feet (15 m^2).
   11.4. The *stairway* floor opening shall be protected in the same manner as an *escalator* floor opening complying with 780 CMR 713.3 Exception 8, and 524 CMR.
   11.5. The building is equipped throughout with an approved *automatic sprinkler system* in accordance with 780 CMR 906.2.1.

713.4 Penetration protection: All penetrations of a floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a *shaft* enclosure that complies with 780 CMR 710.0.

Exceptions:

1. Penetrations within and through a floor opening permitted to be unenclosed by 780 CMR 713.3.
2. Penetrations through assemblies required to be fireresistance rated and complying with 780 CMR 713.4.1 or 780 CMR 713.4.2.
3. Penetrations through assemblies without a required fireresistance rating and complying with 780 CMR 713.4.1 or 780 CMR 713.4.3.

713.4.1 Through-penetration system: A *shaft* enclosure shall not be required where cables, cable trays, conduits, tubes or pipes penetrate a floor assembly and are protected with an approved *through-penetration protection system* tested in accordance with ASTM E814 listed in ***Appendix A***. The positive pressure differential between the exposed and unexposed surfaces of the test assembly shall not be less than 0.01-inch water gage (2.5 P). The system shall have an "F" rating and a "T" rating of not less than 1 hour but not less than the required fireresistance rating of the assembly being penetrated. All penetrations through a ceiling that is an integral component of a fireresistance rated floor/ceiling or roof/ceiling assembly, shall comply with 780 CMR 713.4.2.

Exceptions:

1. A "T" rating shall not be required for floor penetrations that are contained and located within the cavity of a wall.
2. A "T" rating shall not be required for floor penetrations by pipe, tube and conduit that are not in direct contact with combustible material.

713.4.2 Fireresistance rated assemblies: The required fireresistance rating of floor/ceiling and roof/ceiling assemblies shall be determined in accordance with ASTM E119 listed in ***Appendix A***. Except where permitted by 780 CMR 713.4.2.1 through 713.4.2.3, penetrations for electrical, mechanical, plumbing and communication conduits, pipes and systems shall be installed in accordance with the approved ASTM E119 rated assembly. In the

case of ceilings that are an integral component of a fireresistance rated floor/ceiling or roof/ceiling assembly, all penetrations shall be installed in accordance with the approved ASTM E119 rated assembly or 780 CMR 713.4.2.3.

Exceptions:

1. Outlet boxes and fittings are permitted, provided that such devices are listed for installation in fireresistance rated assemblies and are installed in accordance with the listing.
2. Ceiling dampers shall not be required where fire tests have shown that such dampers are not necessary in order to maintain the fireresistance rating of the assembly.

713.4.2.1 Noncombustible penetrations: Penetrations by noncombustible vents, chimneys, conduits, pipes and tubes through a fireresistance rated floor assembly which connect not more than two stories are permitted. Penetrations by noncombustible conduit, pipe and tubes through a fireresistance rated floor assembly which connect more than two stories are permitted provided that the aggregate area of the penetrating items shall not exceed one square foot (0.09 m^2) in any 100 square feet (9.3 m^2) of floor area. In all cases, the annular space between the penetrating item and the assembly shall be protected in accordance with 780 CMR 707.8.

713.4.2.2 Air ducts: Penetrations by an air duct or plenum through a fireresistance rated floor assembly, which connect not more than two stories, are permitted where a *fire damper* that complies with 780 CMR 717.0 is installed at the floor line. A *fire damper* is not required at penetrations of a roof/ceiling assembly where ducts are open to the atmosphere.

713.4.2.3 Ceiling penetrations: In the case of ceilings that are an integral component of a fireresistance rated floor/ceiling or roof/ceiling assembly, openings to accommodate noncombustible conduits, pipes, tubes, electrical outlets or air ducts shall be permitted provided that the aggregate area of such openings does not exceed 100 square inches (0.065 m^2) in any 100 square feet (9.3 m^2) of ceiling area. The space around noncombustible conduits, pipes, tubes and electrical outlet boxes at the ceiling penetration shall be *firestopped* in accordance with 780 CMR 720.6.4 or shall be protected in accordance with 780 CMR 709.7 or 780 CMR 713.4.1. For noncombustible air duct penetrations, an approved ceiling damper shall be installed at the ceiling line. Ceiling dampers shall be constructed in accordance with the details listed in a fireresistance rated design or shall be *labeled* to function as a heat barrier for air-handling outlet/inlet penetrations in the ceiling of a fireresistance rated assembly.

713.4.3 Nonfireresistance rated assemblies: Penetrations of floor assemblies without a required fireresistance rating shall conform to 780 CMR 713.4.3.1 through 713.4.3.3. All penetrations through the ceiling membrane of a roof assembly without a required fireresistance rating shall be protected in accordance with 780 CMR 720.6.4.

713.4.3.1 Noncombustible penetrations: Penetrations by noncombustible vents, chimneys, conduits, pipes and tubes through unprotected floor assemblies which connect not more than three stories are permitted provided that the annular space between the penetrating item and the floor is protected in accordance with 780 CMR 720.6.4.

713.4.3.2 Air ducts: Penetrations by noncombustible air ducts through unprotected floor assemblies which connect not more than three stories are permitted provided that a *fire damper* complying with 780 CMR 717.0 is installed at each floor line.

713.4.3.3 Noncombustible or combustible penetrations: Penetrations by vents, chimneys, cables, wires, air ducts, conduits, pipes and tubes through an unprotected floor assembly which connect not more than two stories are permitted provided that the annular space is protected in accordance with 780 CMR 720.6.4.

713.4.3.4 Escalators/automatic fire shutter: *Escalators* shall be equipped with a power-operated automatic shutter at every floor pierced thereby, constructed of approved noncombustible materials with a fire protection rating of not less than 1½ hours. The shutter shall close immediately upon the automatic detection of fire and smoke by an approved device and shall completely shut off the well opening. The shutter shall operate at a speed of not more than 30 feet per minute (0.15 m/s) and shall be equipped with a sensitive leading edge to arrest the shutter's progress when in contact with any obstacle, and to continue the shutter's progress on release therefrom. Refer to 780 CMR 713.3, Exception 8.

713.4.3.5 Escalators/water curtain: The area of the floor opening shall not exceed twice the horizontal projected area of the *escalator* and the opening shall not connect more than four stories in occupancies in other that Use Groups B and M and the opening shall be protected by a draft curtain and a closed *sprinkler* water curtain conforming to NFiPA 13 listed in ***Appendix A***. Refer to 780 CMR 713.3, Exception 8

780 CMR 714.0 ROOF CONSTRUCTION

714.1 General: Roofs shall be constructed of materials or assemblies of materials designed to afford the fireresistance rating required by Table 602 as herein modified.

714.2 Stadiums: The roof construction, including beams, trusses, framing, arches and roof decks, enclosing stadiums of Type 1 or Type 2 construction, shall be of approved noncombustible materials without a specified fireresistance rating or of Type 4 construction.

714.3 Roofs 20 feet or higher: Where every part of the structural framework of roofs in buildings of Type 1 or Type 2 construction is 20 feet (6096 mm) or more above the floor immediately below, omission of all fire *protection* of the structural members is permitted, including the *protection* of trusses, roof framing and decking.

714.4 Roof slabs, arches and decking: Where the omission of fire *protection* from roof trusses, roof framing and decking is permitted, roofs in buildings of Types 1 and 2 construction shall be constructed of noncombustible materials, or of fireretardant- treated wood as permitted in Table 602, without a specified fireresistance rating, or of Type 4 construction in

NON-TEXT PAGE

CHAPTER 9

FIRE PROTECTION SYSTEMS

(This Chapter is Entirely Unique to Massachusetts)

780 CMR 901.0 GENERAL

901.1 Scope: The provisions of 780 CMR 9 shall specify where *fire protection systems* are required and shall apply to the design, installation, maintenance and operation of all *fire protection systems* in all buildings and structures.

901.1.1 Seismic Requirements: All "required" and "non-required" fire protection systems shall be installed in accordance with the Seismic Criteria requirements of 780 CMR 1612.7, Architectural, Mechanical and Electrical Components and Systems.

901.2 Required systems: All *fire protection systems* required by 780 CMR shall be installed, repaired, operated and maintained in accordance with this code and the applicable reference standards listed in *Appendix A*. All required *fire suppression* and *standpipe systems* shall be provided with at least one automatic supply of fire-extinguishing agent of adequate pressure, capacity and reliability to perform the function intended.

901.3 Nonrequired systems: Any *fire protection system or* portion thereof not required by 780 CMR shall be permitted to be finished for partial or complete protection provided that such installed system meets applicable requirements of 780 CMR. A building permit shall be required for systems installed pursuant to 780 CMR 901.3

901.4 Maintenance: All water based fire protection systems shall be maintained in accordance with NFPA 25 as listed in *Appendix A*. All other *fire protection systems* shall be maintained in accordance with the requirements of the applicable reference standards and standards listed in *Appendix A*. The owner, tenant or lessee of every building or structure shall be responsible for the care and maintenance of all fire protection systems, including equipment and devices, to ensure the safety and welfare of the occupants. Fire protection systems shall not be disconnected or otherwise rendered unserviceable without first notifying the local fire department in accordance with M.G.L. c. 148 § 27A.

When installations of fire protection systems are interrupted for repairs or other necessary reasons, the owner, tenant or lessee shall immediately advise the local fire department and shall diligently prosecute the restoration of the protection.

901.5 Threads: All threads provided for fire department connections to *sprinkler systems, standpipes,* yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department.

901.6 Signs: All signs required to identify fire protection equipment, equipment rooms and equipment locations shall be constructed of durable materials, be permanently installed and be readily visible. Letters and numbers shall contrast with the sign background, shall be at least two inches in height and shall have an appropriate width-to-height ratio to permit the sign to be read easily from a distance of ten feet. The sign and location shall be approved by the local fire department.

Exception: See also 780 CMR 906.8 for entrance doors to sprinkler control valve rooms and 780 CMR 915.8 for fire department connections.

780 CMR 902.0 DEFINITIONS

902.1 General: The following words and terms shall, for the purposes of 780 CMR 9 and as used elsewhere in 780 CMR, have the meanings shown herein.

Alarm verification: A feature of automatic fire detection systems to reduce unwanted alarms wherein *automatic fire detectors* report alarm conditions for a minimum period of time, or confirm alarm conditions within a given period, after being automatically reset to be accepted as a valid alarm initiation signal (see 780 CMR 918.0).

Approval/Permit To Install: The term refers to permits outside the jurisdiction of the building official, issued under authority of M.G.L. c. 148, § 10A or 527 CMR.

Authority Having Jurisdiction: The term "Authority Having Jurisdiction" as used in the NFPA Standards as referenced in 780 CMR 9, shall mean the building official for enforcement of 780 CMR and the BBRS for interpretation, waiver or variences (see 780 CMR 122.0; see official interpretation number 35-94 listed in Appendix B)

Automatic: As applied to fire protection devices, automatic refers to a device or system that provides an emergency function without the necessity of human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise or increase in the level of combustion products - such as incorporated in an *automatic sprinkler system, automatic fire door, etc.*

Automatic fire suppression system: An engineered system using carbon dioxide (CO_2), foam, wet or dry chemical, a halogenated extinguishing agent, or an *automatic sprinkler system* to detect automatically and suppress a fire through fixed piping and nozzles (see 780 CMR 904.0).

Construction Documents: As defined in 780 CMR 2.

Deluge system: An *automatic sprinkler system* consisting of open *sprinklers* with *water supply* valves activated by a separate automatic detection system (see 780 CMR 908.0).

Detector, heat: An alarm-initiating device that detects abnormally high temperature or rate of temperature rise (see 780 CMR 918.0).

Detector, smoke: An alarm-initiating device that detects the visible or invisible particles of combustion (see 780 CMR 918.0).

Emergency Voice/alarm signaling system: A system that provides, to the occupants of a building, dedicated manual or automatic facilities, or both, for originating and distributing voice instructions, as well as alert and evacuation signals that pertain to a fire emergency (see 780 CMR 917.0).

Fire alarm box, manual: A manually operated alarm-initiating device that activates a fire protective signaling system (see 780 CMR 917.0).

Fire command station (Fire command center): The principal location where the status of the detection, alarm, communications and control systems is displayed, and from which the system(s) has the capability for manual control (see 780 CMR 403.7 and 917.9).

Fire Department Designee: An individual authorized by the chief of the fire department to review and approve fire protection system plans and installation.

Fire detector, automatic: An alarm-initiating device that automatically detects heat, smoke or other products of combustion (see 780 CMR 918.0).

Fire Protection Construction Documents: Documents containing the requirements of 780 CMR 903.1.1, 903.1.2, 903.1 .3.

Fire protection system: Devices, equipment and systems used to detect a fire, activate an alarm, suppress or control a fire, or any combination thereof.

Fire Protective Signaling System (Fire Alarm System): A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal initiating devices and to initiate appropriate response to those signals.

Household Fire Warning System: A household fire warning system consists of single or multiple station detectors or a listed control unit with automatic fire detectors and occupant notification appliances. The household fire warning system serves only one dwelling unit, patient room, hotel room or other single area depending on use group requirements in 780 CMR 919.1 through 919.3

Installing Contractor: An individual or firm duly licensed to install fire protection systems. (See 780 CMR 903.3)

- ***Automatic Sprinklers Systems - M.G.L. c. 146, §§ 81 through 85A, 528 CMR 11.00 and 12.00***
- ***Fire Extinguishing systems - M.G.L. c. 148, §§ 58, 527 CMR 23.00***
- ***Fire Alarm Systems - M.G.L. c. 141, §§ I through 10, 237 CMR 1.00 through 6.00***

Maintenance of Fire Protections Systems: Replacement or repair of any component or components of a fire protection system, where such does not affect system performance and compatibility. (Also see *Modifications, Alterations, Additions or Deletions to Fire Protection Systems*). No building permit is required for maintenance. Other permits, however, may be required pursuant to M.G.L. c.148, § 27A and 527 CMR.

Modifications, Alterations, Additions or Deletions to Fire Protection Systems: Any changes which affect the performance of the fire protection system. (Also see *maintenance*). Such changes require a building permit and are subject to other permitting requirements pursuant to M.G.L. c. 148, § 27A.

Master Box: A municipal fire alarm box that may also be operated by remote means.

Municipal Fire Alarm System: A system of alarm initiating devices, receiving equipment, and connecting circuits (other than a public telephone network) used to transmit alarms from street locations to the public fire service communications center.

Preaction system: A fire *sprinkler* system employing automatic *sprinklers* attached to a piping system containing air with a supplemental fire detection system installed in the same areas as the *sprinklers.* Actuation of the fire detection system automatically opens a valve that permits water to

flow into the *sprinkler* piping system and to be discharged from any open *sprinklers* (see 780 CMR 906.9.6).

Proprietary supervising station: Refer to the definition in chapter 1 of NFPA-72 and to further details as identified in chapter 4 of NFPA-72 as listed in Appendix A.

Registered Professional Engineer: A Registered Professional Engineer registered by the Board of Registration of Professional Engineers and of Land Surveyors in accordance with M.G.L. c. 112, §§ 81D through 81T and 250 CMR (see 780 CMR 903.1.3 and 903.5).

Remote station fire alarm system supervising station: Refer to the definitions in chapter 1 of NFPA-72 and to further details as identified in chapter 4 of NFPA-72 as listed in Appendix A.

Shop Drawings: Scaled detailed working drawings (system layout) and equipment specifications (cut sheets) indicating all information in accordance with requirements of the applicable NFPA Standards for the specific fire protection systems to be installed in accordance with the Registered Professional Engineer's plans and specifications.

NON-TEXT PAGE

Smoke detector, multiple station: Single-station smoke detectors that are capable of being interconnected such that actuation of one causes all integral or separate audible alarms to operate (see 780 CMR 919.0).

Smoke detector, single station: An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, which is operated from a power supply either in the unit or obtained at the point of installation (see 780 CMR 919.0).

Sprinkler: A device, connected to a *water supply* system, that discharges water in a specific pattern for extinguishment or control of fire (see 780 CMR 906.0).

Sprinkler system, automatic: A *sprinkler* system, for fire protection purposes, is an integrated system of underground or overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable *water supply.* The portion of the system above the ground is a network of specially or hydraulically designed piping installed in a building, structure or area, generally overhead, and to which automatic *sprinklers* are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the *fire area* (see 780 CMR 906.0).

Sprinkler system, limited area: An *automatic sprinkler system* consisting of not more than 20 *sprinklers* within a *fire area* (see 780 CMR 907.0).

Standpipe system: A *standpipe* system is a *fire protection system* consisting of an arrangement of piping, valves, hose outlets and allied equipment installed in a building or structure (see 780 CMR 914.0).

Supervisory device: An initiating device used to monitor the conditions that are essential for the proper operation of *automatic fire-protection systems* (i.e., switches used to monitor the position of gate valves, a low air-pressure switch on a dry-pipe *sprinkler system,* etc.) (see 780 CMR 923.0).

U.L. Listed or FM approved central station service: Central station service as defined in Chapter 1 of NFPA-72 and as further identified in chapter 4 of NFPA 72 as listed in Appendix A.

Water supply, automatic: A water supply that is not dependent on any manual operation, such as making connections, operating valves or starting pumps (see 780 CMR 914.5).

780 CMR 903.0 FIRE PROTECTION SYSTEMS APPROVAL/ACCEPTANCE

903.1 Required: Complete *fire protection construction documents* shall be submitted in accordance with 780 CMR 110 and a building permit obtained prior to the installation of all "required" or "non required" fire protection systems, including *modifications, alterations, additions or deletions* to an existing fire protection system. The *fire protection construction documents* shall contain sufficient information to completely describe the *fire protection systems*, including operational features. The information required pursuant to 780 CMR 903.0 shall include, where required, the items listed in 780 CMR 903.1.1:

Exception: *Maintenance*; no building permit required.

903.1.1 Fire Protection Construction Documents:

1. a. Basis (methodology) of design for the protection of the occupancy and hazards for compliance with 780 CMR and applicable NFPA Standards, in the form of a narrative report.
   b. Sequence of operation of all fire protection systems and operation in the form of a narrative report.
   c. Testing criteria to be used for final system acceptance in the form of a narrative report.
2. Building and site access for fire fighting and/or rescue vehicle(s) and personnel.
3. Fire hydrant(s) location and water supply information.
4. Type/description and design layout of the automatic sprinkler system(s).
5. Automatic sprinkler system(s) control equipment location.
6. Type/description and design layout of the automatic standpipe system(s).
7. Standpipe system hose valve(s) type and location.
8. Fire department siamese connection type(s) and location.
9. Type/description and design layout of the fire protective signaling system(s).
10. Fire protective signaling system(s) control equipment and remote annunciator location.
11. Type/description and design layout of the smoke control or exhaust system(s).
12. Smoke control or exhaust system(s) control equipment location.
13. Building life. safety system features (auxiliary functions) required to be integrated as part of the fire protective signaling system(s).
14. Type/description and design layout of the fire extinguishing system(s).
15. Fire extinguishing system(s) control equipment location.

16. Fire protection system(s) equipment room location.
17. Fire protection system(s) equipment identification and operation signs.
18. Fire protection system(s) alarm/ supervisory signal transmission method and location.

903.1.2 Plans: All fire protection system plans shall contain sufficient information to identify the occupancy, hazards, system and equipment arrangements, system and equipment sizing, systems specifications, systems sequence(s) of operation and design/engineering calculations.

903.1.3 Design: All fire protection systems and fire protection system operation including building and site features as identified in 780 CMR 903.1 1 shall be designed and specified by a qualified *Registered Professional Engineer(s)*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. All plans shall bear the original seal and signature of the *Registered Professional Engineer(s),* 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. Specifications shall include requirements for the preparation of shop drawings when required by 780 CMR or applicable NFPA Standards. The *Registered Professional Engineer(s) or other legally recognized professional (M.G.L. c. 112, § 81R) shall* be responsible for the review and certify that all shop drawings conform to the approved fire protection *construction documents* as submitted for the building permit and approved by the building official.

903.1.4 As-built plans: In accordance with the applicable referenced standards, as-built plans shall be prepared by the contractor responsible for the installation of the fire protection system for the following occupancies:

(a) High-rise buildings
(b) Buildings and structures of Use Group A with a total occupant load exceeding 1000.
(c) Buildings and structures of Use Group H.
(d) Use Group I-2 and I-3 except I-2 Uses provided for in 780 CMR 424.
(e) Bulk Merchandising/Retail occupancies (See 780 CMR 416.0).

As-built plans shall be provided to the owner upon completion.

903.1.5 Safeguarding Construction: The *fire protection construction documents* shall provide specifications for conformance to 780 CMR 33 and NFPA-241 listed in *Appendix A* in order to safeguard against fires during construction, alterations and demolition of all buildings and structures regulated by 780 CMR.

903.2 Authority: In accordance with the requirements of 780 CMR 110 and 780 CMR 903.1 the building of official shall transmit one set of the *fire protection construction documents* (780 CMR 903.1.1) and *building construction documents* to the head of the fire department or his designee for review and approval of the items specified in 780 CMR 903.1.1.

Note:
1. M.G.L. c. 148 §§ 26G, 26H and 26I, when adopted by a city or town, will impact the fire protection requirements of 780 CMR 9. A building official shall consult *Official Interpretation* Number 45-96, listed in Appendix B, for guidance, where communities have adopted M.G.L. c. 148, §§ 26G, 26H, and/or 26I.
2. In addition to the building permit requirements for fire protection systems in 780 CMR, M.G.L. c. 148 § 10A and 527 CMR may impose additional installation permitting requirements.

903.2.1 Alternative Fire Protection Design Methodologies - Independent Engineering Review: Where alternative design methodologies are utilized and where such methodologies result in designs which vary from any prescriptive requirement of 780 CMR, the owner shall engage an independent registered professional engineer to review said alternative design methodologies. The scope of the independent registered professional engineer review shall include, but not be limited to the following;

(a) Review of the design assumptions, methodologies and resulting proposed system designs, to determine whether the proposed fire protection system designs and any other systems which are affected by the design assumptions, are consistent with the general objectives and prescriptive provisions of this code and to determine whether or not the methodologies and assumptions conform to accepted engineering practice;
(b) Preparation of a written report to the building official as to the appropriateness of the proposed design, specifically listing any variances from the prescriptive provisions of 780 CMR and describing, in detail, the design provisions used to achieve compliance.

If the reviewing engineer concurs with the proposed design, the owner shall make application for a variance, to the State Building Code Appeals Board as provided in 780 CMR 122. In addition to all supporting information and materials, the reviewing engineer's report required in 780 CMR 903.2.1(b) shall be included in the application for variance.

A building permit shall not be issued until the variance, if required, has been granted, or unless the building permit is issued in part, as provided for in 780 CMR 111.13.

903.3 Fire Protection Systems Installation: Fire protection systems shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts (***licensed installing contractor***). Shop drawings required for submittals and reviews by the *Registered Professional Engineer*, or other legally recognized professional (M.G.L. c. 112,§ 81R), by 780 CMR 903.1.3 or by applicable NFPA Standards shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing the fire protection systems.

903.4 Acceptance: In accordance with the provisions of 780 CMR 120, a Certificate of Occupancy shall not issue until the building official and the head of the fire department or their designees have witnessed a satisfactory functional test of all *fire protection systems,* installed in accordance with the approved *fire protection construction documents*. All fire protection systems shall be tested in accordance with the applicable provisions of 780 CMR and NFPA Standards and approved testing criteria and operational sequence as submitted in 780 CMR 903.1.1, items 1.b and c. In addition, the following documents and/or information shall be simultaneously submitted to the building official and head of the fire department or their designees prior to the witnessing of the operational fire protection system(s) testing:

1. Certification, from the *Registered Professional Engineer* or other legally recognized professional (M.G.L. c. 112, § 81R) responsible for the design in accordance with 780 CMR 903.1.3 stating that the fire protection systems have been installed in accordance with the approved *fire protection construction* documents and that he has reviewed the shop drawings for conformance to 780 CMR 903.3 and has identified deviations if any, from the approved *fire protection construction documents*.
2. Confirmation by the building owner/developer or authorized representative that they have received the as-built fire protection system shop drawings from the *installing contractor* and that *the Registered Professional Engineer* or other legally recognized professional (M.G.L. c. 112, § 81R) has certified their reasonable accuracy.
3. Material, Test, Performance and Completion Certificates, properly executed by the *installing contractor* in accordance with the applicable NFPA Standards.

Exception: In lieu of witnessing a satisfactory functional test, the building official and head of the fire department 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 a complete satisfactory functional test of all fire protection systems in accordance with the approved testing criteria and operational sequence have been witnessed.

903.4.1 Conditional Acceptance: The requirements of 780 CMR 903.4 shall not preclude the issuance of a temporary Certificate of occupancy by the Building Official in accordance with 780 CMR 120.3.

780 CMR 904.0 FIRE SUPPRESSION SYSTEMS

904.1 Where required: *Automatic fire suppression systems* shall be installed where required by 780 CMR, and in the locations indicated in 780 CMR 904.2 through 904.9.

Exceptions:

1. An *automatic fire suppression system* shall not be required in portions of buildings that comply with 780 CMR 406.0 for open parking structures less than 70 feet in height above mean grade.
2. In telecommunications equipment buildings, an *automatic fire suppression system* shall not be required in those spaces or areas occupied exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an *automatic fire detection system* in accordance with 780 CMR 918.0 and are separated from the remainder of the building with fire separation assemblies consisting of one-hour fireresistance rated walls and two-hour fireresistance rated floor/ceiling assemblies.

Note: Also Refer to M.G.L. c. 148, § 26A and 26G

904.1.1 Additional requirements: When a building or structure is provided with a fire alarm system, all extinguishing systems installed in accordance with the provisions of 780 CMR 904 through 914, shall be connected to the fire alarm system in accordance with the requirements of NFPA 72 as listed in *Appendix A*.

904.1.1.1 Fire pump requirements: Refer to 780 CMR 924.

904.2 Use Groups A-1, A-3, A-4, B, E, M, S-1, F-1 in buildings of 12,000 sf or greater in aggregate floor area: An automatic fire suppression system shall be provided throughout all portions or uses of all buildings of 12,000 sf or greater in aggregate area when any of the following *uses* are located within the building;

A-1, A-3, A-4, B, E, M, S-1, F-1

780 CMR 904.2 shall apply whether or not the *use* is separated from any other *use* within the building by *fire separation assemblies.*

Exceptions:

1. Existing buildings: *Existing buildings* which qualify as such in accordance with 780 CMR

3400.3.1 and which undergo a partial change in *use* to a *use* or *uses* specified in 780 CMR 904.2 or are mixed *use* buildings which undergo renovation of a *use* or *uses* specified in 780 CMR 904.2, shall be provided with automatic fire suppression systems in accordance with the following:

(a) only in those portions of the building which have been changed in *use* and only when such space or spaces exceed 12,000 sf in *aggregate* floor area.

(b) only in those portions of the building which have been altered or renovated provided that such renovation constitutes *substantial alterations or substantial renovations*, in accordance with 780 CMR 3401 and only when such space or spaces exceed 12,000 sf in aggregate floor area.

2. Public Garages: Public Garages shall conform to 780 CMR 408.0.

Note: See also M.G.L. c. 148, §§ 26A and 26G.

904.3 Use Group A-2 in buildings of 5,000 sf or greater in aggregate floor area: An *automatic fire suppression system* shall be provided throughout all portions or *uses* of all buildings of 5,000 sf or greater in aggregate area when any A-2 *use* is located within the building;

780 CMR 904.3 shall apply whether or not the A-2 *use* is separated from any other *use* within the building by *fire separation assemblies*.

Exception:

1. Existing buildings: *Existing buildings* which qualify as such in accordance with 780 CMR 3400.3.1 which undergo a partial change in *use* to an A-2 *use* or partial renovation of an existing A-2 *use* shall be provided with an automatic fire suppression system only in those portions of the building which have been changed to an A-2 *use* or those existing A-2 *uses* which have been renovated when such renovation constitutes *substantial alterations or substantial renovations*, in accordance with 780 CMR 3401 and only when the proposed or existing A-2 *use* exceeds 5,000 sf in aggregate floor area.

904.4 Use Group H: An *automatic fire suppression system* shall be provided throughout all buildings of Use Group H.

Exception: Magazines used for the storage of Use Group H-1 materials which are constructed and located in accordance with NFPA 495 and 527 CMR listed in *Appendix A*.

Note: See also M.G.L. c. 148, §§ 26A and 26G.

904.5 Use Group I: An *automatic fire suppression system* shall be provided throughout all buildings of Use Group I.

Note: See also M.G.L. c. 148, §§ 26A and 26G.

904.6 Use Group R-1: An *automatic fire suppression system* shall be provided throughout all buildings or spaces of Use Group R-1 in accordance with 780 CMR 906.2.1 or 906.2.2.

904.7 Use Group R-2: An *automatic fire suppression* system shall be provided throughout all buildings with an occupancy in Use Group R-2 in accordance with 780 CMR 906.2.1 or 906.2.2.

Note: See also M.G.L. c. 148, §§ 26A and 26I.

904.8 Windowless story: An *automatic fire suppression system* shall be provided throughout every story or *basement* of all buildings where there is not provided at least one of the following types of openings:

1. An exterior *stairway* that conforms to the requirements of 780 CMR 1014.0, or an outside ramp that conforms to the requirements of 780 CMR 1016.0, leading directly to grade in each 50 linear feet (15240 mm) or fraction thereof of exterior wall in the story or *basement*, on at least one side of the building.
2. Openings entirely above the adjoining ground level totaling 20 square feet (1.9 m^2) in each 50 linear feet (15240 mm) or fraction thereof of exterior wall in the story or *basement*, on at least one side of the building. Openings shall have a least dimension of not less than 22 inches (559 mm), and shall have a minimum net clear opening of five square feet (0.5m^2). Access to such openings from the exterior shall be provided to the fire department and such openings shall be unobstructed to allow fire-fighting and rescue operations from the exterior.

When openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22860 mm) from such openings, the story shall be equipped throughout with an *automatic sprinkler system*, or openings as specified herein shall be provided on at least two sides of the exterior walls of the story. If any portion of a basement is located more than 75 feet (22860 mm) from the openings required in 780 CMR 904.0, the *basement* shall be provided with an *automatic sprinkler system*.

Exception: Occupancies in Use Group R-3.

904.9 Other required suppression systems: In addition to the requirements of 780 CMR 904.2 through 904.8, *automatic fire suppression systems* for certain buildings and areas shall be provided in accordance with Table 904.9.

Table 904.9
ADDITIONAL REQUIRED SUPPRESSION SYSTEMS(1)

780 CMR Section	Subject
302.1.1	Specific occupancy areas
402.10; 402.15.2	Covered mall buildings
403.2	High-rise buildings
404.2	Atriums
408.3.1	Public garages
408.4	Fuel-dispensing areas
426.0	Bulk Merchandizing/Warehouse Occupancies
780 CMR Section	Subject
411.7	Sound stages
412.6	Stages and enclosed platforms
413.4	Special amusement buildings
416.4	HPM facilities
419.3	Paint spray booths and storage rooms
	Open parking structures more than 70 feet in height above the mean grade (M.G.L. c. 148, § 26A)
507.1	Unlimited area buildings
1020.3	Exit lobbies
2806.4	Drying rooms
2807.6	Waste and linen chutes and termination and incinerator rooms
2808.4	Refuse vaults

Note (1) See also M.G.L. c. 148, §§ 26A, 26G, 26H, and 26I.

780 CMR 905.0 SUPPRESSION SYSTEM AGENT COMPATIBILITY

905.1 Agent compatibility: The extinguishing agent for each *suppression system* shall be compatible with the type of hazard and fire. Each fixed *fire suppression system* shall be of an approved type and shall be designed and installed in accordance with the requirements of 780 CMR.

905.1.1 Special hazards: In rooms or buildings containing combustibles (such as aluminum powder, calcium carbide, calcium phosphide, metallic sodium and potassium, quick-lime, magnesium powder or sodium peroxide) that are incompatible with water as an extinguishing agent, other extinguishing agents shall be utilized.

780 CMR 906.0 FIRE SPRINKLER SYSTEM

906.1 General: *Automatic sprinkler systems* shall be approved and shall be designed and installed in accordance with the provisions of 780 CMR.

906.2 Equipped throughout: Where the provisions of 780 CMR require that a building or portion thereof be equipped throughout with an *automatic sprinkler system*, the system shall be designed and installed in accordance with 780 CMR 906.2.1, 906.2.2 or 906.2.3.

Exception: Where water as an extinguishing agent is not compatible with the fire hazard (see 780 CMR 905.1) or is prohibited by a law, statute or ordinance, the affected area shall be equipped with an approved *automatic fire suppression system* utilizing a suppression agent that is compatible with the fire hazard.

906.2.1 NFiPA 13 systems: The system shall be designed and installed in accordance with NFiPA 13 listed in ***Appendix A***.

906.2.2 NFiPA 13R systems: In buildings four stories or less in height, systems designed and installed in accordance with NFiPA 13R listed in ***Appendix A*** shall be permitted in Use Group I-1 buildings with not more than 16 occupants and in Use Group R buildings.

906.2.3 NFiPA 13D systems: In Use Group R-3 buildings with at least two-hour fireresistance rated *fire separation assemblies* between *dwelling units*, or in Use Group I-1 buildings with not more than eight occupants, systems designed and installed in accordance with NfiPA 13D listed in ***Appendix A*** shall be permitted.

906.3 Design: Design documentation shall be in accordance with 780 CMR 903.

906.4 Actuation: Water *sprinkler systems* shall be automatically actuated unless otherwise specifically provided for in 780 CMR.

906.5 Sprinkler alarms: Approved audible and visual alarm devices shall be connected to every water *sprinkler system*. Such alarm devices shall be activated by water flow and shall be located in an approved location on the exterior of the building and throughout the building in accordance with the requirements of NFPA-72 listed in ***Appendix A***.

906.6 Water-control valve identification: All valves controlling water to *fire protection systems* shall be provided with permanently attached identification tags indicating the valves' function and what is controlled.

906.7 Sprinkler riser: A *sprinkler system* riser which also serves as the wet standpipe riser in buildings required to have or having both systems, shall conform to 780 CMR 914.6.

906.8 Signs: Where sprinkler control valves are located in a separate room or building, a sign shall be provided on the entrance door. The lettering shall be at least 2½ inches (63.5 mm) in height and shall otherwise conform to 780 CMR 901.6 and shall read "Sprinkler Control Valves."

906.9 Acceptance tests: All *sprinkler systems* shall be tested in accordance with the applicable NFPA

Standards used for *sprinkler system* design and Installation and listed in ***Appendix A***.

906.9.1 Underground connections: Underground mains and lead-in connections shall be flushed and tested in accordance with NFiPA 13 and 24 listed in ***Appendix A***.

906.9.2 Hydrostatic test: All *sprinkler systems* shall be tested hydrostatically in accordance with the applicable NFPA Standards listed in ***Appendix A***.

780 CMR 907.0 LIMITED AREA SPRINKLER SYSTEMS

907.1 General: A *limited area sprinkler system* shall be of an approved type and shall be installed in accordance with the provisions of 780 CMR 907.0. Complete *fire protection construction documents* shall be provided. (See 780 CMR 903.0.)

907.2 Where permitted: Where the provisions of 780 CMR require the installation of a *fire suppression system*, and a water *sprinkler* extinguishing system is used with a limited number of *sprinklers*, a *limited area sprinkler system* that complies with the requirements of 780 CMR 907.0 is permitted to be installed.

907.2.1 Special occupancy areas: A *limited area sprinkler system* shall be permitted within special occupancy areas as designated in 780 CMR 4 or within specific occupancy areas as designated in 780 CMR 302.1.1, provided that the area is enclosed within *fire separation assemblies* as required by 780 CMR, and 20 *sprinklers* or less are required to protect each separately enclosed area. Where nonfireresistance rated separation walls are permitted by Table 302.1.1 to enclose contiguous specific occupancy areas on one floor, the areas shall be considered to be one separately enclosed area for the purposes of determining the number of *sprinklers* based on the spacing limitations of NFPA 13 listed in ***Appendix A***.

907.2.2 Unenclosed floor openings, waste and linen chutes, and kitchen and hazardous exhaust systems: A *limited area sprinkler system* shall be permitted to protect unenclosed *escalator* floor openings that comply with 780 CMR 907.2.2.1, chutes used for waste or linen collection, commercial kitchen exhaust systems and duct systems that exhaust *hazardous materials*.

907.2.2.1 Water curtain: The area of the floor opening shall not exceed twice the horizontal projected area of the *escalator* and the opening shall not connect more than four stories in occupancies in other than Use Groups B and M and the opening shall be protected by a draft curtain and a closed *sprinkler* water system conforming to NfiPA 13 listed in ***Appendix A***.

Note: Relative to escalator floor openings, also see 780 CMR 713.3.

907.3 Design: Except as otherwise provided for in 780 CMR 907.0, a *limited area sprinkler system* shall be designed and installed in accordance with 780 CMR 906.0.

907.4 Actuation: A *limited area sprinkler system* shall be automatically actuated.

907.5 Sprinkler alarms: Alarms and alarm attachments shall be required and shall be located and installed in accordance with the requirements of 780 CMR 906.5.

907.6 Standpipe connection: The *water supply* for the *limited area sprinkler system* shall be from the building *standpipe system* where the building is equipped with a *standpipe system* that is sized for a 500-gallon-per-minute (0.032 m^3/s) minimum flow and has an *automatic water supply* (see 780 CMR 914.5).

907.6.1 Domestic supply: Where *limited area sprinkler systems* are supplied from the domestic water system, the domestic water system shall be designed to support adequately the design flow of the largest number of *sprinklers* required to be hydraulically calculated by NFiPA 13 listed in ***Appendix A*** in any one of the enclosed areas plus the domestic demand.

907.6.2 Cross connection: The potable water supply shall be protected against backflow in accordance with the requirements of the Plumbing and Gas Code (248 CMR), and the Department of Environmental Protection Regulations, 310 CMR as listed in ***Appendix A*** as well as any cross-connection protection criteria legally set forth by the water supplier/purveyor having local jurisdiction.

907.6.3 Domestic connection: Shutoff valves shall not be permitted in the *suppression system* piping. *Water supply* shall be controlled by the riser control valve to the domestic water piping.

Exception: Shutoff valves in the *sprinkler system* piping are permitted provided that such valves are supervised in accordance with 780 CMR 923.0.

907.7 Acceptance tests: All limited area *sprinkler systems* shall be tested as stipulated in 780 CMR 906.9.

780 CMR 908.0 WATER-SPRAY FIXED SYSTEMS

908.1 General: Water-spray fixed systems for fire suppression shall be of an approved type and shall be installed in accordance with the provisions of 780 CMR and NFiPA 15 listed in ***Appendix A***. A water-spray fixed system is a system connected to a reliable source of water supply and equipped with normally open water-spray nozzles for specific

780 CMR 913.0 WET-CHEMICAL RANGE HOOD EXTINGUISHING SYSTEMS

913.1 General: Wet-chemical extinguishing systems shall be installed in accordance with the provisions of 780 CMR 913.0, and the BOCA Mechanical Code and NFiPA 17A listed in *Appendix A*. The system shall bear the *label* of an *approved agency* and shall be installed in accordance with the manufacturer's installation instructions. A wet-chemical system is a solution of water and potassium-car-bonate-based chemical, potassium-acetate-based chemical or a combination thereof which forms the extinguishing agent.

913.2 Design: The details of the system indicated on the *fire protection construction documents* shall include sufficient information and calculations on the amount of wet chemical; the size, length and arrangement of connected piping; and a description and location of nozzles so that the adequacy of the system can be determined. Information shall be submitted pertaining to the location and function of *detecting devices*, operating devices, auxiliary equipment and electrical circuitry, if used. Sufficient information shall be indicated to identify properly the apparatus and devices used. Any special features shall be adequately explained. (See 780 CMR 903.0.)

913.3 Actuation: Wet-chemical extinguishing systems shall be automatically actuated and shall be provided with a manual means of actuation.

913.4 Safety requirements: Where persons will be exposed to a wet-chemical discharge, warning signs and discharge alarms shall be provided.

913.5 Acceptance tests: All wet-chemical extinguishing systems shall be tested in accordance with NFiPA 17A listed in *Appendix A*. A completed system shall be tested by discharge of wet chemical in sufficient amounts to verify that the system is properly installed and functional. Tests shall include a check of the detection systems, the alarms and the releasing devices, including manual stations, fuel and power shutoff devices and other associated equipment.

913.5.1 Discharge test: All systems shall be tested by a discharge of expellant gas through the piping and nozzles with observations being made of the flow of expellant gas through all nozzles as well as observing for leakage and continuity of piping with free unobstructed flow.

780 CMR 914.0 STANDPIPE SYSTEMS

914.1 General: Standpipe systems shall be designed, installed and maintained in accordance with the provisions of 780 CMR and NFPA-14 listed in *Appendix A*. Where *standpipe systems* are required by 780 CMR, such systems shall be automatic wet systems. Automatic dry and semi-automatic dry *standpipe systems* shall be permitted only in areas subject to freezing. Complete *fire protection construction documents* shall be provided. (See 780 CMR 903.0.)

914.2 Where required: Class III *standpipe systems* shall be installed where required by 780 CMR 914.2.1 through 906.2.11 and shall be located in accordance with the provisions of NFPA 14, listed in *Appendix A*.

914.2.1 Use Group A: In all buildings or structures or portions thereof of Use Group A when:

1. Two or more stories in height of Use Group A-1, A-2, or A-3, and having an occupant load or more than 300; or;
2. Three or more stories in height regardless of the area per floor; or;
3. Having an auditorium seating over 500. Standpipes shall be located one on each side of the auditorium in each tier, one in each mezzanine, one in each tier of dressing rooms, and protecting each property, store and work room; or;
4. Having a stage. Standpipes shall be located on each side of the stage.

Such standpipes shall be not less that 2½-inch diameter, equipped with approved 1½ inch hose station.

914.2.2 Use Group B: In all buildings or structures or portions thereof of Use Group B when:

1. Three or more stories in height, and more than 3,000 square feet in area per floor; or;
2. Four or more stories in height regardless of the area per floor.

914.2.3 Use Group E: In buildings or structures or portions thereof of Use Group E when three or more stories in height regardless of the area per floor or when having a stage or auditorium in accordance with 780 CMR 914.2.1(3) and 914.2.1(4).

914.2.4 Use Group F: In all buildings or structures or portions thereof of Use Group F when:

1. Three or more stories in height, and more than 3,000 square feet in area per floor, or;
2. Four or more stories in height regardless of the area per floor.

914.2.5 Use Group H: In all buildings or structures or portions thereof of Use Group H when:

1. Three or more stories in height, and more than 10,000 square feet in area per floor; or;
2. Four or more stories in height, regardless of the area per floor.

914.2.6 Use Group I: In all buildings or structures or portions thereof of Use Group I, three or more stories in height, regardless of the area per floor.

914.2.7 Use group M: In all buildings or structures or portions thereof of Use Group M when:

1. Three stories or more in height, and more than 3,000 square feet in area per floor, or;
2. Four or more stories in height regardless of the area per floor, or;
3. Classified as a covered mall building within the mall portions (see 780 CMR 4).
4. Classified as a bulk/merchandising warehouse. (See 780 CMR 4.)

914.2.8 Use Group R-1 and R-2: In all buildings or structures or portions thereof of Use Group R-1 and R-2 when:

1. Three or more stories in height and of Use Group R-1 regardless of the area per floor; or;
2. Three or more stories in height and more than 10,000 square feet in area per floor, or;
3. Four or more stories in height regardless of the area per floor.

914.2.9 Use Group S: In all buildings or structures or portions thereof of Use Group S, other than public garages which shall conform to 780 CMR 914.2.10 when:

1. Three or more stories in height, or Use Group S-1, and more than 3,000 square feet in area per floor; or;
2. Three or more stories in height, Use Group S-2, and more than 10,000 square feet in area per floor; or;
3. Four or more stories in height of Use Groups S-1 or S-2 regardless of the area per floor.

914.2.10 Use Group U: In all buildings or structures or portions thereof of Use Group U when:

1. Three or more stories in height and more than 10,000 square feet in area per floor; or;
2. Four or more stories in height regardless of the area per floor.

914.2.11 Public Garages: In all Group I and 11 public garages and open parking structures when:

1. More than 10,000 square feet in area per floor; or;
2. More than 7,500 square feet in area per floor and more than **one story** in height; or;
3. More than 5,000 square feet in area per floor, and more than two stories in height; or;
4. More than three stories in height; or;
5. Located in buildings where the upper stories are designed for other uses: or;
6. When located in any story that is more than 50% below grade.

Exception: Standpipe systems can be "Class I Manual Dry Type" as defined by NFPA-14 for open parking structures less than 70' in height.

914.3 Standpipe system piping sizes: The riser piping, supply piping, and the water service piping shall be hydraulically sized in accordance with the provisions of NFPA-14 listed in ***Appendix A***.

Exception: The residual pressure(s) as noted in NFPA-14 are not required to be maintained in buildings less than 70 feet in height which are equipped throughout with an approved automatic fire suppression system. However the system shall be designed to accommodate the outlet pressures and water flows in accordance with NFPA 14 and inlet pressures consistent with local fire department equipment..

914.4 High-rise buildings: All buildings more than 70 feet in height above the mean grade shall have each floor supplied by a minimum of two combination standpipe/sprinkler risers installed in accordance with the requirements of NFPA-14, listed in ***Appendix A***.

914.5 Outlets: Standpipe system outlets shall comply with the provisions for, Class III Systems of NFPA-14 as listed in ***Appendix A***.

914.6 Acceptance Tests: All Standpipe systems shall be tested in accordance with NFPA listed in ***Appendix A***.

914.6.1 Underground Connections: Underground mains and lead-in connections shall be flushed and tested in accordance with NFPA 14 and NFPA 24 listed in ***Appendix A***.

914.7 Standpipe system requirements for buildings under construction or demolition:

914.7.1 General: Standpipes required by 780 CMR 914.7 are to be either temporary or permanent in nature, with or without a water supply, provided, however, that such standpipes conform to the requirements of 780 CMR 914.0 as to number of risers, capacity, outlets and materials.

914.7.2 Buildings under construction or demolition: Standpipe requirements for buildings under construction or demolition shall be in accordance with the provisions of 780 CMR 3305.3 and NFPA 241 as listed in ***Appendix A***.

780 CMR 915.0 FIRE DEPARTMENT CONNECTIONS

915.1 Required: All required water fire-extinguishing and *standpipe systems* shall be provided with a fire department connection in accordance with the applicable NFPA standards. Standpipes in buildings under construction or

demolition shall conform to 780 CMR 3305.3 and NFPA 241 listed in *Appendix A*.

Exceptions:
1. *Limited area sprinkler systems* supplied from the domestic water system.
2. Where the local fire department approves a single connection for large diameter hose of at least four inches.
3. An *automatic sprinkler system* with less than 20 *sprinklers*.

915.2 Connections: Fire department connections shall be arranged in such a manner that the attachment to any one water *sprinkler* connection will serve all sprinklers, and the attachment to any one standpipe connection will serve all *standpipes* within the building.

915.3 Location: Fire department connections shall be located and shall be visible on a street front or in a location approved by the fire department. Such connections shall be located so that immediate access is provided to the fire department. Fire department connections shall not be obstructed by fences, brushes, trees, walls or any other similar object.

915.4 Height: Fire department connections shall not be less than 18 inches (457 mm) and not more than 42 inches (1067 mm) in elevation, measured from the ground level to the centerline of the inlets.

915.5 Projection: Where the fire department connection will otherwise project beyond the property line or into the *public way*, a flush-type fire department connection shall be provided.

915.6 Hose thread: Hose thread in the fire department connection shall be uniform with that used by the local fire department.

915.7 Fittings: Fire department inlet connections shall be fitted with check valves, ball drip valves and plugs with chains or frangible caps.

915.8 Signs: A metal sign with raised letters at least one inch (25 mm) in height shall be mounted on all fire department connections serving *sprinklers* or *standpipes*. Such signs shall read "Automatic Sprinklers" or "Standpipe," or both, as applicable.

780 CMR 916.0 YARD HYDRANTS/ UNDERGROUND FIRE MAINS

916.1 Fire hydrants: Fire hydrants and underground fire mains installed on private property shall be located and installed as directed by the fire department. Hydrants shall conform to the standards of the administrative authority of the jurisdiction and the fire department. Hydrants shall not be installed on a water main less than six inches in diameter. Standards of construction shall be in accordance with NFPA 24 as listed in *Appendix A*.

780 CMR 917.0 FIRE PROTECTIVE SIGNALING SYSTEMS (Fire Alarm System)

917.1 General: Fire protective signaling systems shall be of an approved type and shall be installed in accordance with the provisions of 780 CMR and NFPA 72 listed in *Appendix A*.

917.2 Fire Protection Construction documents: Where a fire protective signaling system is required by 780 CMR, the *fire protection construction documents* shall show the location and number of all alarm-initiating devices and alarm notification appliances, and shall provide a description of all equipment to be used, proposed zoning, a list of auxiliary control functions (i.e., elevator capture), location of the control panel(s) and annunciator(s), and a complete sequence of operation for the system. (Also see 780 CMR 903.0)

917.3 Approval: All devices, combinations of devices, appliances and equipment shall be approved for the fire protective signaling purpose for which such equipment is used.

917.4 Where required: A fire protective signaling system shall be installed and maintained in full operating condition in the locations described in 780 CMR 917.4.1 through 917.4.6.

917.4.1 Use Group A or E: A fire protective signaling system shall be installed and maintained in all occupancies in Use Group A or E.

917.4.2 Use Group B: A fire protective signaling system shall be installed and maintained in all occupancies in Use Group B where such buildings have occupied floors which are two or more stories above the lowest *level of exit discharge or* which have floors two or more stories below the highest *level of exit discharge.*

917.4.3 Use Group H: A fire protective signaling system shall be installed and maintained in all occupancies in Use Groups H.

917.4.4 Use Group I: A fire protective signaling system shall be installed and maintained in all occupancies in Use Group I.

917.4.5 Use Group R-1: A fire protective signaling system shall be installed and maintained in all occupancies in Use Group R-1.

917.4.6 Use Group R-2: A fire protective signaling system shall be installed and maintained in all occupancies in Use Group R-2 containing 13 or more dwelling units or where any *dwelling unit* is located more than three stories above the lowest *level of exit discharge* or more than one

story below the highest *level of exit discharge* of *exits* serving the *dwelling unit.*

917.5 Location: Manual fire alarm boxes shall be located not more than five feet (1524 mm) from the entrance to each *exit.* Manual fire alarm boxes shall be located in each story including basements. In buildings of use group A where a stage is provided, a manual fire alarm box shall be located next to the lighting control panel.

Exception:

1. In buildings of use group A, assembly occupancy, and where approved by the local fire department, manual fire alarm boxes may be omitted at *exits* and any other required locations, but shall be provided at constantly attended locations such as ticket booths, refreshment facilities, bars, etc. Where the building official determines that it is impractical to have a constantly attended location in an assembly occupancy other than a theater, manual fire alarm boxes shall be provided at each required building *exit.*
2. Manual fire alarm boxes are not required in an occupancy in Use Group B where the height of the building is 70 feet or less above the lowest level of fire department vehicle access and the building is equipped throughout with an *automatic sprinkler system,* and/or an *automatic fire detection system* or combination thereof, in accordance with 780 CMR 906.0 and 780 CMR 918.0.

917.5.1 Manual fire alarm boxes: The height of the manual fire alarm boxes shall be a minimum of 42 inches (1067 mm) and a maximum of 54 inches (I372 mm) measured vertically, from the floor level to the activating handle or lever of the box. Manual fire alarm boxes shall be red in color. In all occupancies in Use Group I-3, the manual fire alarm boxes shall be permitted to be locked in areas where staff is present whenever such areas are occupied and keys are readily available to unlock the boxes, or the boxes shall be located in a manned staff location which has direct supervision of the sleeping area.

Exception: Where 521 CMR, Architectural Access Board regulations apply, manual fire alarm box height shall be as prescribed in 521 CMR.

917.6 Power supply: The primary and secondary power supply for the fire protective signaling system shall be provided in accordance with NFPA 72 listed in ***Appendix A.***

917.7 Wiring: All wiring shall conform to the requirements of NFPA 72 and 527 CMR 12.00: Massachusetts Electrical Code listed in ***Appendix A.*** Wireless systems utilizing radio frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72 listed in ***Appendix A.***

917.7.1 Activation: The alarm notification appliances shall be automatically activated by all of the following where provided:

1. Smoke detectors, other than single- and multiple-station smoke detectors, as required by 780 CMR 919.0;
2. *Sprinkler* water-flow devices;
3. Manual fire alarm boxes; and
4 Other approved types of automatic fire detection devices, extinguishing, or *suppression systems.*

Exceptions:

1. Smoke detectors in an occupancy in Use Group I-3 are permitted to actuate an audible alarm-indicating appliance at a constantly attended location and are not required to activate a general alarm.
2. Audible alarms in buildings of Use Group A with an occupant load greater than 300 persons shall sound only in a constantly attended receiving station within the building for purposes of initiating emergency action. Occupant notification shall be by means of either voice or prerecorded message announcement initiated by the person in the constantly attended receiving station and in accordance with 780 CMR 917.9. In buildings of Use Group A utilizing reduced lighting levels on a regular basis, lights providing normal lighting levels shall be activated simultaneously with the beginning of the voice or prerecorded message announcement. Where the building official determines that it is impractical to have a constantly attended location in an assembly occupancy the fire alarm system shall be arranged to automatically provide prerecorded evacuation instructions.
3. For mixed use group occupancies that contain an A use group the use group A area shall be in accordance with 780 CMR 917.7.1 exception 2.

917.7.1.1 Length of evacuation signal: Automatic deactivation of audible and visible alarms shall not be allowed.

Exception: Automatic deactivation of audible alarms after a period of operation of 15 minutes shall be permitted when approved by the local fire department. Automatic deactivation of audible alarms shall only be permitted when the fire alarm system is supervised in accordance with 780 CMR 923.2 or by an approved auxiliary fire alarm system in accordance with NFPA 72.

917.7.2 Presignal or positive alarm sequence system: Presignal or positive alarm sequence

systems shall not be installed unless approved by the code official and by the local fire department. Where a presignal or positive alarm sequence system is installed, 24-hour supervision by trained personnel shall be provided at a location approved by the local fire department, in order that the alarm signal can be actuated in the event of fire or other emergency.

917.7.3 Zones: Each floor shall be zoned separately and a zone shall not exceed 20,000 square feet (1860 m^2). The length of any zone shall not exceed 300 feet (91440 mm) in any direction. A zoning indicator panel and the associated controls shall be provided in a location approved by the local fire department. Where individually addressable alarm initiating devices are used, a single circuit (or pathway) shall not exceed the above size limitations unless the circuit is a Class A circuit, and the style and device loading meets the requirements for proprietary systems as listed in NFPA 72. Where individually addressable alarm initiating devices are logically combined into groups for annunciation purposes, the above zone size limitations shall apply to the group. The local fire department shall approve all zone and point descriptions. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible alarm - silencing switch. In buildings that have floors located more than 70 feet above mean grade, a separate zone by floor shall be provided for the following types of alarm-initiating devices where provided:

1. Smoke detectors;
2. *Sprinkler* water-flow devices;
3. Manual fire alarm boxes; and
4. Other approved types of automatic fire detection devices, extinguishing, or *suppression systems.*

Exceptions:

1. *Automatic sprinkler system* zones shall not exceed the area permitted by NFPA 13 listed in *Appendix A.*
2. Duct type smoke detectors shall be separately identified with a remote test/ indicator station. The location of the remote test/indicator shall be approved by the local fire department.

917.8 Alarm notification appliances: Alarm notification appliances of the approved type shall be provided.

917.8.1 Visible alarms: Visible alarm notification appliances shall be provided in accordance with NFPA 72 and 521 CMR in public and common areas of all buildings and areas of buildings housing the hearing impaired and where required by 521CMR. In occupancies in Use Groups I-1 and R-1, all required accessible sleeping rooms and suites plus an additional number of sleeping rooms or suites in accordance with Table 917.8.1 shall be provided with a visible alarm notification appliance, activated by both the in-room smoke detector and the building fire protective signaling system. In hospital intensive care units, special care units and operating rooms, the audible signal need not be sounded; however a visual alarm shall be displayed with an approved device.

Table 917.8.1
VISIBLE AND AUDIBLE ALARMS

Number of sleeping rooms or suites	Sleeping rooms or suites with visible and audible alarms
6 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1,000	2% of total
1,001 and over	20 plus 1 for each 100 over 1,000

917.8.2 Audible alarms: Audible alarm notification appliances shall be provided and shall sound a distinctive sound which shall not be used for any purpose other than that of a fire alarm. The audible alarm notification appliances shall provide a sound pressure level of 15 dBA above the average ambient or 5 dBA above the maximum sound level having a duration of at least 60 seconds (whichever is greater) sound level in every occupied space within the building. The minimum sound pressure levels shall be: 70 dBA in occupancies in Use Groups R and I-1; 90 dBA in mechanical equipment rooms; and 60 dBA in all other use groups. The maximum sound pressure level for audible alarm notification appliances shall be 120 dBA at the minimum hearing distance from the audible appliance.

917.8.2.1 All audible evacuation signals shall have a synchronized three - pulse temporal pattern in accordance with NFPA 72.

917.9 Voice/alarm signaling system: A voice/alarm signaling system shall be provided where required by other sections of 780 CMR. When activated in accordance with 780 CMR 917.7.1, the voice/alarm signaling system shall automatically sound an alert signal to all occupants within the building on a general or selective basis to the following terminal areas: elevators, elevator lobbies, *corridors, exit stairways,* rooms and tenant spaces exceeding 1,000 square feet (93 m^2) in area; *dwelling units* in occupancies in Use Group R-2; and guestrooms or suites in occupancies in Use Group R-1. The *fire command station* shall contain controls to transmit

manually an evacuation signal and voice instructions on a selective and all-call basis to the terminal areas indicated herein. The voice/alarm system shall be designed and installed in accordance with the provisions of 780 CMR, 527 CMR and NFPA 72 listed in ***Appendix A***.

Exception: A distinctive signal in lieu of a voice alarm is permitted in an occupancy in Use Group F or S.

917.9.1 The sequence of operation of the voice alarm signaling system shall be as follows:

1. Sound an alert (pre-signal) tone (the alert tone shall be a 900 hertz tone pulsed to produce one round of code 4 at approximately one second intervals.
2. Activate the recorded message regarding the evacuation procedure. The alarm and communications system shall provide a pre-recorded message to all required areas. The message shall contain the following information. " attention please. The signal tone you have just head indicated a report of an emergency in this building. If your floor evacuation signal sounds after this message, walk to the nearest stairway and leave the floor. While the report is being verified, occupants on other floors should await further instructions."

   This message shall be transmitted three times.

   A female voice shall be used for this message.
3. Activate the evacuation signal on the floor of incident and the next floor above and below (the evacuation signal shall be in accordance with 780 CMR 917.8.2.1

917.10 Acceptance tests: Upon completion of the fire protective signaling system, all alarm notification devices and circuits, alarm indicating appliances and circuits, supervisory-signal initiating devices and circuits, signaling line circuits, and primary and secondary power supplies shall be subjected to a 100% acceptance test in accordance with NFPA 72 listed in ***Appendix A*** and 780 CMR 903.0.

780 CMR 918.0 AUTOMATIC FIRE DETECTION SYSTEMS (FIRE ALARM SYSTEMS)

918.1 General: Automatic fire detection systems shall be of an approved type and shall be installed in accordance with the provisions of 780 CMR and NFPA 72 listed in ***Appendix A***.

918.2 Fire Protection Construction documents: Where an automatic fire detection system is required by 780 CMR, the *fire protection construction documents* shall show the location and number of all *automatic fire detectors* with specifications of the type of fire detector, proposed zoning and a complete sequence of operation for the system. The system shall be installed in accordance with 780 CMR 918.0 and shall be part of and be subject to the requirements of a fire protective signaling system specified in 780 CMR 917.0. (Also see 780 CMR 903.0)

918.3 Approval: All devices, combinations of devices, appliances and equipment shall be approved for the fire signaling purpose for which such equipment is used. The *automatic fire detectors* shall be smoke detectors, except an approved alternative type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.

918.4 Where required: An *automatic fire detection system* shall be installed and maintained in full operating condition in the locations described in 780 CMR 918.4.1 through 918.4.7.

918.4.1 Use Group A-4: An *automatic fire detection system* shall be installed in all occupancies of use group A-4.

918.4.2 Use Group E: An *automatic fire detection system* shall be installed in all occupancies of use group E.

918.4.3 Use Group I-1: An *automatic fire detection system* shall be installed and maintained in all occupancies in Use Group I-1.

918.4.4 Use Group I-2: An *automatic fire detection system* shall be installed and maintained in all occupancies in Use Group I-2.

Exception: Occupancies that are equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.0 and that comply with 780 CMR 409.0.

918.4.5 Use Group I-3: An *automatic fire detection system* shall be installed and maintained in all resident housing areas of Use Group I-3. Smoke detectors shall be arranged and positioned to prevent damage or tampering provided that the function and speed of detecting a fire is equivalent to that provided by the spacing and arrangement requirements of NFPA 72 listed in ***Appendix A***.

918.4.6 Use Group R-1: An automatic fire detection system shall be installed and maintained throughout all occupancies in Use Group R-1 and in accordance with Table 918.

TABLE 918
RESIDENTIAL FIRE PROTECTION REQUIREMENTS

Use Group	Number of Units	Unit Occupant Protection	Other Occupant Protection	Standby Power	Manual Stations	Zoned	Provision for Fire Department Notification
R-3	1 or 2	Yes 919.3.2	Note a.	Yes 919.5	N.A.	N.A.	N.A.
R-1	3 to 12	Yes 919.3.1	Yes 918.4.6	Yes 917.6	Yes 917.4.5	N.A.	N.A.
R-2	3 to 12	Yes 919.3.2	Yes 918.4.7	Yes 919.5	Yes 917.4.6	N.A.	N. A.
R-1	13 or more	Yes 919.3.1	Yes 918.4.6	Yes 917.6	Yes 917.4.5	Yes 917.7.3	Yes 923.2
R-2	13 or more	Yes 919.3.2	Yes 918.4.7	Yes 919.5	Yes 917.4.6	Yes 917.7.3	Yes 923.2

Note a: Where common areas exist.

Exceptions:

1. An *automatic fire detection system* is not required in buildings that do not have interior *corridors serving* guestrooms or dwelling units and where all guestrooms or dwelling units have a *means of egress* door opening directly to an exterior *exit access* which leads directly to the *exits*.
2. System smoke detectors are not required in guestrooms or *dwelling units* provided that the single-station detectors required by 780 CMR 919.3.1 are connected to the emergency electrical system and are annunciated by guestroom or *dwelling unit* at a constantly attended location from which the fire protective signaling system is capable of being manually activated.
3. A system heat detector shall be required within each guest room or *dwelling unit* located not more than six feet from each door way that leads to an interior *corridor* or exit. System heat detectors shall not be required where the guestroom or *dwelling unit* is equipped with residential *sprinklers* that when activated will activate the fire protective signaling system.

918.4.7 Use Group R-2: An *automatic fire detection* system shall be installed and maintained throughout all occupancies in use group R-2 and in accordance with table 918.

Exceptions:

1. An *automatic fire detection system* is not required in buildings that do not have interior *corridors serving* guestrooms or *dwelling units* and where all guestrooms or *dwelling units* have a *means of egress* door opening directly to an exterior *exit access* which leads directly to the *exits*.
2. System smoke detectors are not required in guestrooms or *dwelling units*.
3. A system heat detector shall be required within each guest room or *dwelling unit* located not more than six feet from each door way that leads to an interior *corridor* or exit. System heat detectors shall not be required where the guestroom or dwelling unit is equipped with residential sprinklers that, when activated, will activate the fire protective signaling system.

918.5 Sprinklered buildings exception: Buildings equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1 or 780 CMR 906.2.2 are not required to be equipped with an automatic fire detection system, but are required to be equipped with a fire protective signaling system that conforms to 780 CMR 917.0. This exception does not apply to Use Groups I, R-1, R-2 , to high-hazard use groups in accordance with 780 CMR 417.5.3, to special amusement buildings in accordance with 780 CMR 413.0, or to single-station smoke detectors as required in 780 CMR 919.3.

918.6 Zones: Zoning shall be provided in accordance with 780 CMR 917.7.3.

918.7 Alarm verification: Alarms activated by smoke detectors required by 780 CMR 918.0 shall be activated by a single smoke detector monitored by an *alarm verification* zone or an approved equivalent method.

918.8 Local control functions: *Automatic fire detectors* utilized for the purpose of performing local control functions shall be a part of a fire protective signaling system. The detector shall, upon actuation, perform the intended function and activate the alarm notification devices or activate a visible and audible supervisory signal at a constantly attended location.

Exception: In buildings not required to be equipped with a fire protective signaling system, the *automatic fire detector shall* be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72 listed in ***Appendix A***. This exception does not apply to smoke detectors required for elevator recall.

918.9 Access: Access shall be provided to each detector for periodic inspection, maintenance and testing.

780 CMR 919.0 SINGLE- AND MULTIPLE-STATION SMOKE DETECTORS

919.1 General: Single- and multiple-station smoke detectors shall be of an approved type and shall be installed in accordance with the provisions of 780 CMR and NFPA 72 listed in *Appendix A*.

919.1.1 A control and associated equipment, single or multiple station alarm devices or any combination thereof shall be permitted to be used as a *household fire warning system* provided that the requirements of NFPA 72 Chapter 2 are met.

919.2 Fire Protection Construction documents: Where single- and multiple station smoke detectors are required by 780 CMR, the *fire protection construction documents* shall show the location and number with specifications of the type of detector. (Also see 780 CMR 903.0.)

919.3 Where required: Single and multiple station smoke detectors or household fire warning systems shall be installed and maintained in full operating condition in the locations described in 780 CMR 919.3.1 through 919.3.3. Any smoke detector located within 20 feet of a kitchen or within 20 feet of a bathroom containing a tub or shower shall be a photo electric type smoke detector.

919.3.1 Use Group R-1: Single and multiple station smoke detectors or household fire warning systems shall be installed and maintained in the following locations in Use Group R- 1:

1. In all sleeping areas;
2. In every room or hallway in the path of the *means of egress* from the sleeping area to the door leading from the guestroom or suite; and
3. In each story within the guestroom or suite, including *basements.*

Exception: For suites or guestrooms or *dwelling unit* with split levels and without an intervening door between the adjacent levels, a smoke detector installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

919.3.2 Use Groups R-2, R-3, R-4 and R-5: Single and multiple station smoke detectors or household fire warning systems shall be installed and maintained in all occupancies in Use Groups R-2, R-3, R-4 and R-5 at the following locations:

1. In the immediate vicinity of bedrooms;
2. In all bedrooms; and
3. In each story within a *dwelling unit*, including *basements.*
4. In residential units 1200 square feet or more in area an additional *automatic fire detector* shall be provided for each 1200 square feet of area or part thereof.

Exceptions:

1. In *dwelling units* with split levels and without an intervening door between the adjacent levels, a smoke detector installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
2. In buildings equipped throughout with an *automatic sprinkler system* installed in accordance with 780 CMR 906.2.1, 906.2.2 or 906.2.3, smoke detectors are not required in bedrooms where the bedrooms are equipped with residential sprinklers.

919.3.3 Use Group I-1: Single and multiple station smoke detectors or household fire warning systems shall be installed and maintained in all sleeping areas in occupancies in Use Group I- 1.

Exception: Where the building is equipped throughout with an automatic detection system in accordance with 780 CMR 918.4.

919.4 Interconnection: Where more than one detector is required to be installed within an individual *dwelling unit* in an occupancy in Use Group R-2 , R-3 or R4, or within an individual guestroom or suite in an occupancy in Use Group R-1, the detectors shall be wired in such a manner that the actuation of one alarm will actuate all of the alarms in the individual unit.

919.5 Battery backup: In addition to the required AC primary power source, required smoke detectors in occupancies in Use Groups R-2, R-3, R-4, R-5 and I-1 shall receive power from a battery when the AC primary power source is interrupted.

Exception: In buildings equipped throughout with an *automatic sprinkler system* installed in accordance with 780 CMR 906.2.1, 906.2.2 or 906.2.3.

919.6 Acceptance testing: When the installation of the detectors is complete, each detector - and all interconnecting wiring for multiple-station detectors shall be subject to a 100% acceptance test in accordance with NFPA 72 listed in *Appendix A*

780 CMR 920.0 FIRE EXTINGUISHERS

920.1 Approval: Portable fire extinguishers shall bear the label of an *approved agency*, be of an approved type and be installed in a location visible and available to the occupants.

920.2 Where required: A portable fire extinguisher shall be installed in the following locations in accordance with NFiPA 10 listed in ***Appendix A***:

1. In all occupancies in Use Group A-1, A-2, A-3, B, E, I-2, M, R-1 or H;
2. In all areas containing commercial kitchen exhaust hood systems;
3. In all areas where fuel is dispensed;
4. In all areas where a *flammable* or *combustible liquid* is used in the operation of spraying, coating or dipping;
5. In all occupancies in Use Group I-3 at staff locations. Access to portable extinguishers shall be permitted to be locked;
6. On each completed floor of buildings under construction, other than occupancies in Use Group R-3.
7. In any laboratory, shop or other room occupied for similar purposes; and
8. Where required by the fire prevention code listed in ***Appendix A***.

780 CMR 921.0 SMOKE CONTROL SYSTEMS

921.1 General: Smoke control systems required by 780 CMR shall conform to the provisions of 780 CMR 921.0

921.2 Design criteria: The smoke control system shall be designed to keep the smoke layer interface above the highest of either the highest unprotected opening to adjoining spaces, or six feet (1829 mm) above the highest floor level of *exit access* open to the atrium for a period of 20 minutes. The limiting height for the smoke layer interface for *stages* shall be in accordance with 780 CMR 412.3.8.2. The limiting height of the smoke interface above the floor of the space required to be provided with smoke control is Z_{cr}. Provisions shall also be made to provide for smoke removal from the space at a rate of not less than two air changes per hour by means of natural or mechanical *ventilation.*

921.2.1 Passive system: Active smoke control is not required where it is shown that the smoke interface level requirement will be met without operating smoke exhaust.

921.2.1.1 Regular spaces: For spaces with flat ceilings, a constant horizontal cross-sectional area above the smoke layer interface, and an A/H^2 ratio between 0.9 and 14, the following equation shall be used to estimate the height of the interface at 20 minutes

$$Z = 0.67H - 0.28H \ln\left[\frac{t\,Q^{1/3}H^{2/3}}{A}\right]$$

where:

Z = Height from floor to the smoke interface (feet).

t = Time for interface to descent to Z; Use 1,200 seconds.

H = Height of the space required to be provided with smoke control; floor to flat ceiling (feet).

Q = Steady state heat release rate; Use 4,400 Btu/sec. where the primary use group is M, S-1 or F-1. Otherwise use 2,000 Btu/sec.

A = Horizontal cross-sectional area of the above ceiling space being filled (square feet). Maximum A to be used shall be: $A = 14\,H^2$.

921.2.1.2 Irregular spaces: For spaces with sloped or irregular ceilings, A/H^2 ratios outside the specified range, or varying cross sections, the filling time shall be determined using numerical integration from the ceiling to the critical smoke interface. The following equations shall be used to determine the rate of smoke production:

Where the interface level is above the limiting elevation (z_l) use:

$$V = 17.6Q_c^{1/3}Z^{5/3} + 3.36Q_c$$

Where the interface level is below the limiting elevation (z_l) use:

$$V = 16.64Q_c^{3/5}Z$$

where:

V = The volumetric rate of smoke production (cubic feet per minute).

z_l = Limiting elevation (ft) = $0.533Q_c^{2/5}$

Qc = The convective portion of the heat release rate shall be estimated as 70 percent of the total heat release rate, Q.

921.2.2 Mechanical systems: Where the smoke filling predicted in 780 CMR 921.2.1 does not meet the design criteria of 780 CMR 921.2, mechanical exhaust shall be provided to maintain these conditions.

921.2.2.1 Exhaust quantities: Sufficient mechanical exhaust shall be provided to maintain the smoke layer interface at or above the critical elevation for the 20-minute period. The volumetric rate of smoke production (V) shall be determined by the equations in 780 CMR 921.2.1.2. If the rate of smoke exhaust is less than the rate of smoke production, the minimum exhaust rate to be supplied for smoke control shall be determined in accordance with Table 921.2.2.1.

Table 921.2.2.1
MINIMUM EXHAUST RATE ADJUSTMENT FACTOR[a]

Z/H	t/t_o					
	Ve/V					
	0.25	0.35	0.50	0.70	0.85	0.95
0.2	1.12	1.19	1.30	1.55	1.89	2.49
0.3	1.14	1.21	1.35	1.63	2.05	2.78
0.4	1.16	1.24	1.40	1.72	2.24	3.15
0.5	1.17	1.28	1.45	1.84	2.48	3.57
0.6	1.20	1.32	1.52	2.00	2.78	4.11
0.7	1.23	1.36	1.61	2.20	3.17	4.98
0.8	1.26	1.41	1.71	2.46	3.71	6.25

Note a. Notation:
Z = Design height of smoke layer interface above fire source.
H = Ceiling height above fire source.
t = Time for smoke layer interface to descend to Z(with exhaust) (seconds).
t_o = Value of t in absence of smoke exhaust (see 780 CMR 921.2.1.1 or 921.2.1.2) (seconds).
V_e = Smoke control exhaust rate (minus any airflow into the smoke layer other than that from the plume).
V = Volumetric smoke production rate (from the equations in 780 CMR 921.2.1.2).

921.2.3 Operation: The smoke control system shall be a dedicated system or shall be integrated with the mechanical *ventilation* system of the building. Operation of the smoke control system shall automatically shut down all systems and devices which interfere with the effective operation of the smoke control system. Where the mechanical *ventilation system* is designed for smoke control, the return air shall be moved directly to the outside without recirculation to other areas of the building.

921.2.4 Alternative systems: An engineered design which will achieve the same level of smoke control as described in 780 CMR 921 is permitted in lieu of these requirements and otherwise in conformance with the requirements of 780 CMR 903.2.1.

921.3 Smoke removal: Provisions shall be made to provide *ventilation* at a rate of at least two air changes per hour from the space required to be provided with smoke control. This *ventilation* shall be through openable vents, separate mechanical exhaust, or through the building mechanical *ventilation* system. The exhaust inlets shall be located a minimum of six feet (1829 mm) above any *exit access* walkway and above any openings into adjoining spaces. The smoke removal system shall be activated by manual controls provided for fire department use unless it is part of the smoke control system.

921.4 Activation: The smoke control system shall be activated by actuation of the following:

1. *Automatic sprinkler system;*
2. Smoke detectors required by 780 CMR 921 that comply with NFPA 72 listed in *Appendix A*; and
3. Manual controls provided for fire department use.

Note: The smoke control system shall not be activated by a manual fire alarm system.

921.4.1 Manual control: Manual controls shall be provided at a location approved by the fire department.

921.4.2 Smoke detector activation: Where the height of the ceiling of the space required to be provided with smoke control exceeds 30 feet (9144 mm) above the floor of the space, approved smoke detectors shall be provided to detect smoke above the highest floor open to an atrium or at the highest point of another space required to be provided with smoke control. The installation of smoke detectors shall comply with 780 CMR 918.0.

921.5 Standby power: All equipment required to provide smoke control in floor openings connecting three or more stories and stage areas in accordance with 780 CMR 412.3.8.2 shall be equipped with a standby source of power that complies with 527 CMR 12.00 as listed in *Appendix A*.

921.6 Acceptance: Any required smoke control design that requires operation of mechanical equipment shall be functionally tested in accordance with 780 CMR 921.6.2 until proper operation of all required mechanical equipment and controls is demonstrated.

921.6.1 System operation report: Prior to acceptance testing, a report of the required system operations shall be provided to the code official. (**NOTE**: also see 780 CMR 903.1.1.1.a., b. and c. The following items shall be included in the report if part of the required system:

1. Identify type(s) of smoke control activation signal(s), such as *sprinkler* waterflow, smoke detection, manual, etc., and associated smoke control system operation(s) that are activated by the signals.
2. Identify *building area(s)* where maximum mechanical exhaust to the outside is implemented and supply air is not provided.
3. Identify *building area(s)* where maximum air supply is implemented and exhaust to the outside is not provided.
4. Identify fan(s) which shall be "On" as required to implement the smoke control system. If multiple speed fans are used, the capacity at which the fans shall operate in the smoke control mode shall be identified.
5. Identify fan(s) which shall be "Off" as required to implement the smoke control system.
6. Identify damper(s) which shall be "Open" to implement the smoke control system.
7. Identify damper(s) which shall be "Closed" to implement the smoke control system.

8. Identify other functions required to implement the smoke control system.
9. Identify *building areas* with smoke and heat vents and method of operation of vents.
10. If required, identify the type(s) of standby power and the equipment that is served.

921.6.2 Testing procedures: The acceptance test procedure shall be approved. Acceptance testing shall be conducted in the presence of the Building official and fire official or their designees or shall include documentation indicating that all mechanical equipment, control sequences, devices and components have been operationally tested and are functioning properly in accordance with the system operation report. Such documentation provided by a *registered professional engineer* or other legally recognized professional (M.G.L. c. 112, § 81R). All documentation from operational testing shall be available for inspection. Acceptance testing shall include the following:

1. Prior to beginning acceptance testing, all building smoke control equipment shall be placed in the normal operating mode.
2. Acceptance testing shall demonstrate that each initiating device, fan, damper and other required equipment is operational and performs to the limits and capacity required.
3. Acceptance testing shall demonstrate that correct control outputs are produced for a given control input for each control sequence specified by the system operation report.
4. If standby power is required for the operation of the smoke control system, acceptance tests shall be conducted while on both normal building power and standby power.
5. Opening of smoke/heat vents shall be demonstrated if the vent is capable of being opened in a manner that does not require destructive testing.

921.7 Elevators: Except when otherwise required by 524 CMR, where buildings are equipped with a mechanical smoke control system that will restrict smoke and hot gases from entering the elevator shaft in the fire floor, hoistway venting is not required. In high-rise buildings equipped with this system and equipped throughout with an automatic fire suppression system, the one-hour fireresistance rated elevator lobby as specified in 780 CMR 403.8 is not required.

780 CMR 922.0 SMOKE AND HEAT VENTS

922.1 General: Where *exit access* travel distance is increased in accordance with 780 CMR 1006.5.1, smoke and heat vents shall be constructed and installed in accordance with 780 CMR 922.0.

922.2 Vent size and spacing: The vent area and the spacing of the vents shall comply with Table 922.2.

922.2.1 Releasing devices: Smoke and heat vents shall open automatically by activation of a heat-responsive device rated at 100°F (38°C) to 220°F (104°C) above ambient. The releasing mechanism shall be capable of operation such that the vent shall fully open when the vent is exposed to a time-temperature gradient that reaches an air temperature of 500°F (260°C) within five minutes. Vents shall be capable of being opened by an approved manual operation.

922.3 Curtain board construction: Curtain boards shall be provided to subdivide a vented building. Curtain boards shall be constructed of material that will resist the passage of smoke and is consistent with the building type of construction. Curtain board location and depth shall comply with Table 922.2. The bottom of the curtain board shall be level.

Table 922.2
SMOKE AND HEAT VENT SIZE AND SPACING[b]

Use Group	Hazard classsification of contents[a]	Vent height above the floor, *H* (feet)	Minimum curtain board depth from vent bottom (feet)	Maximum area formed by curtain boards (square feet)	Vent area to floor area ratio	Maximum spacing of vent centers (feet)	Maximum distance from wall of curtain boards (feet)	Maximum distance between curtain boards
F-1	-	-	0.2XH but ≥4	50,000	1:100	120	60	8 X H but ≤250 feet
S-1	I through IV	20 or less	6	10,000	1:100	100	60	8 X H
S-1	I through IV	Over 20 to 40	6	8,000	1:75	100	55	8 X H but ≤250 feet
S-1	I through IV	20 or less	4	3,000	1:75	100	55	8 X H
S-1	I through IV	Over 20 to 40	4	3,000	1:50	100	50	8 X H but ≤250 feet
S-1	V	20 or less	6	6,000	1:50	100	50	8 X H
S-1	V	Over 20 to 30	6	6,000	1:40	90	45	8 X H
S-1	V	30 or more	4	2,000	1:30	75	40	8 X H but ≤100 feet

Note a. See NFiPA 231 C listed in ***Appendix A*** for classification of Contents Class I through IV Class V commodities are products that present special fire hazards beyond those of Class I, II, III or IV, such as aerosols, foam plastic, PVC, PU, PS and asphalt paper.
Note b. 1 foot = 304.8 mm; 1 square foot = 0.093 m .

780 CMR 923.0 SUPERVISION

923.1 Fire suppression systems: All *automatic fire suppression systems* required by 780 CMR shall be supervised by one of the following methods below.

1. A *UL listed or FM approved Central Station Service* in accordance with NFPA 72 listed in ***Appendix A***.
2. a. Approved *proprietary supervising station system*, in accordance with NFPA 72 in accordance with NFPA 72 as listed in *Appendic A.*
   b. Approved remote *station fire alarm system supervising station* in accordance with NFPA 72 as listed in ***Appendix A***.
3. Alarm signals to an approved Auxiliary Fire Alarm System in accordance with NFPA 72, with supervisory signals supervised by one or two above or at a constantly attended location approved by the local fire department, having personnel on duty trained to recognize the type of signal received and to take prescribed action. This shall be permitted to be a location different from that at which alarm signals are received.

Exceptions:

1. Underground gate valves with roadway boxes.
2. Halogenated extinguishing systems that are not an integral part of a required *automatic fire suppression system.*
3. Carbon dioxide extinguishing systems that are not an integral part of a required *automatic fire suppression system.*
4. Dry- and wet-chemical extinguishing systems.
5. *Limited area sprinkler systems* (see 780 CMR 907.0).
6. Occupancies in Use Group R complying with 780 CMR 906.2.2 and supervised in accordance with NFPA 13R listed in ***Appendix A***.

923.1.1 Re-transmission of alarm signals received by central stations: In all cases, central stations shall re-transmit alarm signals within 90 seconds of receipt, to the fire department having jurisdiction.

923.2 Fire protective signaling systems and automatic fire detection systems: All *fire protective signaling systems* and automatic fire detection systems required by 780 CMR shall be supervised by one of the following methods below:

1. A *UL listed or FM approved Central Station Service* in accordance with NFPA 72 listed in ***Appendix A***.
2. a. Approved *proprietary supervising station system*, in accordance with NFPA 72 in accordance with NFPA 72 as listed in *Appendic A.*
   b. Approved remote *station fire alarm system supervising station* in accordance with NFPA 72 as listed in ***Appendix A***.
3. Alarm signals to an approved Auxiliary Fire Alarm System in accordance with NFPA 72, with supervisory signals supervised by one or two above or at a constantly attended location approved by the local fire department, having personnel on duty trained to recognize the type of signal received and to take prescribed action. This shall be permitted to be a location different from that at which alarm signals are received.

Exceptions:

1. *For use group R see table 918*
2. Single- and multiple-station detectors as required by 780 CMR 919.0.
3. Smoke detectors in occupancies in Use Group I-3 (see 780 CMR 917.7.1).
4. Smoke detectors in patient sleeping rooms in occupancies in Use Group 1-2 (see 780 CMR 409.5.1).
5. Fire protective signaling systems in occupancies in Use Groups H.

923.2.1 Re-transmission of alarm signals received by central stations: In all cases, central stations shall re-transmit alarm signals within 90 seconds of receipt, to the fire department having jurisdiction.

780 CMR 924.0 FIRE PUMPS

924.1 General: Where fire pumps are required to be installed as part of a required or non-required system(s), the fire pump(s) shall be designed and installed in accordance with 527 CMR 12.00 and NFPA 20 as listed in ***Appendix A***.

924.2 Rooms: Fire pumps and all related equipment shall be located in a dedicated room meeting the physical and environmental features of NFPA 20 listed in ***Appendix A***, and enclosed with not less than two hours fire resistive construction. Fire pumps rooms shall have either direct access to the room from grade or access by a two hour rated passageway and shall be properly secured from unauthorized entry.

924.3 Emergency power: All fire pumps shall be provided with emergency power when installed in the following types of buildings or use groups. Emergency power equipment installation shall

conform to 527 CMR 12.00 and NFPA 20 as listed in ***Appendix A***.

1. High-rise buildings as defined by M.G.L. c. 148 § 26A and 780 CMR.
2. Buildings and structures of Use Group A, with a total occupant load of more than 300 occupants.
3. Buildings and structures of Use Group E, with a total occupant load of more than 300 occupants.
4. Buildings and structures of Use Group H.
5. Buildings and structures of Use Group I, having surgery or treatment areas.

NON-TEXT PAGE

1006.5.1 Roof vent increase: In buildings which are one story in *height*, equipped with automatic heat and smoke roof vents complying with 780 CMR 922.0 and equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1, the *exit access* travel distance limitation in Table 1006.5 for occupancies in Use Group F-1 or S-1 shall be increased to 400 feet (122 m).

1006.5.2 Use Group A-5: Occupancies in Use Group A-5, where all portions of the *means of egress* are essentially open to the outside, shall have an *exit access* travel distance of not more than 400 feet (122 m), except that such occupancies in buildings and structures of Type 1 or 2 construction shall not have an *exit access* travel distance limitation.

1006.6 Elevators, escalators and moving walks: Elevators, *escalators* and *moving walks* shall not be accepted as a required element of the *means of egress*.

Exception: An elevator conforming to 780 CMR 1007.3 shall be permitted for an accessible *means of egress*.

1006.7 Common path of travel: The *common path of exit access travel* distance for occupants to reach a point where two separate and distinct paths of travel are available to two *exits* shall not exceed 100 feet (30480 mm) in occupancies in Use Group I-3.

780 CMR 1007.0 ACCESSIBLE MEANS OF EGRESS

1007.1 General: All spaces required to be accessible by ***521 CMR, the Rules and Regulations of the Architectural Access Board, referenced in 780 CMR 11, and listed in Appendix A*** shall be provided with not less than one accessible *means of egress* that complies with 780 CMR 1007.0. Where more than one *means of egress* is required from any required accessible space, each accessible portion of the space shall be served by not less than two accessible *means of egress*. Each accessible *means of egress* shall provide a continuous path of travel from a required accessible space to a *public way* which is usable by a mobility impaired person and shall include accessible routes, ramps, *exit stairways*, elevators, *horizontal exits* or smoke barriers.

1007.2 Exit stairways: An *exit stairway* to be considered part of an accessible *means of egress* shall have a clear width of at least 48 inches (1219 mm) between handrails and shall either incorporate an area of refuge within an enlarged story-level landing or shall be accessed from an area of refuge complying with 780 CMR 1007.5 or a *horizontal exit*.

Exceptions:

1. Stairs serving a single *dwelling unit* or guestroom.
2. Occupancies equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1.
3. The clear width of 48 inches (1219 mm) between handrails is not required for *exit stairways* accessed from a *horizontal exit*.

1007.3 Elevators: An elevator, to be considered part of an accessible *means of egress*, shall comply with 524 CMR and standby power shall be provided in accordance with 527 CMR 12.00 as listed in ***Appendix A***. The elevator shall be accessed from an area of refuge complying with 780 CMR 1007.5 or a *horizontal exit*. In buildings where a required accessible floor is four or more stories above or below a *level of exit discharge* serving that floor, at least one elevator shall be provided and shall serve as one required accessible *means of egress*.

Exceptions:

1. In buildings equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1, the elevator shall not be required to serve floors which are located at or above the *level of exit discharge* and provided with a *horizontal exit* complying with 780 CMR 1019.0.
2. Elevators are not required to be accessed from an area of refuge or a *horizontal exit* in occupancies equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1.

1007.4 Platform lifts: Platform (wheelchair) lifts shall not serve as part of an accessible *means of egress* except within a *dwelling unit*.

1007.5 Areas of refuge: Every required area of refuge shall be accessible from the space it serves by an accessible *means of egress*. The maximum travel distance from any accessible space to an area of refuge shall not exceed the travel distance permitted for the occupancy in accordance with 780 CMR 1006.5. Every required area of refuge shall have direct access to an *exit stairway* complying with 780 CMR 1007.2 or an elevator complying with 780 CMR 1007.3. Where an elevator lobby is used as an area of refuge, the *shaft* and lobby shall comply with 780 CMR 1015.0 for *smokeproof enclosures* except where the elevators are in an area of refuge formed by a *horizontal exit* or smoke barrier.

Exception: Areas of refuge are not required in open parking structures

1007.5.1 Size: Each area of refuge shall be sized to accommodate one wheelchair space of 30 inches (762 mm) by 48 inches (1219 mm) for each 200 occupants or portion thereof, based on the occupant load of the area of refuge and all

areas served by the area of refuge. Such wheelchair spaces shall not reduce the required *means of egress* width. Access to any of the required wheelchair spaces in an area of refuge shall not be obstructed by more than one adjoining wheelchair space.

1007.5.2 Separation: Each area of refuge shall be separated from the remainder of the story by a smoke barrier complying with 780 CMR 712.0. Each area of refuge shall be designed to prevent the intrusion of smoke, except those areas of refuge located within a *stairway* enclosure or those areas of refuge where the area of refuge and all areas served by the area of refuge are equipped throughout with an *automatic sprinkler system* in accordance with 780 CMR 906.2.1.

1007.5.3 Communication system: Every area of refuge in buildings more than four stories in height shall be provided with a two-way emergency communication system between the area of refuge and a central control point.

In each area of refuge provided with a two-way emergency communication system, instructions on the use of the area under emergency conditions shall be posted adjoining the communication system. The instructions shall include:

1. Directions to other *means of egress*;
2. Advice that persons able to use the *exit* stairs do so as soon as possible unless they are assisting others;
3. Information on how to summon planned availability of assistance in the use of stairs or supervised operation of elevators; and
4. Directions for use of the two-way emergency communication system.

1007.5.4 Identification: Each door providing access to an area of refuge from an adjacent floor area shall be identified by a sign complying with 521 CMR and CABO A117.4 listed in ***Appendix A*** stating "Area of Refuge" and the International Symbol of Accessibility. The sign shall be illuminated as required for "Exit" signs where "Exit" sign illumination is required. Additionally, tactile signage complying with 521 CMR listed in ***Appendix A*** shall be located at each door to an area of refuge.

1007.6 Signage: Signage indicating the location of accessible *means of egress* shall be installed at all *exits* and elevators that serve a required accessible space, but which are not an approved accessible *means of egress*.

780 CMR 1008.0 OCCUPANT LOAD

1008.1 Design occupant load: In determining required facilities, the number of occupants for whom *exit* facilities shall be provided shall be established by the largest number computed in accordance with 780 CMR 1008.1.1 through 1008.1.3.

1008.1.1 Actual number: The actual number of occupants for whom each occupied space, floor or building is designed.

1008.1.2 Number by Table 1008.1.2: The number of occupants computed at the rate of one occupant per unit of area as prescribed in Table 1008.1.2.

1008.1.3 Number by combination: The number of occupants of any space as computed in 780 CMR 1008.1.1 or 1008.1.2 plus the number of occupants similarly computed for all spaces that discharge through the space in order to gain access to an *exit*.

1008.1.4 Increased occupant load: The occupant load permitted in any building or portion thereof is permitted to be increased from that number established for the occupancies in Table 1008.1.2 provided that all other requirements of 780 CMR are also met based on such modified number. Where required by the code official, an approved aisle, seating or fixed equipment diagram to substantiate any increase in occupant load shall be submitted. Where required by the code official, such diagram shall be *posted*.

Table 1008.1.2
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

Occupancy	Floor area[a] in square feet per occupant
Assembly with fixed seats	See 780 CMR 1008.1.6
Assembly without fixed seats	
Concentrated (chairs only - not fixed)	7 net
Standing space	3 net
Unconcentrated (tables and chairs)	15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	100 gross
Courtrooms - other than fixed seating areas	40 net
Educational	
Classroom area	20 net
Shops and other vocational room areas	50 net
Industrial areas	100 gross
Institutional areas	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Mercantile, basement and grade floor areas	30 gross
Areas on other floors	60 gross
Storage stock, shipping areas	300 gross

shall be indicated with a distinctive marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform risers.

1014.6.3 Winders: Winders shall not be permitted in required *means of egress stairways* except in occupancies in Use Group R-3 and *stairways* serving a single *dwelling unit*. Such winders shall have a tread depth of not less than nine inches (229 mm) at a point not more than 12 inches (305 mm) from the side where the tread is narrower and the minimum tread depth shall not be less than six inches (152 mm).

1014.6.4 Spiral stairways: Spiral *stairways* shall not be used as an element of a *means of egress* except: in occupancies in Use Group R-3; within a single *dwelling unit*; from a *mezzanine* area not more than 250 square feet (23.25 m^2) in area which serves not more than five occupants; and in penal facilities from a guard tower, observation station or control room not more than 250 square feet (23 m^2) in area. The minimum width of all spiral *stairways* shall be 26 inches (660 mm) with each tread having a 7½-inch (191 mm) minimum tread depth at 12 inches (305 mm) from the narrow edge. All treads shall be identical and the rise shall not be more than 9½-inches (241 mm). A minimum headroom of six feet six inches (1981 mm) shall be provided.

1014.6.5 Circular *stairways*: Circular *stairways* shall have a minimum tread depth and a maximum riser height in accordance with 780 CMR 1014.6 and the smaller radius shall not be less than twice the width of the *stairway*. The minimum tread depth measured 12 inches (305 mm) from the narrower end of the tread shall not be less than 11 inches (279 mm).

1014.6.6 Alternating tread stairways: *Alternating tread stairways* are permitted as an element of a *means of egress* in buildings from a *mezzanine* area not more than 250 square feet (23 m^2) in *area* and which serves not more than five occupants; and in penal facilities, from a guard tower, observation station or control room not more than 250 square feet (23 m^2) in area. *Alternating tread stairways* are also permitted for access to roofs as provided for in 780 CMR 1027.0.

1014.6.6.1 Handrails of alternating tread stairways: Handrails shall be provided on both sides of *alternating tread stairways* and shall conform to 780 CMR 1022.0.

1014.6.6.2 Treads of alternating tread stairways: *Alternating tread stairways* shall have a minimum projected tread of five inches (127 mm), a minimum tread depth of 8½ inches (216 mm), a minimum tread width of seven inches (178 mm) and a maximum riser to the next surface of the alternating tread of 9½ inches (241 mm). The initial tread of the *stairway* shall begin at the same elevation as the platform, landing or floor surface.

Exception: *Alternating tread stairways* used as an element of a *means of egress* in buildings from a mezzanine area not more than 250 square feet (23 m^2) in area which serves not more than five occupants shall have a minimum projected tread of 8½ inches (216 mm) with a minimum tread depth of 10½ inches (267 mm). The rise to the next alternating tread surface shall not be more than eight inches (203 mm).

1014.7 Stairway guards and handrails: *Stairways* shall have continuous guards and handrails on both sides. Intermediate handrails are required so that all portions of the required width of stairs are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel. Handrails shall be provided for *alternating tread stairways* in accordance with 780 CMR 1014.6.6.1. Guards shall be constructed in accordance with 780 CMR 1021.0. Handrails shall be constructed in accordance with 780 CMR 1022.0.

Exceptions:

1. *Stairways* with fewer than three risers are not required to have handrails where serving a single *dwelling unit* or where such *stairways* are not in an *exit access corridor* or aisle, *exit* or *exit discharge*.
2. Aisle stairs provided with a center handrail or serving seating on one side shall be equipped with a minimum of one handrail.
3. *Stairways* within a *dwelling unit* shall be equipped with a minimum of one handrail.
4. Spiral *stairways* shall be equipped with a minimum of one handrail.

1014.8 Egress doors: *Means of egress stairway* doors shall provide an egress capacity of not less than the required capacity of the *stairway* which serves the floor or area from which the egress door leads.

1014.8.1 Width: The minimum required width of every door to or from a *means of egress stairway* shall be determined by the most restrictive of the following criteria:

1. 29¾-inch (756 mm) clear width within a *dwelling unit* that is not required to be accessible or adaptable.
2. 36-inch (914 mm) minimum width of door leaf in an occupancy in Use Group I-2.
3. 32-inch (813 mm) clear width in all other cases.

1014.8.2 Direction of swing: All *means of egress* doors shall swing on a landing in the direction of egress travel. When opening, egress doors shall not reduce the width of landings to less than one-

half of the required width. When fully open, *means of egress* doors shall not project more than seven inches (178 mm) into the required width.

Exception: Doors leading from a room or tenant space to a *stairway* in buildings in which only one *exit* is required are not required to swing in the direction of egress travel.

1014.8.3 Door construction: All doorway opening protectives shall be *fire doors* complying with 780 CMR 716.0. *Labeled means of egress fire doors* shall have a maximum transmitted temperature end point of not more than 450°F (232°C) above ambient at the end of 30 minutes of standard fire test exposure.

1014.9 Stairway construction: All *stairways* shall be built of materials consistent with the types of materials permitted for the type of construction of the building; except that wood handrails shall be permitted for all types of construction. Such *stairways* shall have solid treads and landing platforms, and all finish floor surfaces shall be of slip-resistant materials.

1014.9.1 Strength: All *stairways*, platforms and landings in other than occupancies in Use Group R-3 shall be adequate to support a *live load* of 100 pounds per square foot (488.20 kg/m^2) and a concentrated *load* of 300 pounds (136.20 kg).

1014.10 Discharge identification: *Exit stairways* which continue beyond the *level of exit discharge* shall be interrupted at the *level of exit discharge* by partitions, doors or other effective means of preventing persons from continuing past the floor of discharge while egressing.

1014.11 Interior stairway enclosures: Interior *exit stairways* shall be enclosed with *fire separation assemblies* having a fireresistance rating of not less than two hours except that such *stairways* in occupancies in Use Group A, B, E, F, H-4, I, M, R or S which connect less than four stories shall be enclosed with *fire separation assemblies* having a fireresistance rating of not less than one hour. An *exit stairway* enclosure shall not be used for any purpose other than *means of egress*. Openings in exit enclosures, other than unexposed exterior openings, shall be limited to those necessary for *exit access* to the enclosure from normally occupied spaces and for egress from the enclosure.

Exceptions:

1. *Stairways* are not required to be enclosed in occupancies in Use Group A-5 in which all portions of the *means of egress* are essentially open to the outside.
2. *Stairways* serving and contained within a single residential *dwelling unit* in occupancies in Use Group R-2 or R-3 are not required to be enclosed.
3. *Stairways* that are not a required *means of egress* element are not required to be enclosed where such *stairways* comply with 780 CMR 713.3.
4. *Stairways* in open parking structures which serve only the parking structure are not required to be encloed.
5. *Stairways* in occupancies in Use Group I-3 as provided for in 780 CMR 410.3.7.

1014.11.1 Exterior walls: Exterior walls of an enclosed *exit stairway* shall comply with the requirements of 780 CMR 705.0 for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the *stairway*, the building exterior walls within ten feet (3048 mm) horizontally of the nonrated wall or unprotected opening shall be constructed as required for *stairway* enclosures, including opening protectives, but are not required to exceed a one-hour fireresistance rating with ¾-hour opening protectives. This construction shall extend vertically from a point ten feet (3048 mm) above the topmost landing of the *stairway* or to the roof line, whichever is lower, and down to the ground.

1014.11.2 Penetrations: Penetrations into and openings through an *exit* enclosure assembly are prohibited except for required *exit* doors, ductwork and equipment necessary for independent stair pressurization, required *ventilation sprinkler* piping, *standpipes* and electrical conduit serving the *stairway* and terminating at a steel box that does not exceed 16 square inches (10323 mm^2) in area. There shall not be any penetrations or communicating openings, whether protected or not between adjacent *stairway* enclosures.

1014.11.3 Door locks: All interior *stairway means of egress* doors shall be openable from both sides without the use of a key or special knowledge or effort.

Exceptions:

1. *Stairway* discharge doors shall be operable from the egress side and shall only be locked from the opposite side.
2. 780 CMR 1014.0 shall not apply to doors arranged in accordance with 780 CMR 403.10 and 1017.4.

1014.11.4 Exit signs: Each door to an enclosed *exit stairway* shall be equipped with tactile signage reading "Exit" complying with 521 CMR listed in ***Appendix A*** and installed on the side of the door from which *egress* is to be made.

1014.11.5 Stairway floor number signs: A sign shall be provided at each floor landing in all interior *exit stairways* connecting more than three stories designating the floor level above and below the *level of exit discharge*, the identification of the *stairway* and the availability of roof access from that *stairway*. The sign shall be located

approximately five feet (1524 mm) above the floor landing in a position which is readily visible when the doors are in the open and closed positions.

1014.12 Exterior stairways: Exterior *stairways* shall have openings on at least one side facing an *outer court*, yard or *public way*. The openings shall have an aggregate width of not less than 20% of the *stairway* perimeter and an aggregate area on each level of not less than 12% of the total perimeter wall area of each level. In other than occupancies in Use Group R-3, treads, platforms and landings which are part of exterior stairways in climates subject to snow or ice shall be protected to prevent accumulation of same. Exterior *stairways* shall not be accepted as an *exit* in the following cases:

1. Occupancies in Use Groups I-2 and I-3 in buildings that exceed four stories or 50 feet (15240 mm) in *height*.
2. Floors that exceed five stories or 65 feet (19812 mm) in height above the *level of exit discharge*.

1014.12.1 Location: Exterior *exit stairways* shall not project beyond the *street lot line*. Exterior *exit stairways* shall be located at least ten feet (3048 mm) from adjacent *lot lines* and from other buildings on the same lot unless openings in such buildings are protected by ¾-hour opening protectives.

Exception: Noncombustible exterior *stairways* constituting not more than 50% of the required *means of egress* shall be exempt from the ten-foot (3048 mm) *fire separation distance* requirement.

1014.12.2 Protection: Exterior *exit* stairs shall be separated from the interior of the building by walls with a fireresistance rating of not less than one hour, with fixed or self-closing opening protectives as required in 780 CMR 1014.11. This protection shall extend vertically from a point ten feet (3048 mm) above the topmost landing or the roof line, whichever is lower, down to the ground, and shall extend horizontally ten feet (3048 mm) from each side of the *stairway*. Openings within the horizontal ten-foot (3048 mm) extension of the protected walls beyond the *stairway* shall be equipped with fixed ¾-hour opening protective assemblies.

Exceptions:

1. Occupancies, other than those in Use Group R-1 or R-2, in buildings that are two stories or less above grade where the level of *exit discharge* is the first *story above grade*.
2. Separation from the interior of the building is not required where the exterior *stairway* is served by an exterior *exit access* balcony that connects two remote exterior *stairways* or other approved *exits*, with a perimeter which is not less than 50% open. To be considered open, the opening shall be a minimum of 50% of the height of the enclosing wall, with the top of the openings not less than seven feet (2134 mm) above the top of the balcony.
3. Separation from the interior of the building is not required for an exterior *stairway* located in a building or structure that is permitted to have unenclosed interior *exit stairways* in accordance with 780 CMR 1014.11.

780 CMR 1015.0 SMOKEPROOF ENCLOSURES

1015.1 General: A *smokeproof enclosure* shall consist of an enclosed interior *exit stairway* that conforms to 780 CMR 1014.0 and an outside balcony or a *ventilated* vestibule meeting the requirements of 780 CMR 1015.0. Where access to the roof is required by 780 CMR 1027.0, such access shall be from the *smokeproof enclosure* where a *smokeproof enclosure* is required.

1015.2 Where required: In buildings having a height of 70 feet above the grade plane, at least one exit stairwell shall be protected by a smokeproof enclosure serving all floor levels. In buildings having exit stairwells more than 30 feet below the *level of exit discharge*, at least one exit stairwell shall be protected by a smokeproof enclosure serving all floor levels located below the *level of exit discharge*.

Exception: Occupancies in Use Group I-2.

1015.3 Access: Access to the stair shall be from every story and shall be by way of a vestibule or by way of an open exterior balcony. The minimum dimension of the vestibule shall not be less than the required width of the *corridor* leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

1015.4 Construction: The *smokeproof enclosure* shall be separated from the remainder of the building by not less than a two-hour fireresistance rated *fire separation assembly* without openings other than the required *means of egress* doors. The vestibule shall be separated from the *stairway* by not less than a two-hour fireresistance rated *fire separation assembly*. The open exterior balcony shall be constructed in accordance with the fireresistance rating requirements for floor construction.

1015.4.1 Door closers: All doors in a *smokeproof enclosure* shall be self-closing or shall be automatic-closing by actuation of a smoke detector installed at the floor side entrance to the *smokeproof enclosure* in accordance with 780 CMR 716.5. The actuation of the smoke detector on any door shall activate the closing

at all levels. Smoke detectors shall be installed in accordance with 780 CMR 918.8.

1015.5 Natural ventilation alternative: The provisions of 780 CMR 1015.5.1 through 1015.5.3 shall apply to *ventilation* of *smokeproof enclosures* by natural means.

1015.5.1 Balcony doors: Where access to the *stairway* is by way of an open exterior balcony, the door assembly into the enclosure shall be a *fire door* in accordance with 780 CMR 716.0.

1015.5.2 Vestibule doors: Where access to the *stairway* is by way of a vestibule, the door assembly into the vestibule shall be a *fire door* complying with 780 CMR 716.0. The door assembly from the vestibule to the *stairway* shall have not less than a 20-minute fire protection rating complying with 780 CMR 716.0.

1015.5.3 Vestibule ventilation: Each vestibule shall have a minimum net area of 16 square feet (1.49 m^2) of opening in a wall facing an *outer court*, yard or *public way* which is at least 20 feet (6096 mm) in width.

1015.6 Mechanical ventilation alternative: The provisions of 780 CMR 1015.6.1 through 1015.6.4 shall apply to *ventilation* of *smokeproof enclosures* by mechanical means.

1015.6.1 Vestibule doors: The door assembly from the building into the vestibule shall be a *fire door* complying with 780 CMR 716.0. The door assembly from the vestibule to the *stairway* shall have not less than a 20-minute fire protection rating in accordance with 780 CMR 716.0. The door from the building into the vestibule shall be provided with gaskets or other provisions to minimize air leakage.

1015.6.2 Vestibule ventilation: The vestibule shall be supplied with not less than one air change per minute, and the exhaust shall not be less than 150% of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within six inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than six inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling dampers are permitted where necessary to meet the design requirements, but dampers are not otherwise required.

1015.6.2.1 Engineered ventilation system: Where a specially engineered system is used, the systems shall exhaust a quantity of air equal to not less than 90 air changes per hour from any vestibule in the emergency operation mode and shall be sized to handle three vestibules simultaneously. Smoke detectors shall be located at the floor side entrance to each vestibule and shall activate the system for the affected vestibule. Smoke detectors shall be installed in accordance with 780 CMR 918.8.

1015.6.3 Smoke trap: The vestibule ceiling shall be at least 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward moving air column. The height shall not be decreased unless approved and justified by design and test.

1015.6.4 Stair shaft air movement system: The stair *shaft* shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water column (24.88 P) in the *shaft* relative to the vestibule with all doors closed.

1015.7 Ventilating equipment: The activation of *ventilating* equipment required by the alternatives in 780 CMR 1015.6 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the *smokeproof enclosure*. When the closing device for the stair *shaft* and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with 780 CMR 918.8.

1015.7.1 Ventilation systems: *Smokeproof enclosure ventilation* systems shall be independent of other building *ventilation* systems. The equipment and ductwork shall comply with one of the following:

1. Equipment and ductwork shall be located exterior to the building and shall be directly connected to the *smokeproof enclosure* or connected to the *smokeproof enclosure* by ductwork enclosed by two-hour fireresistance rated *fire separation assemblies*.
2. Equipment and ductwork shall be located within the *smokeproof enclosure* with intake or exhaust directly from and to the outside or through ductwork enclosed by two-hour fireresistance rated *fire separation assemblies*.
3. Equipment and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by two-hour fireresistance rated *fire separation assemblies*.

1015.7.2 Standby power: Mechanical vestibule and stair *shaft ventilation* systems and automatic fire detection systems shall be powered by an approved standby power system conforming to 780 CMR 403.9.1 and ***527 CMR 12.00, the Massachusetts Electrical Code, referenced in 780 CMR 27, and listed in Appendix A.***

NON-TEXT PAGE

1015.7.3 Acceptance and testing: Before the mechanical equipment is approved, the system shall be tested in the code official's presence to confirm that the system is operating in compliance with these requirements.

780 CMR 1016.0 RAMPS

1016.1 Capacity: The capacity of a ramp used as a *means of egress* component shall be computed in accordance with 780 CMR 1009.0.

Note: For ramp design requirements related to building access issues, refer to 780 CMR 11.00

1016.2 Minimum dimensions: The minimum dimensions of *means of egress* ramps shall comply with 780 CMR 1016.2.1 through 1016.2.3.

1016.2.1 Width: The minimum width of a *means of egress* ramp shall not be less than that required for *corridors* by 780 CMR 1011.3.

1016.2.2 Headroom: The minimum headroom in all parts of the *means of egress* ramp shall not be less than 80 inches (2032 mm).

1016.2.3 Restrictions: *Means of egress* ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited except at and below handrail height where, at each handrail, the projections shall not exceed 3½ inches (89 mm) into the required width. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

1016.3 Maximum slope: The maximum slope of *means of egress* ramps in the direction of travel shall be one unit vertical in 12 units horizontal (1:12); except the maximum slope shall be: one unit vertical in eight units horizontal (1:8) if the rise is limited to three inches (76 mm); one unit vertical in ten units horizontal (1:10) if the rise is limited to six inches (152 mm). The maximum slope across the direction of travel shall be one unit vertical in 48 units horizontal (1:48).

Exception: Aisles in areas of Use Group A shall comply with 780 CMR 1012.0.

1016.4 Landings: Ramp slopes of one unit vertical in 12 units horizontal (1:12) or steeper shall have landings at the top, bottom, all points of turning, entrance, *exit* and at doors. Ramps shall not have a vertical rise greater than 30 inches (762 mm) between landings. The maximum slope of landings shall be one unit vertical in 48 units horizontal (1:48). The least dimension of a landing shall not be less than the required width of the ramp except that the landing dimension in the direction of travel is not required to exceed four feet (1219 mm) where the travel from one ramp to the next ramp is a straight run.

Exception: Aisles in areas of Use Group A shall comply with 780 CMR 1012.0.

1016.5 Guards and handrails: Guards shall be provided on both sides of the ramp and shall be constructed in accordance with 780 CMR 1021.0. Handrails conforming to 780 CMR 1022.0 shall be provided on both sides of every ramp having a slope greater than one unit vertical in 20 units horizontal (1:20). Handrails are not required on ramps where the vertical rise between landings is six inches (152 mm) or less.

Exception: Handrails in aisles in occupancies in Use Group A shall comply with 780 CMR 1012.0.

1016.5.1 Drop-offs: The sides of ramps and landings with a drop-off shall have a curb with a minimum four-inch (102 mm) height above the walking surface or shall be provided with a guardrail.

1016.6 Ramp construction: Ramps used as an *exit* shall conform to the applicable requirements of 780 CMR 1014.9 as to materials of construction and enclosure.

1016.6.1 Surface: For all slopes exceeding one unit vertical in 20 units horizontal (1:20) and where the use is such as to involve danger of slipping, the ramp shall be surfaced with approved slip-resistant materials.

1016.6.2 Exterior ramps: Exterior ramps and landings shall be designed and constructed to prevent water from accumulating on the walking surface.

780 CMR 1017.0 MEANS OF EGRESS DOORWAYS

1017.1 General: The requirements of 780 CMR 1017.0 shall apply to all doorways serving as a component or element of a *means of egress*, except as provided for in 780 CMR 1014.8, 1014.12.2, 1015.5.1.1015.5.2 and 1015.6.1.

1017.1.1 Floor surface: The floor surface on both sides of a door shall be at the same elevation. The floor surface over which the door swings shall be at the same elevation as the floor level at the threshold and shall extend from the door in the closed position a distance equal to the door width.

Exception: This requirement shall not apply to:

1. Exterior doors, as provided for in 780 CMR 1005.6, which are not on an accessible route.
2. Variations in elevation due to differences in finish materials, but not more than ½ inch (13 mm).

Thresholds at doorways shall not exceed ¾ inch (19 mm) in height above the finished floor surface for exterior residential sliding doors or ½ inch (13 mm) for all other doors. Raised thresholds and floor level changes greater than ¼ inch (6 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (1:2).

1017.2 Number of doorways: Each occupant of a room or space shall have access to at least two *exits* or *exit access* doors from the room or space where the occupant load of the space exceeds that listed in Table 1017.2, or where the travel distance from any point within the space to an *exit* or *exit access* door exceeds that listed in Table 1017.2. Where the occupant load of a room or space is between 501 and 1,000, a minimum of three *exits* or *exit access* doors shall be provided. Where the occupant load of a room or space exceeds 1,000, a minimum of four *exits* or *exit access* doors shall be provided.

Exceptions:

1. Boiler, incinerator and furnace rooms shall be provided with two egress doorways where the area exceeds 500 square feet (47 m^2) and individual fuel-fired equipment exceeds 400,000 Btuh (117 kW) input capacity. Door ways shall be separated by a horizontal distance equal to not less than one-half of the diagonal dimension of the room. Where two doorways are required by this exception, a fixed ladder access out of the room shall be permitted in lieu of one doorway.
2. In an occupancy in Use Group I-2, any room and any suite of rooms as permitted in 780 CMR 1011.1.1, Exception No.3, of more than 1,000 square feet (93 m^2), shall have at least two *exit access* doors remote from each other.

Table 1017.2
SPACES WITH ONE MEANS OF EGRESS

Use Group	Maximum occupant load	Maximum travel distance (feet)[b]
A, B, E, F, M	50	75
H-1[a], H-2, H-3	3	25
H-4	10	75
I, R	10	75
S	30	100

Note a. For requirements for areas and spaces in Use Group H-1, see 780 CMR 418.2.2.

Note b. 1 foot = 304.8 mm.

1017.2.1 Entrance and egress doorways: Where separate doors are provided for entrance and *means of egress*, the entrance door shall be clearly marked "Entrance Only" in letters not less than six inches (152 mm) in height and legible from both inside and outside.

1017.2.2 Location of doors: The required doorways opening from a room or space within a building and leading to an *exit access* shall be located as remote as practicable from each other and shall conform to 780 CMR 1006.4.1. The distance of *exit access* travel from any point in a room or space to a required *exit* door shall not exceed the limitations of 780 CMR 1006.5.

1017.2.3 Door arrangement: The space between doors in series shall not be less than seven feet (2134 mm) as measured when the doors are in the closed position.

Exception: Power-operated doors and occupancies in Use Groups I-1 and R-3.

1017.3 Size of doors: The minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of not less than 32 inches (813 mm). Where 780 CMR 1017.0 requires a minimum clear width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches (813 mm). The maximum width of a swinging door leaf shall be 48 inches nominal. *Means of egress* doors in an occupancy in Use Group I-2 used for the movement of beds shall be at least 44 inches (1118 mm) wide. The height of doors shall not be less than 80 inches (2032 mm).

Exceptions:

1. A *means of egress* door serving a storage area of not more than 800 square feet (74 m^2) and which is normally unoccupied shall have a maximum width of ten feet (3048 mm).
2. The minimum and maximum width shall not apply to doors that are not required for *means of egress* in occupancies in Use Groups R-2 and R-3.
3. Door openings to resident sleeping rooms in occupancies in Use Group I-3 shall have a clear width of not less than 28 inches (711 mm).
4. Door openings to storage closets less than ten square feet (0.93 m^2) in area shall not be limited by the minimum width.
5. Width of door leafs in revolving doors that comply with 780 CMR 1018.0 shall not be limited.
6. Door openings within a *dwelling unit* shall not be less than 78 inches (1981 mm) in height.
7. Exterior door openings in *dwelling units*, other than the required *exit* door, shall not be less than 76 inches (1930 mm) in height.
8. Interior egress doorways within a *dwelling unit* not required to be adaptable or accessible shall have a minimum clear width of 29¾-inches (755 mm).

1017.4 Door hardware: Door handles, pulls, latches, locks and other operating devices shall be at a maximum height of 48 inches (1219 mm) above the finished floor. The operating devices shall be capable of operation with one hand and shall not require tight grasping, tight pinching or twisting of the wrist to operate. All *means of egress* doors shall be of a side-swinging type. All doors shall swing in the direction of egress where serving an occupant

indicating the direction and way of egress. All "Exit" signs shall be located at *exit* doors or *exit access* areas, so as to be readily visible. Sign placement shall be such that any point in the *exit access* shall not be more than 100 feet (30480 mm) from the nearest visible sign.

Exceptions:

1. "Exit" signs are not required in sleeping room areas in occupancies in Use Group I-3.
2. Main exterior *exit* doors which are obviously and clearly identifiable as *exits* are not required to have "Exit" signs where approved.

1023.2 Size and color: "Exit" signs shall have red letters at least six inches (152 mm) high and the minimum width of each stroke shall be ¾ inch (19 mm) on a white background or in other approved distinguishable colors. The word "Exit," except the letter I, shall have letters having a width of not less than two inches (51 mm) and the minimum spacing between letters shall not be less than ⅜ inch (10 mm). Signs larger than the minimum size herein required shall have letter widths and spacing in the same proportions to the height as indicated in 780 CMR 1023.0. If an arrow is provided as part of an "Exit" sign, the construction shall be such that the arrow direction cannot be readily changed. The word "Exit" shall be clearly discernible when the sign illumination means is not energized.

Exception: All exit signs tested and listed to UL-924 as listed in Appendix A and satisfying the power source requirements of 780 CMR 1023.4 shall be permitted.

1023.3 Illumination: Each sign shall be illuminated by a source providing not less than five footcandles (54 lux) at the illuminated surface and shall have a contrast ratio of not less than 0.5.

Exception: Approved self-luminous signs which provide evenly illuminated letters shall have a minimum luminance of 0.06 foot lamberts (0.21 cd/m^2).

1023.4 Power source: All "Exit" signs shall be illuminated at all times that the building is occupied. To assure continued illumination for a duration of not less than 1 hour in case of primary power loss, the "Exit" signs shall be connected to an emergency electrical system that complies with ***527 CMR 12.00, the Massachusetts Electrical Code, referenced in 780 CMR 27, and listed in Appendix A.***

Exceptions:

1. Approved self-luminous signs which provide continuous illumination independent of external power sources are not required to comply with 780 CMR 2706.0.
2. ***All exit signs tested and listed to UL-924 as listed in Appendix A and satisfying the power source requirements of 780 CMR 1023.4 shall be permitted.***

780 CMR 1024.0 MEANS OF EGRESS LIGHTING

1024.1 Artificial lighting: All *means of egress* in other than occupancies in Use Group R-3 shall be equipped with artificial lighting facilities to provide the intensity of illumination herein prescribed continuously during the time that conditions of occupancy of the building require that the *exits* be available. Lighting shall also be provided to illuminate the *exit discharge*. *Means of egress* lighting in occupancies in Use Group R-2, other than lighting within a *dwelling unit*, shall be wired on a circuit independent of circuits within any *dwelling unit*. The disconnecting means and overcurrent protection device shall not be located within a *dwelling unit* or such that access to such devices must be obtained by going through a *dwelling unit*.

1024.2 Intensity of illumination: The intensity of floor lighting shall not be less than one footcandle (11 lux) except as provided for in 780 CMR 1024.3.

1024.3 Use Groups A and E: In occupancies in Use Groups A and E for the exhibition of motion pictures or other projections by means of directed light, the minimum required illumination of aisles during such period of projection shall be 0.2 footcandle (2 lux).

1024.3.1 Control: The lighting of *exits*, aisles and auditoriums shall be controlled from a location that does not provide access to unauthorized persons. Supplementary control shall be provided as specified in 780 CMR 411.4 in the motion picture projection room.

1024.4 Power source: *Means of egress* lighting in all buildings, rooms or spaces required to have more than one *exit* or *exit access* shall be connected to an emergency electrical system that complies with ***527 CMR 12.00, the Massachusetts Electrical Code, referenced in 780 CMR 27, and listed in Appendix A*** to assure continued illumination for a duration of not less than one hour in case of emergency or primary power loss.

780 CMR 1025.0 FIRE ESCAPES

1025.1 Where permitted: Fire escapes shall be permitted only as provided for in 780 CMR 1025.1.1 through 1025.1.4.

1025.1.1 New buildings: Fire escapes shall not constitute any part of the required *means of egress* in new buildings.

1025.1.2 Existing fire escapes: Existing fire escapes shall be continued to be accepted as a component in the *means of egress* in existing buildings only.

1025.1.3 New fire escapes: New fire escapes for existing buildings shall be permitted only where exterior stairs cannot be utilized due to *lot lines* limiting stair size or due to the sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

1025.1.4 Limitations: Fire escapes shall comply with 780 CMR 1025.0 and shall not constitute more than 50% of the required number of *exits* nor more than 50% of the required *exit* capacity.

1025.2 Location: Where located on the front of the building and where projecting beyond the building line, the lowest landing shall not be less than seven feet (2134 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counterbalanced *stairway* to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall not be less than 12 feet (3658 mm).

1025.3 Construction: The fire escape shall be designed to support a *live load* of 100 pounds per square foot (488.20 kg/m^2) and shall be constructed of steel or other approved noncombustible materials. Fire escapes constructed of wood not less than nominal two inches thick are permitted on buildings of Type 5 construction. Walkways and railings located over or supported by combustible roofs in buildings of Types 3 and 4 construction are permitted to be of wood not less than nominal two inches thick.

1025.3.1 Dimensions: Stairs shall be at least 22 inches (559 mm) wide with risers not more than, and treads not less than, eight inches (203 mm) and landings at the foot of stairs not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than eight inches (203 mm) below the door.

1025.3.2 Opening protectives: Doors and windows along the fire escape shall be protected with ¾-hour opening protectives.

780 CMR 1026.0 SLIDESCAPES

1026.1 Where permitted: Existing slidescapes and safety chutes shall be permitted in existing occupancies in Use Groups E, H and I where approved. Slidescapes and safety chutes shall be permitted in occupancies in Use Groups H-1 and H-2 where constructed in an approved manner.

1026.2 Location: The arrangement and location of slidescapes shall conform to 780 CMR 10 for *means of egress* and shall be designated by "Exit" signs and lights as provided for in 780 CMR 1023.0.

1026.3 Construction: All chutes shall be constructed of approved noncombustible materials with a pitch in the line of travel of not less than 24 nor more than 42° (0.42 rad to 0.73 rad), measured on the developed circumference of spiral chutes. Straight chutes shall not be less than 24 inches (610 mm) and spiral chutes shall not be less than 28 inches (711 mm) in clear width; nor more than 44 inches (1118 mm) wide in any case. Where erected on the interior of a building, the chutes shall be enclosed as required in 780 CMR 1014.11 for interior *stairways* with direct *means of egress* to a street or other *public way*.

1026.4 Capacity: Slidescapes shall have a rated egress capacity of 60 occupants per slide. Slidescapes, except as permitted for occupancies in Use Groups H-1 and H-2, shall not constitute more than 25% of the required *means of egress* capacity from any building or structure or any individual story.

780 CMR 1027.0 ACCESS TO ROOF

1027.1 By stairway or ladder: In buildings more than three stories in *height* except those with a roof slope greater than four units vertical in 12 units horizontal (4:12). access to the roof shall be provided by means of a *stairway*, an *alternating tread stair* in accordance with 780 CMR 1014.6.6 or a ladder and trap door. The ladder shall not be on the exterior of the building. Where the roof is used as a roof garden or for other habitable purposes, sufficient *stairways* shall extend to the roof to provide the necessity *exit* facilities from the roof as required for such occupancy. Roof trap doors shall be constructed to comply with 780 CMR 1510.2.

1027.1.1 Optional stairway or ladder: In buildings not required to have a *stairway*, *alternating tread stair* or ladder to the roof, such devices, if provided, shall conform to the provisions of 780 CMR 1027.0. Ladders placed on the exterior of the building shall be of metal and, if exceeding 20 feet (6096 mm) in height, shall have a protective cage or other safety device. The siderails of exterior ladders shall be carried over the coping or parapet to serve as handrails. Other design details of such exterior ladders are subject to approval.

1027.2 Roof enclosures: *stairways* extending through roofs shall be enclosed in roof structures of fireresistance rated construction which conform to the requirements of 780 CMR 1510.0.

780 CMR 1028.0 MAINTENANCE OF EXITS

1028.1 Obstructions: It shall be unlawful to obstruct, or reduce in any manner, the clear width of any doorway, hallway, passageway or other *means of egress* required by the provisions of 780 CMR.

1028.2 Maintenance: All exterior *stairways* and fire escapes shall be kept free of snow and ice. Exterior *stairways* and fire escapes constructed of materials requiring the application of weather protecting products, shall have these products applied in an approved manner and shall be applied as often as necessary to maintain the *stairways* and fire escapes in safe condition ***where corrodible structural parts of such stairways and fire escapes tie directly into the building structural system, all joints shall be sealed, as necessary, to prevent water from damaging or corroding structural elements.***

1028.3 Testing and Certification: All exterior bridges, steel or wooden stairways, fire escapes and egress balconies shall be examined and/or tested, and certified for structural adequacy and safety every five years, by a Massachusetts registered professional engineer, or others qualified and acceptable to the building official; said engineer or others shall then submit an affidavit to the building official.

NON-TEXT PAGE

CHAPTER 12

INTERIOR ENVIRONMENT

780 CMR 1201.0 GENERAL

1201.1 Scope: The provisions of 780 CMR 12 shall govern the means of light, *ventilation*, sound transmission control and rat-proofing required in all buildings.

1201.2 Buildings on same lot: Where more than one building is hereafter placed on a *lot*, or where a building is placed on the same lot with *existing buildings* and the several buildings are treated as a single structure for the purposes of 780 CMR 12, equivalent uncovered *lot* area or other adequate sources of light and *ventilation* shall be provided for all occupied buildings.

780 CMR 1202.0 DEFINITIONS

1202.1 General: The following words and terms shall, for the purposes of 780 CMR 12 and as used elsewhere in 780 CMR, have the meanings shown herein.

Attic: The space between the ceiling beams of the top story and the roof rafters.

Court: An open, uncovered and unoccupied space on the same *lot* as a building where such space is enclosed wholly or partly by buildings, walls or other enclosing devices (see 780 CMR 1212.0).

Inner: Any *court* enclosed wholly by buildings, *walls* or other enclosing devices.

Outer: A *court* extending to and opening upon a street, public alley or other approved open space that is not less than 15 feet (4572 mm) wide, or upon a required yard.

Court height: The vertical distance from the lowest level of the *court* to the mean height of the top of the enclosing *walls*.

Court width: As applied to an *inner court*, means the least horizontal dimension. As applied to an *outer court*, means the shortest horizontal dimension measured in a direction substantially parallel with the principal open end of such *court*.

Habitable space: Space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

Occupiable space: A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes, or in which occupants are engaged at labor; and which is equipped with *means of egress* and light and *ventilation* facilities meeting the requirements of 780 CMR.

Vapor retarder: A material having a perm rating of 1.0 or less, such as foil, plastic sheeting, or insulation facing, installed to retard the passage of water vapor or moisture through the *exterior envelope*.

Ventilation: The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

Yard: An unoccupied open space other than a *court* (see 780 CMR 1212.0 and 1213.0).

780 CMR 1203.0 CONSTRUCTION DOCUMENTS

1203.1 General: *Construction documents* for all buildings and structures that are designed for human *occupancy*, other than buildings with occupancies in Use Groups I-1, R-2 and R-3, shall designate the number of occupants to be accommodated in the various rooms and spaces; where means of artificial lighting and *ventilation* are required, the application shall include sufficient details and description of the mechanical system to be installed as herein required or as specified in the mechanical code listed in *Appendix A*.

780 CMR 1204.0 ROOM DIMENSIONS

1204.1 Ceiling heights: *Habitable (spaces)* rooms other than kitchens shall have a ceiling height of not less than seven feet six inches (2286 mm). Hallways, *corridors*, bathrooms, toilet rooms, kitchens, laundry rooms and *habitable basements* that are only used as recreation rooms shall have a ceiling height of not less than seven feet (2134 mm) measured to the lowest projection from the ceiling.

Exception: In occupancies in Use Group R-3, the maximum projection below the required ceiling height of beams and girders spaced not less than four feet (1219 mm) on center shall be six inches (152 mm).

1204.1.1 Use Groups A, B, E and M: A clear height from the finished floor to the finished ceiling or lowest projection of not less than seven feet six inches (2286 mm) shall be provided in all exit access and occupiable rooms of structures of Use Groups A, B, E and M.

1204.1.2 Sloping ceilings: If any room in a building has a sloping ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than five feet (1524 mm) from the finished floor to the finished ceiling shall not be included in any computation of the minimum area thereof.

1204.1.3 Furred ceilings: If any room has a furred ceiling, the prescribed ceiling height is required in two-thirds of the area thereof, but the height of the furred ceiling shall not be less than seven feet (2134 mm).

1204.2 Floor area: *Habitable* rooms, except kitchens, shall have an area of not less than 70 square feet (6.51 m^2).

1204.3 Width: A *habitable* room other than a kitchen shall not be less than seven feet (2134 mm) in any dimension.

780 CMR 1205.0 LIGHT AND VENTILATION REQUIRED

1205.1 Light required: Every room or space intended for human occupancy shall be provided with natural or artificial light.

1205.1.1 Bathroom and toilet room lighting: Every bathroom and toilet room shall be provided with artificial light. The illumination shall have an average intensity of three footcandles (32.29 lux) measured at a level of 30 inches (762 mm) above the floor.

1205.2 Ventilation required: Every room or space intended for human occupancy shall be provided with natural or mechanical *ventilation.*

1205.2.1: Every bathroom containing a bathtub and/or shower shall be equipped with a mechanical exhaust fan and associated ductwork with the fan exhausting, at such rates as specified in the BOCA National Mechanical Code/1993 as referenced in Appendix A. Passive ventilation methods such as openable windows shall not substitute for ventilation. Such bathroom exhaust shall vent directly to the outside and no exhaust vent shall terminate in attics or other interior portions of the building.

Note: See also 105 CMR 410.000

780 CMR 1206.0 NATURAL LIGHT

1206.1 General: ***Should natural lighting be chosen as a lighting option***, in the application of the provisions of 780 CMR 12, the standard of natural light for all *habitable* and *occupiable rooms*, unless otherwise specifically required by the provisions of 780 CMR 4 for special occupancies, shall be based on 250 footcandles (2691 lux) of illumination on the vertical plane adjacent to the exterior of the light-transmitting device in the enclosure *wall* and shall be adequate to provide an average illumination of six footcandles (64.58 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

1206.2 Minimum glazing area: Every room or space intended for human occupancy shall have an exterior glazing area of not less than 8% of the floor area. Natural light shall be provided by glazing areas that open onto *courts* or yards which comply with the requirements of 780 CMR 1212.0, or by other approved means.

1206.2.1 Adjoining spaces: Where natural light for rooms or spaces without exterior glazing areas is provided through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8% of the floor area of the interior room or space, but not less than 25 square feet (2.33 m^2). The exterior glazing area shall be based on the total floor area being served.

1206.3 Stairways: Interior *stairways* shall be provided with an exterior glazing area of not less than ten square feet (0.93 m^2) on every floor through which the *stairway* passes.

1206.4 Hallways: Natural light shall be capable of penetrating the full length of the hallway.

780 CMR 1207.0 ARTIFICIAL LIGHT

1207.1 General: ***Should artificial lighting be chosen as a lighting option***, artificial light shall be capable of providing the minimum illumination specified for natural light.

780 CMR 1208.0 NATURAL VENTILATION

1208.1 General: ***Should natural ventilation be chosen as a ventilation option***, natural *ventilation* of an occupied space shall be through windows, doors, louvers or other natural openings to the outdoor air.

Exception: All occupancies shall have mechanical *ventilation* in bathrooms and toilet rooms as specified in 780 CMR 1205.2.1.

1208.2 Ventilation area required: The minimum openable area to the outdoors shall be 4% of the floor area being *ventilated.*

1208.2.1 Adjoining spaces: Where rooms and spaces without openings to the outdoors are *ventilated* through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8% of the floor area of the interior room or space, but not less than 25 square feet (2.33 m^2). The *ventilation* openings to the outdoors shall be based on the total floor area being *ventilated.*

1208.2.2 Openings below grade: Openings below grade shall be acceptable for natural *ventilation* provided that the outside horizontal clear space measured perpendicular to the opening is 1½ times the depth below the average adjoining grade.

1208.3 Contaminants exhausted: Contaminants in the breathing atmosphere shall be exhausted to the outdoor air in accordance with the mechanical code listed in *Appendix A*.

1208.4 Openings onto yards or courts: Natural *ventilation* shall be provided by openings onto yards or *courts* which comply with the requirements of 780 CMR 1212.0, or by other approved means.

780 CMR 1209.0 MECHANICAL VENTILATION

1209.1 General: ***Should mechanical ventilation be chosen as the ventilation option,*** mechanical *ventilation* shall conform to the requirements of the mechanical code listed in *Appendix A*.

Note: Also see 780 CMR 1205.2.1

780 CMR 1210.0 VENTILATION OF SPECIAL SPACES

1210.1 Roof spaces: Enclosed *attics* and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, shall have cross *ventilation* for each separate space by *ventilation* openings that are protected against the entrance of rain and snow. The openings shall be covered with corrosion-resistant mesh not less than ¼ inch (6 mm) nor more than ½ inch (13 mm) in any direction.

1210.1.1 Ventilating area: The minimum required net free ventilating area shall be 1/150 of the area of the space *ventilated*, except that the minimum required area shall be reduced to 1/300, provided that: a *vapor retarder* having a permeance not exceeding one perm is installed on the warm side of the ceiling; or at least 50%, and not more than 80%, of the required ventilating area is provided by ventilators located in the upper portion of the space to be *ventilated* at least three feet (914 mm) above eave or cornice vents, with the balance of the required *ventilation* provided by eave or cornice vents.

1210.2 Crawl spaces: Crawl space areas, other than those used as an underfloor plenum, shall be *ventilated* by an approved mechanical means or by openings in exterior *foundation walls*. Openings shall be located as close to corners as practicable and shall provide cross *ventilation* on at least two approximately opposite sides. The openings shall be covered with corrosion-resistant mesh not less than ¼ inch (6 mm) nor more than ½ inch (13 mm) in any direction.

1210.2.1 Opening size: Openings shall have a net area of not less than one square foot (0.093 m^2) for each 150 square feet (13.95 m^2) of foundation space. Where an approved *vapor retarder* is installed over the ground surface, the required net area of openings shall be reduced to 0.1 square foot (0.093 m^2) for each 150 square feet (13.95 m^2) and vents shall have manually operable louvers.

1210.3 Alternative mechanical ventilation: Enclosed *attic*, rafter and crawl spaces which are not *ventilated* as herein required shall be equipped with a mechanical *ventilation* system conforming to the requirements of the mechanical code listed in *Appendix A*.

780 CMR 1211.0 ACCESS TO CRAWL SPACES AND ATTICS

1211.1 Access to crawl spaces: Access shall be provided to crawl spaces by an opening not less than 18 inches (457 mm) by 24 inches (610 mm). ***Such access, if common to conditioned space, shall be weatherstripped and shall close tightly.***

1211.2 Access to attics: An opening not less than 22 inches by 30 inches (559 mm by 762 mm) with ready access thereto shall be provided to any *attic* area having a clear height of over 30 inches (762 mm). ***Such access, if adjoining conditioned space, shall be weatherstripped, and close tightly. All such access opening framing joints shall be caulked, gasketed, weatherstripped, foamed or otherwise sealed to limit infiltration/exfiltration.*** Where doors or other openings are installed in attic *draftstopping*, such doors shall be self-closing and be of approved materials as specified in 780 CMR 1211.0, and the construction shall be tightly fitted around all pipes, ducts or other assemblies piercing the *draftstopping*.

780 CMR 1212.0 COURTS AND YARDS

1212.1 General: All *courts* and yards required to serve rooms for natural light or *ventilation* purposes shall comply with the requirements of 780 CMR 1212.0.

1212.2 Minimum width: Every such *court* or yard shall have a minimum width of three inches (76 mm) for each one foot (305 mm) of height or fraction thereof, but not less than five feet (1524 mm) for *outer courts* and twice these values for *inner courts*.

1212.2.1 Irregular court or yard width: In the case of irregular or gore-shaped *courts* or yards, the average width shall not be less than the required width of a *court* in accordance with 780 CMR 1212.2, but shall not be less than five feet (1524 mm) at any point.

1212.3 Area of court: The cross-sectional area of a required *court* shall not be less than 1½ times the square of its width; nor shall the length of any *court* be more than twice its width.

1212.4 Access to court: A door or other means of access shall be provided at the bottom of every *court* that is not otherwise provided with convenient access for purposes of cleaning.

1212.5 Air intakes: Every *court* which serves one or more *habitable* rooms and which does not open for its full height on one or more sides to a street or legal yard, shall be connected at or near the bottom with a street or yard by a horizontal intake or passage of fireresistance rated construction. Such intake or passage shall have a cross-sectional area of not less than 21 square feet (1.95 m^2) and shall remain fully open at both ends and unobstructed for its full size and length, except that grilles of noncombustible construction are permitted at the ends of the intake.

1212.5.1 Fireresistance rating: The *walls*, floors and ceilings of such intakes or passages shall have a fireresistance rating of not less than two hours in buildings of Type 1, 2, 3 or 4 construction and not less than a one-hour *fireresistance rating* in buildings of Type 5 construction.

1212.6 Court walls: Where, in the opinion of the code official, windows facing on *courts* do not receive adequate direct light by reason of peculiar arrangement or orientation, the code official shall require the *walls* to be constructed of light-colored masonry, or to be painted and maintained a light color to furnish additional reflected light, or shall require other approved means of providing additional light.

1212.7 Court drainage: The bottom of every *court* shall be properly graded and drained to a public sewer or other approved disposal system complying with the plumbing code listed in *Appendix A*; and shall be paved with concrete or other non-absorbent material where required by the code official.

780 CMR 1213.0 OBSTRUCTION OF COURTS AND YARDS

1213.1 Permissible projections: Every required *court* and yard shall remain unobstructed for its required area and full height, except for the projections permitted in 780 CMR 1213.2 through 1213.7.

1213.2 Maximum encroachment: A part of any building or structure shall not extend into side *courts*, *inner courts* or yards required for light and *ventilation* of *habitable* and *occupiable rooms* by the *zoning* law or other statutes controlling building construction. The encroachment shall not exceed 20% of the legal area of the yard or *court* which is required for light and *ventilation* purposes.

1213.3 Accessories: In Use Groups R and I, clothes poles, arbors, garden trellises and other such accessories shall not be prohibited in the open spaces at ground level.

1213.4 Roof eaves: Roof eaves shall not project more than three feet (914 mm) beyond the face of the *wall*.

1213.5 Steps and architectural features: Steps, window sills, belt courses and similar architectural features, as well as rain leaders and chimneys, shall not project more than two feet (610 mm) beyond the face of the *wall*.

1213.6 Exterior stairways and fire escapes: Outside *stairways*, smokeproof tower balconies, fire escapes or other required elements of a *means of egress* shall not project more than four feet (1219 mm) beyond the face of the *wall*.

1213.7 Motor vehicle parking: Where approved, required *court* and yard areas for automobile parking spaces or *private garages* not exceeding one story in *height* where accessory to and only for the occupants of a Use Group R occupancy are permitted, provided that required windows for light and *ventilation* are not obstructed thereby.

780 CMR 1214.0 SOUND TRANSMISSION CONTROL IN RESIDENTIAL BUILDINGS

1214.1 Scope: 780 CMR 1214.0 shall apply to all common interior *walls*, partitions and floor/ceiling assemblies between adjacent *dwelling units* or between *dwelling units* and adjacent public areas such as halls, *corridors*, stairs or service areas in all occupancies in Use Group R.

1214.2 Air-borne noise: *Walls*, partitions and floor/ceiling assemblies separating *dwelling units* from each other or from public or service areas shall have a sound transmission class (STC) of not less than 45 for air-borne noise when tested in accordance with ASTM E90 listed in *Appendix A*. This requirement shall not apply to *dwelling unit* entrance doors; however, such doors shall be tight fitting to the frame and sill.

1214.3 Structure-borne sound: Floor/ceiling assemblies between *dwelling units* or between a *dwelling unit* and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492 listed in *Appendix A*.

780 CMR 1306.0 BUILDING INSULATION SPECIFICATIONS

1306.1 Scope: 780 CMR 1306.0 applies to all buildings.

1306.2 General: Insulating materials must conform to the Federal Specifications (F.S.), the American Society for Testing Materials (ASTM) Test Standards, or the Code of Federal Regulations (CFR) as listed in Table 1306.2.

Table 1306.2
INSULATION MATERIALS STANDARDS

Material	Standard
Mineral Fiber	
blanket/batt	ASTM C665-91
loose-fill	ASTM C-764-94
Mineral Cellular	
perlite	ASTM C549-81/R1986
vermiculite	ASTM C516-80/R1990
perlite board	ASTM C728-91
cellular glass block	ASTM C552-91
Organic Fiber	
cellulose fiber board	ASTM C208-94
cellulose loose fill	16 CFR Part 1209
Organic Cellular	
polystyrene board	ASTM C578-92
urethane board	ASTM C591-85
flexible unicellular	ASTM C534-94
polyurethane or polyiso-cyanurate with foil face	ASTM C-1289-95
polyurethane or polyiso-cyanurate with felt face	ASTM C-1289-95

1306.3 Moisture control: The design of buildings for energy conservation shall not create conditions of accelerated deterioration from moisture condensation (additionally, see 780 CMR 12 for attic and under-floor space ventilation).

1306.4 Installation:

1306.4.1 Recessed light fixtures: Only IC labeled recessed lights allowing direct contact with insulating materials shall be used in areas separating conditioned and unconditioned spaces.

1306.4.2 High heat sources: A clearance of three inches from any high heat source, including but not limited to chimneys, flues and vents, shall be maintained for combustible insulating materials.

1306.4.3 Urea formaldehyde foams: Urea formaldehyde foams shall not be used in any building.

1306.4.4 Walls: Batt/blanket insulation with a vapor barrier attached shall be stapled to the winter warm sides or faces of wall studs at intervals of eight inches on center vertically. Where batt/blanket insulation is of a "friction fit" design and a poly vapor barrier is employed, the vapor barrier shall be affixed to the interior face of the wall studs (winter warm side) in accordance with the insulation manufacturer's recommendations.

1306.4.5 Cavities: All cavities between rough framing and door and window heads, jambs, and sills shall be filled with insulation and covered with a vapor barrier meeting the criteria of 780 CMR 1307.

1306.4.6:

1306.4.6.1 Low rise residential buildings/ perimeter insulation: Perimeter insulation for slab on grade construction in buildings of Use Group R of three stories or less shall be installed so that the concrete to concrete contact between the foundation wall and the floor slab is broken and the insulation extends downward the thickness of the slab and then extends four feet vertically down from, or four feet horizontally beneath, the floor slab. Perimeter insulation may be installed in alternative locations if installed in a manner to thermally isolate the floor from the exterior.

1306.4.6.2 Commercial and high rise residential buildings/perimeter insulation: Perimeter Insulation for slab on grade construction in buildings of Use Group R of more than three stories or in buildings of other Use Groups shall be installed in a manner consistent with that specified in 780 CMR 1306.4.6.1, except that alternate locations and dimensions may be permitted by the provisions of 780 CMR 1314.

1306.4.7 Foundation wall insulation:

1. For interior foundation wall insulation, the entire gross wall area extending from the top of the band joist to the floor shall be insulated in accordance with Table 1309.1 for low rise residential buildings or in accordance with the requirements of 780 CMR 1314.0, for other than low rise residential buildings.
2. For exterior foundation wall insulation, the insulation shall extend from the top of the foundation to a minimum of eight feet below grade or to foundation footing, whichever is less. All exterior basement and foundation wall insulation shall be suitably protected so as to prevent deterioration caused by ultra-violet light or insect damage in accordance with manufacturer's instructions.

1306.5 Fire safety relating to insulation: See 780 CMR 722 and 2603.

1306.6: Labeling

1306.6.1 Batt and blanket and rigid board: Insulation of this type shall be labeled according to type, manufacturer or distributor, R value of the insulation at the labeled thickness, and material specification as listed in Table 1306.2.

1306.6.2 Blown, poured, or sprayed on types: Insulation of these types shall be labeled according to type, manufacturer, recommended insulation density, thickness and R value, fire safety requirements and material specifications as listed in Table 1306.

780 CMR 1307.0 AIR INFILTRATION AND MOISTURE CONTROL

1307.1: 780 CMR 1307.0 applies to all buildings.

1307.2 Vapor barriers: A vapor barrier of one point zero (1.0) perm or less shall be installed on the winter warm side of walls, ceilings and floors enclosing a conditioned space.

Exception: Vapor barriers may be eliminated with adequate ventilation as defined in 780 CMR 12 (See 780 CMR 1210).

1307.3 Taping: All tears in the vapor barrier shall be taped or sealed.

1307.4 Air leakage for all buildings:

1. The requirements of this section shall apply to those locations separating outdoor ambient conditions from interior spaces that are heated and/or mechanically cooled and are not applicable to the separation of interior conditioned spaces from each other.
2. The following openings in the exterior building envelope shall be caulked, gasketed, weatherstripped, foamed or otherwise sealed to limit infiltration:
   a. Around window and door frames, between the unit and the rough framing;
   b. Between all exterior wall soleplates and the structural floor, using two rows of caulking or alternate approved procedure;
   c. Over all framing joints where floors over conditioned spaces intersect exterior walls, using a water vapor permeable infiltration barrier or alternate approved technique;
   d. Around openings for plumbing, electricity, telephone and gas lines in walls, ceilings and floors;
   e. At openings in the ceiling, such as where the ceiling panels meet interior and exterior walls, at exposed beam and masonry fireplaces;
   f. At the mudsill, in addition to normal sill sealer in conditioned basements and conditioned crawlspaces; and,
   g. At all other openings in the exterior building envelope.
   h. See additional requirements for attic and crawl space access, 780 CMR 1310.0.
3. Electrical outlet plate gaskets shall be installed on all receptacle, switch, or other electrical boxes in walls separating conditioned from unconditioned space.
4. Heating ducts shall be sealed at all joints and corners as specified in 1310.0.
5. Interior openings between conditioned and non-conditioned space shall be sealed using sealant, closed-cell gasket material, permanent tape, or another method that limits infiltration.

1307.5 Air leakage requirements for fenestration and doors:

1307.5.1 Windows shall have an air leakage rate of 0.34 cfm per foot of operable sash crack in accordance with the following standards as applicable:

ANSI/AANA 101-88, Aluminum Prime Windows,

ASTM D 4099-89, Specifications for Polyvinylchloride (PCV) Prime Windows,

ANSI/NWWDA I.S. 2-87, Wood Window Units (Improved PerformanceRating Only).

AAMA 101V-1986, Polyvinyl Chloride (PVC) Prime Windows and Sliding Glass Doors,

AAMA 1701.2-1985 Prime Windows and Sliding Glass Doors/Manufactured Housing

1307.5.2 Sliding Doors shall meet one of the following standards for air leakage:

ANSI/AANA 101-88, Aluminum Sliding Glass Doors, or

ANSI/NWWDA I.S. 3-88, Wood Sliding Patio Doors.

AAMA 101V-1986, Polyvinyl Chloride (PVC) Prime Windows and Sliding Glass Doors,

AAMA 1701.2-1985, Prime Windows and Sliding Glass Doors/Manufactured Housing

1307.5.3 Commercial entrance swinging or revolving doors shall limit air leakage to a rate not to exceed 1.2 cfm per square foot of door area, at standard test conditions.

1307.5.4 Residential swinging doors shall limit air leakage to a rate not to exceed 0.5 cfm per square foot of door area, at standard test conditions.

1307.5.5 Spaces that have regular high volume traffic through the building envelopes such as retail store entrances and loading bays, shall be designed accounting for the steady state air transfer between conditioned and unconditioned or exterior space.

780 CMR 1308.0 COMPONENT DESIGN

1308.1 Scope: All low rise residential buildings that are heated or mechanically cooled shall be constructed so as to provide the required thermal performance of the various components listed in 780 CMR 1308.0 through 1311.0, and to provide the lighting switching requirements of 780 CMR 1313.2.2.1.

All commercial and high rise residential buildings that are mechanically heated and cooled shall be constructed so as to provide the required thermal and lighting system performance of the various components listed in 780 CMR 1308.0, and 1310.0 through 1314.0, as applicable.

1308.2 Thermal Performance: Information on thermal properties, performance of building envelope sections and components, and heat transfer shall be obtained from laboratory or field test measurements, or when information is not available from these sources, then such information may be obtained from the ASHRAE Handbook, 1993 Fundamentals.

When laboratory or field test measurements are used, they shall be conducted in accordance with ASTM standards:

1. C-177-85/R1993, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate,
2. C-518-91, Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter,
3. C-236-89/R1993, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box, or
4. C-976-90, Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box.

To determine thermal conductance through window assemblies the following ASTM or American Architectural Manufacturers Association (AAMA), or National Fenestration Rating Council (NFRC) standards shall be used.

1. AAMA 1503.1-1988, Test Method of Thermal Transmittance of Windows, Doors and Glazed Wall Sections,
2. ASTM C-236-89/R1993, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of Guarded Hot Box, or
3. ASTM C-976-90, Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box.
4. NFRC 100-91 Procedure for Determining Fenestration Product Thermal Properties.

When using any of the four test procedures above, a 15 mile per hour wind shall be applied perpendicular to the glazing and applied in other definitions as required by the subject standard.

1308.3 Gross wall area: For the purposes of 780 CMR 13, the gross area of exterior walls consists of all opaque wall areas, including foundation walls, areas between floor spandrels, peripheral edges of floors, window areas including sash, and door areas, where such surfaces enclose a heated or mechanically cooled space including interstitial areas between two such spaces, but excluding vents, grills and pipes.

1308.4 Roof assembly: For the purpose of 780 CMR 13, a roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thereby creating a building transmission heat loss or gain, where such assembly encloses a heated or mechanically cooled space.

1308.4.1 Gross roof area: The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights, exposed to the heated or mechanically cooled space.

1308.4.2 Ceiling plenums: Where air ceiling plenums are employed, the roof/ceiling assembly shall:

1. for thermal transmittance purposes not include the ceiling proper nor the plenum space as part of the assembly; and
2. for gross area purposes be based upon the interior face of the upper plenum surface.

1308.5 Swimming pools: All pool enclosures shall be designed in accordance with the 1993 edition of the ASHRAE Applications Handbook.

Such pool enclosures shall have a maximum overall (roof/gables/sidewalls) U value of 0.25.

780 CMR 1309.0 EXTERIOR ENVELOPE REQUIREMENTS FOR LOW RISE RESIDENTIAL BUILDINGS

1309.1 Criteria for low rise residential buildings: The following requirements shall apply to all buildings and structures or portions thereof in use groups R-1, R-2, R-3, and R-4 (hotels, multi-family, and one- and two-family) that are heated or mechanically cooled and not more than three stories high.

1. All buildings in these use groups shall conform to the thermal transmittance values in Table 1309.1 or shall be designed to satisfy the requirements of 780 CMR 1309.3 or shall be designed to satisfy the requirements of 780 CMR 1315.0 or 780 CMR 1316.0, as applicable..
2. An overall Uo value of 0.167 for structures heated by oil, gas or heat pumps, or an overall Uo of 0.105 for structures heated by electric resistance may be used for the combination of walls, doors and windows containing heated space in lieu of the separate U values listed for walls, doors and windows. The overall Uo of 0.167 or 0.105 shall be used when the windows exceed 15% of the gross exterior wall area.
3. For purposes of 780 CMR 1309.0 only, framing members shall not be included in the calculations of R and U values.

Table 1309.1
MAXIMUM U VALUES AND MINIMUM R VALUES OF WALLS, ROOF/CEILING, AND FLOORS FOR RESIDENTIAL BUILDINGS OF 780 CMR 1309.1

Element	Description	U Value	Total R Value	Notes
Walls	All wall construction containing heated or mechanically cooled space	0.08	12.5	1
	Electric resistance heating	0.05	20.0	1
Foundation Walls Including Band Joist	Containing heated or mechanically cooled space	0.08	12.5	-
	Containing unheated space	0.08	12.5	4
Roof/Ceiling Assembly	All roof construction containing heated or mechanically cooled space	0.033	30.0	-
Windows	All construction enclosing heated or mechanically cooled space	0.65	1.54	2
	Electric resistance heating	0.40	2.50	6, 7
Doors	All construction enclosing heated or mechanically cooled space	0.40	2.50	-
Floors	Floor sections over areas exposed to outside air or unheated space	0.05	20.0	3
	Slab on grade beneath conditioned space	-	10.0	5

Note 1: These values may be used when the doors and windows do not exceed 15% of the gross exterior wall area. When doors and windows exceed 15% of the gross wall area, see 780 CMR 1309.1, item 2.

Note 2: Double glazed primary windows or single glaze primary windows with storm windows will satisfy the required U value of 0.65.

Note 3: Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of 0.08.

Note 4: The U value requirement of 0.08 for foundation walls may be omitted when floors over unheated spaces are provided with a U value of 0.05.

Note 5: R value for perimeter insulation (see 780 CMR 1306.4.6).

Note 6: When doors and windows do not exceed 15% of the gross exterior wall area, this value may be used. When doors and windows do not exceed 10% of the gross exterior wall area, windows having a U value of 0.65 (R value of 1.54) may be used. When windows and doors exceed 15% of the gross exterior wall area, see 780 CMR 1309.1, item 2.

Note 7: Double glazed primary windows with storm windows or most triple glazed primary windows or double glazed low emissivity primary windows will typically satisfy the required U value of 0.40.

1309.2 Calculation of Uo: Separate overall thermal transmittance values shall be calculated for wall assemblies, roof/ceiling assemblies, and floors. Equation 1 is provided as an example of the Uo calculation for walls.

Equation 1:

$$\textit{Overall wall } Uo = \frac{Uw\ Aw + Ug\ Ag = Ud\ Ad}{A}$$

Where:

Uo = average or combined transmittance of the gross exterior wall; (Btu/hr-ft^2-°F).
Aw = gross exterior wall area; (ft^2).
Uw = thermal transmittance of the components of the opaque wall; (Btu/hr-ft^2-°F).
Aw = opaque wall area; (ft^2).
Ug = thermal transmittance of the windows; (Btu/hr-ft^2-°F).
Ag = window area; (ft^2).
Ud = thermal transmittance of the door or similar opening; (Btu/hr-ft^2-°F).
Ad = door area; (ft^2).

NOTE: Where Ug is determined by test, it shall be calculated using the procedure contained in 780 CMR 1314.3.2.2 including calculation for framing, sash, edge effects, and all other factors pertinent to the complete window assembly.

1309.3 Alternates: The stated Uo (or U) value of any one assembly, such as roof/ceiling, wall, or floor, may be increased and the Uo (or U) value for other components decreased provided that the overall heat gain or loss for the entire building envelope does not exceed the total resulting from conformance to the stated Uo (or U) values.

780 CMR 1310.0 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) SYSTEMS

1310.1 Scope: 780 CMR 1310.0 covers the determination of heating and cooling loads, systems performance, and control requirements for all buildings. Criteria are established for insulating HVAC systems and for duct construction.

Exception: Special applications, including but not limited to hospitals, museums, laboratories, rooms containing thermally sensitive equipment such as computers, open refrigerated display cases, may be exempted from the requirements of 780 CMR 1310.0, when calculations and requirements are submitted establishing the unique environmental criteria that exist.

1310.2 Calculation of heating and cooling loads:

1310.2.1 Calculation procedures: For the purpose of sizing HVAC systems, heating and cooling design loads shall be determined in accordance with techniques recommended in the

Table 1310.12
MINIMUM PIPE INSULATION[1]
INSULATION THICKNESS IN INCHES FOR PIPE SIZES (Note 2)

Piping System Types / Heating Systems Steam & Hot Water	Fluid Temperature Range (°F)	Runouts[2] Up to 2"	1" & less	1¼" to 2"	2½" to 4"	5" to 6"	8" and larger	Insulation Conductivity (B-in/F-hr-sf) at temp °F
High Press./Temp.	351-450	1.5	2.5	2.5	3.0	3.5	3.5	0.32 @ 250°
Med. Press./Temp.	251-350	1.5	2.0	2.5	2.5	3.5	3.5	0.29 @ 200°
Low Press./Temp.	201-250	1.0	1.5	1.5	2.0	2.0	3.5	0.27 @ 150°
Low Temp.	141-200	0.5	1.5	1.5	1.5	1.5	1.5	0.25 @ 125°
Low Temp.	105-140	0.5	1.0	1.0	1.0	1.5	1.5	0.24 @ 100°
Steam Condensate (for feedwater)	Any	1.0	1.5	1.5	2.0	2.0	2.0	0.27 @ 150°
COOLING SYSTEMS[3]								
Chilled Water	40-55	0.5	0.5	0.75	1.0	1.0	1.0	0.23 @ 75°
Refrigerant or Brine	Below 55	1.0	1.0	1.5	1.5	1.5	1.5	0.23 @ 75°

Notes:
1. For minimum thicknesses of alternative insulation types, see 780 CMR 1310.12.1.
2. Runouts to individual terminal units not exceeding 12 ft. in length.
3. The required minimum thicknesses do not consider condensation. Additional insulation and/or vapor barriers may be required to prevent condensation.

780 CMR 1311.0 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

1311.1 Scope: 780 CMR 1311.0 applies to all buildings.

1311.2 HVAC equipment performance requirements: The requirements of 780 CMR 1311.0 apply to equipment and component performance for heating, ventilating, and air conditioning systems. Where equipment efficiency levels are specified, data furnished by the equipment supplier, or certified under a nationally recognized certification program or rating procedure, shall be used to satisfy these requirements.

1311.3 HVAC system combustion heating equipment: All gas and oil fired comfort heating equipment shall have an Annual Fuel Utilization Efficiency (AFUE) not less than the values shown in Tables 1311.3 through 1311.5. Equipment types not covered in these tables shall show a minimum combustion efficiency of 75% at maximum rated output. Combustion efficiency is defined as 100% minus stack losses in percent of heat input. Stack losses are:

1. loss due to sensible heat in dry flue gas;
2. loss due to incomplete combustion; and
3. loss due to sensible and latent heat in moisture formed by combustion of hydrogen in the flue.

Table 1311.3(a)
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS

Reference Standards[1]	Category	Rating Condition	Minimum Performance
10 CFR 430(B)	Gas-Fired <225,000 Btu/h	Seasonal Rating	AFUE 78%[4] / E_t[3] 80%
	Oil-Fired <225,000 Btu/h	Seasonal Rating	AFUE 78%[4] / E_t[3] 80%
ANSI Z21.47-90	Gas-Fired ≥225,000 Btu/h	1. Maximum Rating Capacity[2] Steady-State	E_t[5] 80%
		2. Minimum Rating Capacity[2] Steady-State	E_t[5] 78%
UL 727-86	Oil-Fired ≥225,000 Btu/h	1. Maximum Rating Capacity[2] Steady-State	E_t[5] 81%
		2. Minimum Rating Capacity[2] Steady-State	E_t[5] 81%

For SI: °F = 1.8°C = 32, 1 Btu/h = 0.2931 W
1. Listed in ***Appendix A***
2. Minimum and maximum ratings as provided for and allowed by the unit's controls.
3. These requirements apply to combination units not covered by NAECA (three phase power or cooling capacity > 65,000 Btu/h).
4. This is used to be consistent wth National Appliance Energy Conservation Act (NAECA) of 1987 (Public Law

100-12). These values apply to furnace and combination units covered by NAECA.
5. See references for detailed definition of thermal efficiency (E_t) = (100% minus flue losses).

Table 1311.3(b)
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE WARM AIR DUCT FURNACES AND UNIT HEATERS

Reference Standards[1]	Category	Rating Condition	Minimum Performance
ANSI Z83.9-86	Duct Furnaces Gas-Fired	1. Maximum Rating Capacity[2] Steady-State	E_t[3] 78%[4]
		2. Minimum Rating Capacity[2] Steady-State	E_t[3] 75%[4]
ANSI Z83.8-95	Unit Heaters Gas-Fired	1. Maximum Rating Capacity[2] Steady-State	E_t[3] 78%
		2. Minimum Rating Capacity[2] Steady-State	E_t[3] 74%
UL 731-88	Unit Heaters Oil-Fired	1. Maximum Rating Capacity[2] Steady-State	E_t[3] 81%
		2. Minimum Rating Capacity[2] Steady-State	E_t[3] 81%

1. Listed in *Appendix A*
2. Provided and allowed by the controls.
3. E_t = thermal efficiency, 100% minus flue losses. See reference standard for detailed definition.

Table 1311.3(c)
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE GAS AND OIL-FIRED STEAM AND HOT WATER BOILERS

Reference Standards[1]	Category	Rating Condition	Minimum Performance
10 CFR 430(B)	Gas-Fired <300,000 Btu/h	Seasonal Rating	AFUE 80%[4,5]
	Oil-Fired <300,000 Btu/h	Seasonal Rating	AFUE 80%[4]
HI[6]	Gas-Fired ≥300,000 Btu/h	1. Maximum Rating Capacity[2] Steady-State	E_c[3] 80%
		2. Minimum Rating Capacity[2] Steady-State	
HI[7]	Oil-Fired ≥300,000 Btu/h	1. Maximum Rating Capacity[2] Steady-State	E_c[3] 83%
		2. Minimum Rating Capacity[2] Steady-State	
HI[8]	Oil-Fired (Residual) ≥300,000 Btu/h	1. Maximum Rating Capacity[2] Steady-State	E_c[3] 83%
		2. Minimum Rating Capacity[2] Steady-State	

1. Listed in *Appendix A*
2. Provided and allowed by the controls.
3. E_c = combustion efficiency, 100% minus flue losses. See reference standard for detailed definition.
4. To be consistent with National Appliance Energy Conservation Act of 1987 (Public Law 100-12).
5. Except for gas-fired steam boilers for which minimum AFUE is 75%
6. HI = Hydronics Institute, Test & Rating Standard/ Heating Boilers - 1982; ANSI Z21.13-87; ANSI/ASME Ptc 4.1-64; UL 795-73.
7. Hydronics Institute, Test & Rating Standard/ Heating Boilers - 1982; ANSI/ASME Ptc 4.1 - 64; UL 726-90
8. Hydronics Institute, Test & Rating Standard/ Heating Boilers - 1982; ANSI/ASME Ptc 4.1 - 64.

1311.4 HVAC system heating equipment, heat pumps heating mode: Heat pumps whose energy input is entirely electric shall show a coefficient of performance (COP heating, as defined herein) not less than the values shown in Table 1311.4.

1. These requirements apply to, but are not limited to, unitary heat pumps (air source) in the heating mode, and to packaged terminal heat pumps in the heating mode. Field assembled unitary heat pumps, consisting of one or more components, shall show compliance with 780 CMR 1311.4

2. **Coefficient of performance heating**: the ratio of the rate of net heat output to the rate of total on-site energy input, expressed in consistent units and under designated rating conditions. The rate of net heat output shall be defined as the change in the total heat content of the air between entering and leaving the equipment (not including supplementary heat).

3. **Supplementary heater**: The heat pump shall be installed with a control to prevent supplementary heater operation when the heating load can be met by the heat pump alone. Supplementary heater operation is permitted during transient periods, such as start-ups, following room thermostat set-point advance and during defrost. A two stage thermostat, which controls the supplementary heat on its second stage, shall be accepted as meeting this requirement. The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating shall be higher than the cut-off temperature for the supplementary heat. Supplementary heat may be derived from any source of electric resistance heating or combustion heating.

Table 1311.4
MINIMUM COP FOR HEAT PUMPS, HEATING MODE

CATEGORY	PERFORMANCE	REFERENCE STANDARD(S)
Air Source, single phase: (Cooling capacity less than 65,000 Btu/hr)	Hi-temp (47db/43wb); (Min. COP = 2.7) Low-temp (17db/15wb); (Min. COP = 1.8)	ARI 210/24/-89
Air Source, three phase: (Cooling capacity less than 35,000 Btu/hr)	Hi-temp (47db/43wb); (Min. COP = 2.7) Low-temp (17db/15wb); (Min. COP = 1.8)	
Packaged Terminal Heat Pumps	Min. COP = 2.5	

1311.5 HVAC system equipment, electrically operated cooling mode: HVAC system equipment as listed below whose energy input in the cooling mode is entirely electric shall show a Seasonal Energy Efficiency Ratio (SEER) or Energy Efficiency Ratio (EER) not less than the values shown in Table 1311.5.

1311.5.1: These requirements apply to, but are not limited to, unitary cooling equipment (air-cooled, water-cooled, and evaporatively cooled); the cooling mode of unitary heat pumps; and packaged terminal air conditioners.

TABLE 1311.5
MINIMUM SEER AND EER FOR ELECTRICALLY DRIVEN AIR CONDITIONING EQUIPMENT

TYPE	PERFORMANCE	REFERENCE STANDARD(S)
Air, single phase: (Cooling capacity less than 65,000 Btu/hr)	Min. SEER = 7.8	ARI 210/240-89
Air, three phase: (Cooling capa-city less than 65,000 Btu/hr)	Min. EER (Hi-temp) = 6.2	
Air: (Cooling capacity greater than 65,000 Btu/hr but less than 135,000 Btu/hr)	Min. EER (Hi-temp) = 8.2	
Packaged Terminal Heat Pump	Min. EER = 7.8	
Packaged Terminal Air Conditioner	Min. EER = 7.8	

1311.6 Applied HVAC system components, electrically operated cooling mode: HVAC system components, as listed in Table 1311.6, whose energy input is entirely electric shall show a coefficient of performance (COP) cooling, as defined herein, not less than the values shown in Table 1311.6.

1311.6.1 Coefficient of performance: Coefficient of Performance (COP) cooling is the ratio of the rate of net heat removal to the rate of total energy input, expressed in consistent units and under designated rating conditions.

The rate of net heat removal is defined as the difference in total heat content of the water or refrigerant entering and leaving the component.

Total on-site energy input shall be determined by combining the energy inputs to all elements and accessories of the component, including but not limited to compressors, internal circulating pumps, purge, and the HVAC system component control circuit.

Table 1311.6
MINIMUM EER AND COP FOR ELECTRICALLY DRIVEN AIR CONDITIONING SYSTEM COMPONENTS

Component	Condensing Means	Coolant	EER	COP	Reference Standard
Self-Contained Chillers	Centrifugal	Air	8.2	2.4	ARI 550-92
Self-Contained Chillers	Centrifugal < 250 Tons	Water	16.4	4.8	ARI 550-92
Self-Contained Chillers	Centrifugal > 250 Tons	Water	17.1	5.0	ARI 550-92
Self-Contained Chillers	Rotary	Air	8.2	2.4	ARI 550-92
Self-Contained Chillers	Rotary	Water	14.0	4.1	ARI 550-92
Self-Contained Chillers - with Condenser	Positive Displace-ment	Air	8.9	2.6	ARI 590-92
Self-Contained Chillers - with Condenser	Positive Displace-ment	Water	12.6	3.7	ARI 590-92
Self-Contained Chillers - without Condenser	Positive Displace-ment	Air	10.1	3.0	ARI 590-92
Condenser Units 135,000 Btu/hr or Less		Air	9.5	2.8	ARI 365-94
Condenser Units 135,000 Btu/hr or Less		Water (Evap)	12.7	3.7	ARI 365-94

1311.7 HVAC system equipment, heat operated, cooling mode: Heat operated cooling equipment shall show a coefficient of performance (COP) cooling not less than the values shown in Table 1311.7. These requirements apply to, but are not limited to, absorption equipment, engine driven equipment, and turbine drive equipment.

When the refrigeration components are supplied by different manufacturers, it shall be the responsibility of the system designer to determine compliance with these requirements, using data provided by the suppliers of the elements.

Table 1311.7
MINIMUM COP FOR HEAT OPERATED AIR CONDITIONING SYSTEM EQUIPMENT

HEAT SOURCE	MINIMUM COP
Direct fired (gas/oil)	0.48
Indirect fired (steam/hot water)	0.68

780 CMR 1312.0 ELECTRICAL POWER DISTRIBUTION

1312.1 Scope: Electrical distribution systems shall be designed for the efficient distribution of electrical energy from the service entrance to the points of use.

1312.1.1 Exempt buildings: Buildings in use groups R-3 and R-4 (one-and two-family dwellings) shall be exempt from the requirements of 780 CMR 1312.0

1312.2 Power factor: Utilization equipment greater than 1,000 watts and lighting equipment greater than 15 watts with an inductive reactance load component shall have a power factor of not less than 85% under rated load conditions. Power factor of less than 85% shall be corrected to at least 90% under rated load conditions. Power factor corrective devices, installed to comply with this code, shall be switched with the utilization equipment, except where this results in an unsafe condition or interferes with the intended operation of the equipment.

1312.3 Service voltage: Where a choice of service voltage is available, a computation shall be made to determine which service voltage would produce the least energy loss, and that voltage shall be selected.

1312.4 Electric energy determination: In all multi-family dwellings, each dwelling unit shall be separately metered. Also see 527 CMR 12.00.

Exceptions:

1. Publicly financed housing for the elderly with fuel fired heating systems, with centrally operated air conditioning systems, or without air conditioning systems are exempt from this requirement.
2. Publicly financed housing for the elderly with electric resistance or storage heating systems are exempt from 780 CMR 1312.4 provided there is informational metering of the individual dwelling units.

780 CMR 1313.0 LIGHTING SYSTEMS

1313.1 Scope: 780 CMR 1313.0 establishes the maximum power limits and control requirements for interior and exterior illumination systems.

Note: All electrical wiring shall comply with applicable requirements of 527 CMR 12.00 as listed in ***Appendix A***.

1313.1.1 The rooms, spaces and areas covered by 780 CMR 1313.0 include:

1. Interior spaces of buildings.
2. Building exterior areas such as: entrances, exits, loading docks, etc.
3. Roads, grounds and other exterior areas including open-air covered areas where lighting is required and is energized through the building electrical service.

1313.1.2 Exempt buildings and spaces: The following buildings and spaces are exempt from the provisions of 780 CMR 1313.0:

1. Lighting for dwellings units contained in use groups R-2, R-3 and R-4, except for the switching requirements in 1313.2.2.1.
2. Outdoor activities such as manufacturing, storage, commercial green houses and processing facilities.
3. Lighting power for theatrical productions, television broadcasting, audio-visual presentations and those portions of entertainment facilities where lighting is an essential technical element for the function performed.
4. Specialized luminaires for medical and dental purposes.
5. Outdoor athletic facilities.
6. Display lighting required for art exhibits or displays in galleries, museums and monuments.
7. Exterior lighting for public monuments and recognized landmarks such as buildings individually listed on the National Register of Historic Places.
8. Special lighting needs for research.
9. Lighting to be used solely for indoor plant growth during the hours of 10:00 P.M. to 6:00 A.M.
10. Emergency lighting that is automatically "off" during normal operation.
11. High risk security areas identified by local ordinances or regulations or by security or safety personnel as requiring additional lighting.
12. Classrooms specifically designed for the hard of seeing, hard of hearing (lip-reading), and for senior citizens.
13. Lighting for signs.

14. Store-front display windows in retail facilities.
15. Spaces regularly used for religious services or worship.

1313.2 Minimum requirements: This 780 CMR 1313.2 establishes the minimum requirements which must be met for all spaces covered by 780 CMR 1313.0.

1313.2.1 Building Lighting Power Limit (BLPL): A Building Lighting Power Limit (BLPL) is the upper limit of the power to be available to provide the lighting needs of a building.

The Building Lighting Power Limit (BLPL) is the sum of the building Exterior Lighting Power Allowance (ELPA), the Roads and Grounds Lighting Power Allowance (RLPA), and the building Interior Lighting Power Limit (ILPL).

1. The building Exterior Lighting Power Allowance (ELPA) is calculated in 780 CMR 1313.2.1.4.
2. The Roads and Grounds Lighting Power Allowance (RLPA) is calculated in 780 CMR 1313.2.1.5.
3. The building Interior Lighting Power Limit (ILPL) may be calculated either by the prescriptive criteria in 780 CMR 1313.4 or by the system performance criteria in 780 CMR 1313.5.

The prescriptive criteria (780 CMR 1313.4) provide a simple calculation procedure with limited flexibility. The system performance criteria (780 CMR 1313.5) provide a more complex and lengthy calculation procedure with greater flexibility usually suitable for complex lighting systems in larger buildings.

When using the system performance criteria (780 CMR 1313.5) computer-based procedures are required to be utilized.

1313.2.1.1 Compliance: A building design shall be considered in compliance with 780 CMR 1313.0 if:

1. The exterior lighting power to be installed is no greater than the Exterior Lighting Power Allowance (ELPA).
2. The roads and ground lighting power to be installed is not greater than the Roads and Grounds Lighting Power Allowance (RLPA).
3. The interior lighting power to be installed is not greater than the Interior Lighting Power Limit (ILPL). Tradeoffs between ILPL and ELPA or RLPA shall not be allowed (also see 780 CMR 1313.2.1.2).

1313.2.1.2 Compliance for multiple buildings of a facility: The lighting power limits for each building in a facility shall be calculated separately. Tradeoffs among buildings shall be restricted as described below:

1. Tradeoffs of Interior Lighting Power Limits among other buildings of the same facility shall not be allowed.
2. Tradeoffs between Interior Lighting Power Limits and Exterior Lighting Power Allowances or Roads and Grounds Power Allowances shall not be allowed.
3. Tradeoffs of Exterior Lighting Power Allowances among buildings of the same facility are allowed.

1313.2.1.3 Forms for compliance: Forms approved by the Board of Building Regulations and Standards, when such Forms exist, shall be completed to show compliance with 780 CMR 1313.0, as follows:

1. To summarize the total Exterior Lighting Power Allowance (ELPA).
2. To summarize the maximum Road and Grounds Lighting Power Allowance (RLPA).
3. To summarize the maximum Building or Facility Lighting Power Limit (BLPL, FLPL). The BLPL or FLPL shall be the sum of the ILPL and the ELPA of the building (or of all buildings) and the RLPA of the road and grounds.
4. If the prescriptive criteria of 780 CMR 1313.4 are used to determine the Interior Lighting Power Limit (ILPL), then an approved form shall be used to summarize the maximum Interior Lighting Power Limit.
5. If the system performance criteria of 780 CMR 1313.5 are used to determined the interior lighting power limit (ILPL), then calculations by a Massachusetts Registered Engineer or other legally recognized professional (see M.G.L. c. 112, § 81R) (or an equivalent computer generated printout) shall be used to summarize the Interior Lighting Power Limit.

1313.2.1.4 Exterior Lighting Power Allowance (ELPA): Lighting power for building exteriors shall not exceed the values given in Table 1313.2.1.4 in accordance with the activities to be performed.

Table 1313.2.1.4
MAXIMUM LIGHTING POWER ALLOWANCES (CONNECTED LOAD) FOR BUILDING EXTERIORS

LOCATION	ALLOWANCE [1]
Exit (with or without a canopy)	20 W/lin. ft. of door opening
Entrance (without a canopy)	30 W/lin. ft. of door opening
Entrance (with a canopy) High traffic (retail, hotel, airport, theater, etc.)	10 W/ft of canopied area
Light traffic (hospital, office, school, etc.)	4 W/ft^2 of canopied area
Loading area	0.030 W/ft^2
Loading door	20 W/lin. ft. of door opening

NOTE: Total illumination allowance for the building is 10 W/Lin. Ft. exterior (including the above allowances) of building perimeter.

1313.2.1.5 Roads and Grounds Power Allowance (RLPA): Lighting power for roads and grounds shall not exceed the values in Table 1313.2.1.5.

Table 1313.2.1.5
MAXIMUM LIGHTING POWER ALLOWANCES (CONNECTED LOAD) FOR ROADS AND GROUNDS

LOCATION	ALLOWANCE
Storage and work areas	0.20 W/ft^2
Other activity areas for casual use such as picnic grounds, gardens, parks, and other landscaped areas	0.10 W/ft^2
Private driveways/walkways	0.10 W/ft^2
Public driveways/walkways	0.15 W/ft^2
Private parking lots	0.12 W/ft^2
Public parking lots	0.18 W/ft^2

1313.2.2 Interior and exterior lighting controls: All lighting systems except those required for emergency or exit lightings shall be provided with manual, automatic or programmable controls.

1313.2.2.1 Minimum number of lighting controls:

1. Each area enclosed by ceiling height partitions shall have independent control of the lighting within that area.
2. The maximum area to be controlled by a single switch shall be 750 square feet. The total number of switches shall be not less than one switch for each 1600 watts (@ 277 volts) of connected load, or one switch for each 1250 watts (@ 120 volts) of connected load.

Exception: Lighting control requirements for spaces which must be used as a whole and operate during well defined periods of the 24 hour day shall be exempt from 780 CMR 1313.2.2.1.2. If all the lighting is automatically controlled such that during non-business hours (from ½ hour after closing to ½ hour before opening) ⅔ of the connected load is shut off, or the operating connected load does not exceed 0.7 watts per square foot. (Examples of such spaces may include retail and department stores, warehouses, service corridors, public lobbies of office buildings and other such spaces.)

Lighting requirements for other spaces which must be used as a whole but are not operated during well defined periods of the day and therefore may be utilized during any period of the 24 hour day, may be controlled by a lesser number of controls, but not less than one control point for each 1500 watts of connected lighting power or total of three control points, whichever is greater. Lighting in such spaces shall be controlled in accordance with the work activities. (Examples of such spaces may include the public lobbies of hotels and hospitals and other such spaces, all under central supervision.)

3. Hotel and motel guest rooms excluding bathrooms shall have one or more master switches at the door that turn off all permanently wired lighting fixtures and switched receptacles. For multiple room hotel suites, switches at the entry of each room, in lieu of the switch at the main door, will be acceptable to meet these requirements.
4. Bathrooms in hotels and motels shall have a switchable, permanently installed night light with a maximum wattage of five watts.
5. Switches controlling the same load from more than one location shall not be credited as increasing the number of controls to meet the requirements of 780 CMR 1313..2.2.
6. All task lighting shall be separately controlled. There shall be at least one switch per task area. Switches for task lighting may be incorporated as part of the lighting fixture.

Exceptions:

1. Lighting controls for spaces which must be used as a whole, such as public lobbies of office buildings, hotels, and hospitals; and warehouses, storerooms and service corridors under centralized supervision may be centralized in remote locations.
2. Manual and automatic control devices may reduce the number of controls required as listed in Table 1313.2.2.

Table 1313.2.2
REDUCTION ALLOWANCE FOR SELECTED CONTROLS

TYPE OF CONTROL	EQUIVALENT NUMBER OF CONTROL POINTS
Occupancy sensors	2
Timer - Programmable from the space being controlled	2
Three level, including off, step control or pre-set dimming	2
Four level, including off, step control or pre-set dimming	3
Automatic or continuous dimming	3

1313.2.2.2 Accessibility of switches: All switching devices used to control lighting

NON-TEXT PAGE

within an area shall be readily accessible to personnel occupying that area.

Exceptions:

1. Lighting controls for spaces which must be used a whole, such as public lobbies of office buildings, hotels, and hospitals; retail and department stores and warehouses, storerooms and service corridors under centralized supervision may be centralized in remote locations.
2. Automatic controls
3. Programmable controls
4. Controls requiring trained operators.
5. Controls for safety hazards and security.

1313.2.2.3 Exterior lighting controls: In all exterior areas, lighting fixtures shall be automatically switched for non-operation when natural light is available except where security considerations would dictate otherwise.

1313.2.3 Ballasts:

1313.2.3.1 Fluorescent lamp ballasts: Fluorescent lamp ballasts which have all the following characteristics shall meet or exceed the minimum ballast efficiency factor as shown in Table 1313.2.3.

1. Operate at nominal input voltages of 120 or 277 volts;
2. Have a power factor equal to or greater than 0.60 for a single F40T12 lamp;
3. Used to operate either F40T12 or F96T12 lamps as specified in Table 1313.2.3;
4. Designed for use at temperatures above 0°F;
5. Not specifically designed for use with dimming controls.

Table 1313.2.3
MINIMUM BALLAST EFFICIENCY FACTOR

BALLAST TYPE	BALLAST EFFICIENCY FACTOR
One - 4 foot lamp	1.805
Two - 4 foot lamps (120 V)	1.06
Two - 4 foot lamps (277 V)	1.05
Two - 8 foot slimline lamps	0.57
Two - 8 foot high output rapid start lamps	0.39

Note: The Ballast efficiency factor shall be calculated in accordance with Equation 1313.2.3.1:

Equation 1313.2.3.1

$$BEF = \frac{BF}{Power\ Input}$$

where:

BEF = Ballast efficiency factor

BF = Ballast factor, expressed as a percent (also known as Relative Light Output)

Power Input = Total wattage of combined lamps and ballasts

Tests for ballast factor and power input shall be in accordance with ANSI Standard C82.2 1984 Method of Measurement for Fluorescent Lamps Ballasts using Standard Lamps.

1313.2.3.2 One-lamp or three-lamp fluorescent luminaires recess-mounted within ten feet center-to-center of each other or pendant-mounted or surface-mounted within one foot of each other, and within the same room, shall be tandem wired to eliminate unnecessary use of single-lamp ballast.

1313.2.3.3 Ballasts shall have a power factor greater than 90%.

Exception:

1. Ballasts for circline and compact fluorescent lamps and low wattage high intensity discharge lamps of less than 100 watts.
2. Dimming ballasts.

1313.3 Interior lighting power adjustment factors:

1313.3.1 Adjusted Lighting Power (ALP): When determining interior lighting compliance in 780 CMR 1313.4 or 1313.5, the Connected Lighting Power (CLP) for lights controlled by normal switching must not exceed the Interior Lighting Power Limit (ILPL). However, when the switching controls are automatic (i.e. daylight sensors, occupancy sensors, or lumen maintenance controls) the connected lighting power may exceed the ILPL provided that the Adjusted Lighting Power (ALP), calculated using equation 1313.3.1 does not exceed the ILPL.

Equation 1313.3.1

$ALP = CLP \times PAF$ Where:

ALP = Adjusted Lighting Power, watts

CLP = Connected Lighting Power for the luminaires controlled by the automatic control device, watts

PAF = Power Adjustment Factor

1313.3.2 Power Adjustment Factor (PAF): The Power Adjustment Factor is limited to the specific area controlled by the automatic control device. The Power Adjustment Factor shall be as shown in Table 1313.3.2.

1313.3.3 Daylighting credits: Where daylighting credit is utilized, based on the procedures in 780 CMR 1313.2.2.1 or 1313.3.2, automatic controls such as photoelectric switches or automatic dimmers shall be provided in the daylighted spaces.

Table 1313.3.2
POWER ADJUSTMENT FACTOR (PAF)

AUTOMATIC CONTROL DEVICE	PAF
1. Occupancy sensors	0.70
2. Daylighting sensors	
a) Continuous dimming	0.70
b) Multiple step control	0.80
c) On-off control	0.90
3. Lumen maintenance control	0.90
4. Combination of 1. and 2.	0.60
5. Combination of 1. and 3.	0.65
6. Combination of 1., 2 and 3.	0.55
7. Programmable timing control	0.85

Notes:
1. PAF credits shall not be applied to the dimming controls of incandescent lamps or luminaires.
2. Only one adjustment factor may be used for each building space or luminaire, and 50% or more of the luminaire shall be within the applicable space to qualify for the power adjustment factor. Controls shall be installed in series with the lights and in series with all manual switching devices in order to qualify for an adjustment factor.
3. Daylighting controls shall be able to reduce electrical power consumption for lighting, continuously or in two or more steps, to 50% or less of maximum power consumption; shall control all luminaires more than 50% within a daylighted space, and shall not control any luminaire more than 50% outside a daylighted space.
4. Programmable timing controls used for credit in conjunction with Table 1313.3.2 shall be capable of:
   a. programming different schedules for week days and weekends.
   b. temporary override by occupants with automatic return to the original schedules. Override controls shall be readily accessible.
   c. providing independent control of each lighting load which is required to be separately controlled.

1313.4 Prescriptive criteria: These prescriptive lighting requirements shall be used with 780 CMR 1313.2 and 1313.3. 780 CMR 1313.5 may be used instead of 780 CMR 1313.4.

1313.4.1 Interior Lighting Power Limit (ILPL) calculation: Installed adjusted lighting power, including supplemental or task lighting provided by fixtures permanently wired in place but not by movable fixtures shall comply with the power limits established in this section. To establish a lighting power allowance, the following procedure shall be used:

1. Determine the space use categories and Unit Lighting Power Allowances (ULPA) for the various parts of the building from Table 1313.4.1. If a space use intended for the building is not listed in Table 1313.4.1, then the closest related building or space type listed in the Table shall be used.
2. Multiply the Unit Lighting Power Allowance (ULPA) for each space use category by the gross floor area included in that space use category.
3. Add the total number of watts for each area to arrive at the Interior Lighting Power Limit (ILPL) for the building.
4. In all cases of alterations or additions to existing buildings, the Unit Lighting Power Allowance (ULPA) for the new or altered area shall be calculated using Building Size Ranges in Table 1313.4.1 determined by combining the square footage of each category represented in such alterations or additions with the total square footage of the respective categories of the building.

1313.4.2 Compliance: A building shall be considered in compliance with 780 CMR 1313.4 if the interior Adjusted Lighting Power (ALP) to be installed, as determined in 1313.3.1, does not exceed the Interior Lighting Power Limit (ILPL) for the building, as determined in 1313.4.1.

Table 1313.4.1
UNIT LIGHTING POWER ALLOWANCE (ULPA), W/ft^2

BUILDING SPACE/TYPE	BUILDING SIZE RANGE, Ft^2 Less than 6,000	6,001 to 15,000	15,001 to 30,000	30,001 to 50,000	50,001 or more
Food Service					
Fast Food/Cafeteria	1.5	1.4	1.3	1.3	1.3
Leisure Dining/Bar	2.2	1.9	1.7	1.5	1.4
Offices	1.9	1.8	1.7	1.6	1.5
Retail[1]					
Type B & C[2]	3.3	2.8	2.5	2.3	2.1
Type D & E[3]	3.0	2.5	2.2	2.0	1.8
Mall Concourse at multi-store shopping centers	1.4	1.4	1.3	1.3	1.2
Garages & Basements	0.3	0.3	0.2	0.2	0.2
Schools					
Pre-High School	1.8	1.8	1.7	1.6	1.5
High School/ Technical University	2.0	2.0	2.0	1.9	1.8
Warehouse/Storage	0.8	0.6	0.5	0.5	0.4
Factory & Workshop[4]	1.2	1.1	1.0	1.0	1.0

Notes:
1 Includes general merchandising and display lighting.
2 Type B & C Retail: Fine Merchandising and Mass Merchandising.
3 Type D & E Retail: General Merchandising and Food and Miscellaneous Merchandising.
4 General lighting.

1313.5 System performance criteria: These system performance lighting requirements shall be used with the minimum requirements specified in 780 CMR 1313.2 and 1313.3. The prescriptive criteria listed in 780 CMR 1313.4 may be used instead of 780 CMR 1313.5 (Note that if 780 CMR 1313.5, "System Performance Criteria", is employed, a supplemental computer program, available through

the State House Bookstore must be utilized/the detailed materials in 780 CMR 1315.5.1 thru 1315.5.3 and Table 1315.5.1 are provided here for information only - see notes 1, 2 and 3.

NOTE (1):
A COMPUTER SOFTWARE PROGRAM, *LGTSTD* (LIGHTING STANDARD) IS AVAILABLE TO PERFORM 780 CMR 1333.5 EVALUATION. THIS PROGRAM PERFORMS PASS/FAIL ANALYSIS.

THE *LGTSTD* SOFTWARE PROGRAM, ALONG WITH THE *ENVSTD* SOFTWARE PROGRAM (SEE 780 CMR 1314.5) ARE COMBINED ON A SINGLE 5¼" FLOPPY DISC AND THIS DISC, PLUS A USER'S MANUAL FOR BOTH PROGRAMS, ARE AVAILABLE THROUGH THE STATE BOOKSTORE (617) 727-2834.

NOTE (2):
USE OF THE LIGHTING COMPLIANCE CALCULATION COMPUTER PROGRAM (LTGSTD21) OF THE CODIFIED VERSION OF ASHRAE/IES 90.1-1989 *"ENERGY CODE FOR COMMERCIAL AND HIGH-RISE RESIDENTIAL BUILDINGS"* SHALL BE AN ACCEPTABLE OPTION FOR DEMONSTARTING COMPLIANCE WITH THE LIGHTING REQUIREMENTS OF 780 CMR.

NOTE (3):
780 CMR 1313.5.1 THROUGH 1313.2.3, TABLE 780 CMR 1313.5.2 AND FIGURES 1313.5.1 AND 1313.5.2 ARE INFORMATIONAL - THE SUPPLEMENTAL COMPUTER SOFTWARE *LGTSTD1* AND *LGTSTD21* ARE "PASS/FAIL" EVALUATIONS.

1313.5.1 Unit power density procedure: Installed Adjusted Lighting Power (ALP), including supplemental or task related lighting provided by movable fixtures shall comply with the power allowances established in 780 CMR 1313.5.

1313.5.1.1 The Lighting Power Budget (LPB) of each interior space shall be determined in accordance with equation 1313.5.1.

Equation 1313.5.1

$LPB = A \times Pb \times AF$ where:

LPB = Lighting power budget of the space, watts
A = Area of the space, ft^2
Pb = Base UPD, w/ft^2 (Table1313.5.1)
AF = Area factor of the space (Figure 1313.5.1)

1. The Room Area (A) shall be calculated from the inside dimensions of the room.

2. The Base UPD (Pb) shall be selected from Table 1313.5.1. For applications to areas or activities other than those given, select values for similar areas or activities.

3. The Area Factor (AF) shall be determined from Figure 1313.5.1 based on the room area and ceiling height. Rooms of identical ceiling height and activities may be listed as a group. The AF of a group of rooms shall be determined from the average area of these rooms.

1313.5.1.2 Special Spaces and Activities

1. Multi-Function Rooms. For rooms serving multi-functions, such as hotel banquet/meeting rooms and office conference/presentation rooms, a supplementary lighting system with independent controls may be installed. The installed power for the supplementary system shall not be greater than 50% of the base LPB calculated in accordance with 780 CMR 1313.5.1.1.

2. Simultaneous Activities. In rooms containing multiple simultaneous activities such as a large general office having separate accounting and drafting areas within the same room, the LPB for the rooms shall be the weighted average of the activities in proportion to the areas being served.

1313.5.2 The Interior Lighting Power Limit (ILPL) shall include a $0.20 W/ft^2$ allowance for unlisted space areas. The ILPL shall be calculated in accordance with equation 1313.5.2.

Equation 1313.5.2:

$$ILPL = LPB(Listed\ Spaces) + 0.20 W/ft^2 X (Unlisted\ Space)$$

where:

$ILPL$ = Interior Lighting Power Limit
$Unlisted\ space$ = (LBA - Area of listed spaces), ft^2
LBA = Lighting Building Area, ft^2
LPB = Lighting Power Budget

1313.5.3 Compliance: A building shall be considered in compliance with this section if the interior Adjusted Lighting Power (ALP) to be installed in the building, as determined in 780 CMR 1313.3.1, does not exceed the Interior Lighting Power Limit (ILPL) for the building, as determined in 780 CMR 1313.5.2.

Table 1313.5.1
BASE UNIT POWER DENSITY (UPD FOR AREA/ACTIVITY-W/FT^2)

AREA/ACTIVITY	UPD	NOTE
COMMON ACTIVITY AREAS		
Auditorium	1.6	(a)
Corridor	0.9	(b)
Classroom/Lecture hall	2.0	
Elec/Mech equipment room		
General	0.7	(b)
Control rooms	1.5	(b)
Food Service		
Fast food/Cafeteria	1.3	
Leisure dining	2.5	
Bar/Lounge	2.5	(c)
Kitchen	1.4	(c)
Recreation/lounge	0.7	
Stair		
Active traffic	0.6	
Emergency exit	0.4	
Toilet & Washroom	0.8	
Garage		
Auto & Pedestrian		
Circulation	0.3	
Parking area	0.2	
Laboratory	2.3	
OFFICE CATEGORY 1 Enclosed offices, all open plan offices without partitions or with partitions lower than 4.5 ft. below the ceiling		(d)
Reading, typing and filing	1.6	(e)
Drafting	2.5	(e)
Accounting	2.0	(e)
OFFICE CATEGORY 2 Open plan offices 900 square feet or larger with partitions 3.5 to 4.5 feet below the ceiling. (Offices less than 900 square feet shall use Category 1)		(d)
Reading, typing and filing	1.9	(b)
Drafting	2.9	(b)
Accounting	2.4	(b)
OFFICE CATEGORY 3 Open plan offices 900 square feet or larger with partitions higher than 3.5 feet below the ceiling (Offices less than 900 square feet shall use Category 1)		(d)
Reading, typing and filing	2.1	(b)
Drafting	3.4	(b)
Accounting	2.7	(b)
COMMON ACTIVITY AREAS		
Library		
Audio visual	1.1	
Stack area	1.5	
Card file and cataloging	1.6	
Reading area	1.9	
Lobby (General)		
Reception and waiting	1.0	
Elevator lobbies	0.8	
Atrium (multi-story)		
First 3 floors	0.7	
Each additional floor	0.2	
Locker room and shower	0.8	

Notes:

(a) A 1.5 adjustment factor is applicable for multi-functional spaces.
(b) Area Factor of 1.0 shall be used for these spaces.
(c) Base UPD includes lighting power required for clean-up purpose.
(d) Not less than 90% of all work stations shall be individually enclosed with partitions of at least the height described.
(e) Area Factor shall not exceed 1.55.
(f) See Chapter 2 for definitions of Retail Facilities.
(g) Area Factor of 1.0 shall be used for all indoor athletic spaces.

Figure 1313.5.1
AREA FACTOR ADJUSTMENTS

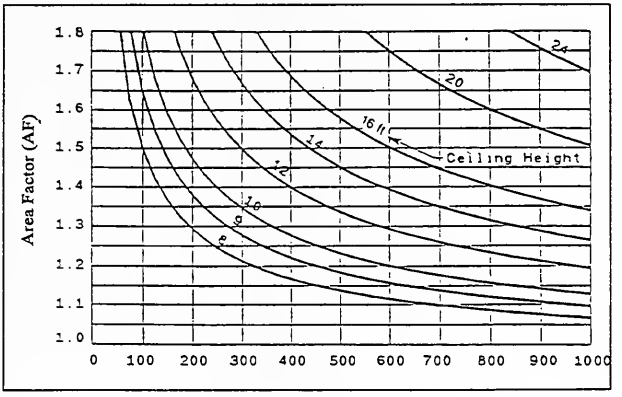
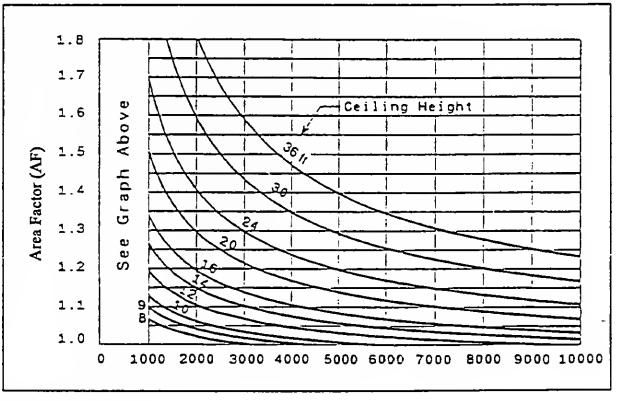


Figure 1313.5.2
AREA OF SPACE (ft^2)



Area Factor Formula:
Area Factor = 0.2 = 0.8 (1/0.9^n)

where $n = \dfrac{10.21(CH - 2.5)}{\sqrt{A_r}} - 1$

A = Area factor,
CH = Ceiling height (ft).
A_r = room area (ft^2).
If AF <1.0 use 1.0; if AF >1.8 use 1.8.

780 CMR 1314.0 BUILDING ENVELOPE REQUIREMENTS FOR COMMERCIAL AND HIGH RISE RESIDENTIAL BUILDINGS

1314.1 Scope: 780 CMR 1314.0 applies to commercial buildings and to high rise residential buildings over three stories.

1314.2 Compliance: The envelope design of a building being evaluated is in compliance with the requirements of 780 CMR 1314.0 provided that:

1. The minimum requirements and calculation procedures of 780 CMR 1314.3 are met; and,
2. Compliance with either the prescriptive criteria (780 CMR 1314.4) or the system performance criteria (780 CMR 1314.5) is met.

1314.2.1 The prescriptive criteria (780 CMR 1314.4) provide a simple calculation procedure with limited flexibility. The system performance criteria (780 CMR 1314.5) provide a more complex and lengthy calculation procedure with greater flexibility usually suitable for complex envelope assemblies in larger buildings.

When using the system performance criteria (780 CMR 1314.5) a computer-based procedure, approved by the State Board of Building Regulations and Standards, must be used to calculate the exterior envelope compliance values. (See 780 CMR 1314.5.)

1314.3 Minimum Requirements

1314.3.1 Overall thermal transmittance (Uo): The overall thermal transmittance of building envelope assemblies shall be calculated in accordance with Equation 1314.3.1:

$$Uo = (UiAi + \ldots UnAn)/Ao$$

where:

- Uo = the average thermal transmittance of the gross area of an envelope assembly, e.g., the exterior wall assembly, including fenestration and doors; roof and/or ceiling assembly; or floor assembly, (Btu/h-ft^2-°F).
- Ao = the gross area of the envelope assembly, (ft^2).
- Ui = the thermal transmittance of each individual element of the envelope assembly, e.g., the opaque portion of the wall or the fenestration - see 780 CMR 1314.3.2, (Btu/h-ft^2-°F).
- Ut = 1/Rt, the total resistance of the envelope assembly, (Btu/h-ft^2-°F).
- Ai = the area of each individual element of the envelope assembly, (ft^2).

1314.3.2 Thermal transmittance (Ui) of an individual element of an envelope assembly: The thermal transmittance of each envelope assembly shall be determined accounting for all series and parallel heat flow paths through the elements of the assembly. Compression of insulation shall be accounted for in determining the thermal resistance.

1314.3.2.1 The thermal transmittance of opaque elements of assemblies shall be determined using a series path procedure with correction for the presence of parallel paths within an element of the envelope assembly (such as parallel paths through wall cavities with insulation and studs). The procedure to be used in meeting the requirements of 780 CMR 1314.3.2.1 is given in Appendix E.

1314.3.2.2 The thermal transmittance of fenestration assemblies shall be corrected to account for the presence of sash, frames, edge effects and spacers in multiple glazed units. If thermal transmittances of sash and frames are known, then Equation 1314.3.1 shall be used for calculation, otherwise Equation 1314.3.2 shall be used:

Equation 1314.3.2

$$\frac{Uof=(Ug,1\cdot Ff,1\cdot A1=Ug,2\cdot Ff,2\cdot A2=\ldots+Ug,n\cdot Ff,n\cdot An)}{A_{of}}$$

Where:

- Uof = the overall thermal transmittance of the fenestration assemblies, including sash and frames, (Btu/h-ft^2-°F).
- Ug = the thermal transmittance of the central area of the fenestration excluding edge effects, spacers in multiple-glazed units, and the sash and frame, (Btu/h-ft^2-°F).
- Ff = framing adjustment factor for sash, frames, etc.
- Aof = the area all fenestration including glazed portions, sash, frames, etc., (ft^2).

Values for Ug shall be the larger of the winter or summer values obtained the ASHRAE Handbook, 1993 Fundamentals Volume. Values for Ff shall be obtained from the ASHRAE Handbook, 1993 Fundamentals Volume. Values for Ug and Ff may also be obtained from manufacturer's test data for specific product assemblies. Where a range of framing adjustment factors is provided, the average of the range shall be used.

1314.3.3 Shading coefficients: The Shading Coefficient (SC) for fenestration shall be obtained from the ASHRAE Handbook, 1993 Fundamentals Volume or from manufacturers' test data. For the prescriptive or systems performance envelope compliance calculations in 780 CMR 1314.4 and 1314.5 a factor, *SCx*, is used. *SCx* is the Shading Coefficient of the fenestration, including internal and external shading devices, but excluding the effect of external shading projections which is calculated separately. The shading coefficient used for louvered shade screens shall be determined using a profile angle

sheathing is of wood not less than one-inch nominal thickness or of wood structural panels not less than 5/16 inch thick. Where wood shingles or shakes are applied over fiberboard shingle backer and fiberboard sheathing, such shingles or shakes shall be attached with approved corrosion-resistant annular-grooved nails and the installation shall be done in accordance with the approved manufacturer's installation instructions. Where wood shingles or shakes and asbestos shingles or siding are nailed directly to nail base fiberboard sheathing, the sheathing shall not be less than ½-inch nominal thickness, the shingles, shakes and siding shall be attached with approved corrosion-resistant annular-grooved nails, and the installation shall be done in accordance with the approved manufacturer's installation instructions.

1405.3.8 Metal siding: Exposed metal siding or sheathing shall be protected from corrosion at the ground level by supporting the foundation channel at sufficient height above grade on the concrete apron or other approved water-resistant foundation.

1405.3.9 Exterior wall pockets: In exterior walls of all buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with adequate caps or drips, or other approved means shall be provided to prevent water damage.

1405.3.10 Flashings: Approved corrosion-resistant flashings shall be provided at the top and sides of all exterior window and door openings in such a manner as to be leakproof Approved corrosion-resistant flashings shall be installed: at the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings; under and at the ends of masonry, wood or metal copings and sills; continuously above all projecting wood trim; at the intersection of exterior walls and porches and decks; at wall and roof intersections; and at built-in gutters.

> **Exception**: When approved, flashing is not required where an approved water-resistant sheathing is installed and an approved water-resistant caulking is applied at the top and sides of all window and door openings in such a manner as to be leakproof.

1405.4 Metal veneers: Veneers of metal shall be fabricated from approved corrosion-resistant materials or shall be protected front and back with porcelain enamel or shall otherwise be treated to render the metal resistant to corrosion. Such veneers shall not be less than 0.017-inch nominal thickness galvanized sheet steel mounted on wood or metal furring strips or approved sheathing on the wood construction.

1405.4.1 Construction: Metal veneer for buildings of other than Type 5 construction shall be: securely attached to masonry; supported on approved metal framing protected by painting, galvanizing or other approved protection; or supported by wood furring strips treated with an approved *preservative* process that complies with 780 CMR 2311.3.

1405.4.2 Waterproofing: All joints and edges exposed to the weather shall be caulked with approved durable waterproofing material or by other approved means to prevent penetration of moisture.

1405.4.3 Grounding metal veneers: Grounding of metal veneers on all buildings shall comply with the requirements of 780 CMR 27 and 527 CMR listed in ***Appendix A***.

1405.5 Anchored masonry veneer: Anchored veneer is veneer secured with approved mechanical fasteners to an approved backing. All masonry units, mortar and metal accessories used in anchored veneer shall meet the physical requirements of 780 CMR 21. Anchored veneer units shall not be less than 1⅝ inches (41 mm) in actual thickness for solid masonry units and not less than 2⅝ inches (67 mm) in actual thickness for hollow masonry units.

1405.5.1 Height of anchored veneer: Anchored veneer shall be supported on footings, foundation walls or other approved noncombustible structural supports or on wood foundations meeting the requirements of 780 CMR 1808.3. The weight of all anchored veneer installed on structures more than 30 feet (9144 mm) in height above the noncombustible foundation or support, with the exception of concrete masonry veneers, shall be supported by noncombustible construction. The construction shall have horizontal supports located at each story height above the initial 30 feet (9144 mm).

> **Exception**: Height increases are permitted where an engineering analysis is prepared by a *registered design professional* and approved.

1405.5.2 Horizontal supports: Noncombustible lintels and noncombustible supports shall be provided over all openings. Beams and lintels supporting unreinforced masonry veneer shall not exceed 1/600 of the span nor 0.3 inches (8 mm).

1405.5.3 Wood frame: Masonry veneer anchored to wood framing shall be attached with corrosion-resistant corrugated sheet metal not less than 0.029 inch (No. 22 gage) by ⅞ inch wide, or corrosion-resistant ties of strand wire not less than 0.148-inch (No.9 W&M gage) wire with the ends of the wire bent to a 90-degree (1.57 rad) angle to form a hook not less than two inches (51 mm) long. The metal ties shall be embedded in the mortar joint a minimum of one-half the veneer

thickness. Each metal tie shall support not more than three square feet (0.28 m^2) of wall area with a maximum spacing of 16 inches (406 mm) vertically and 32 inches (813 mm) horizontally. Where anchored veneer is applied over wood frame, the studs shall be spaced a maximum of 24 inches (610 mm) on center and be faced with sheathing on both sides. A one-inch (25 mm) minimum air space shall be maintained between the anchored veneer and the sheathing. Moisture protection shall be provided as required by 780 CMR 1405.3.6.

1405.5.4 Steel frame: Masonry veneer anchored to corrosion-resistant steel framing shall be attached with corrosion-resistant ties of strand wire not less than 0.148-inch (No. 9 W&M gage) wire with the ends of the wire bent to a 90-degree (1.57 rad) angle to form a hook not less than two inches (51 mm) long. The wire ties shall be embedded in the mortar joint a minimum of one-half the veneer thickness. Each metal tie shall support not more than 2.67 square feet (0.25 m^2) of wall area with a maximum spacing of 16 inches (406 mm) vertically and 24 inches (610 mm) horizontally. Where anchored veneer is applied over steel frame, the studs shall be spaced a maximum of 24 inches (610 mm) on center and be faced with sheathing on both sides. A one-inch (25 mm) minimum air space shall be maintained between the anchored veneer and the sheathing. Moisture protection shall be provided as required by 780 CMR 1405.3.6.

1405.5.5 Masonry or concrete walls: Masonry veneer anchored to masonry or concrete walls shall be attached with corrosion-resistant ties of strand wire not less than 0.148-inch (No. 9 W&M gage) wire with the ends of the wire bent to a 90-degree (1.57 rad) angle to form a hook not less than two inches (51 mm) long. The metal ties shall be embedded in the mortar joint a minimum of one-half the veneer thickness. Each metal tie shall support not more than three square feet (0.28 m^2) of wall area with a maximum spacing of 16 inches (406 mm) vertically and 32 inches (813 mm) horizontally. A one-inch (25 mm) minimum air space shall be maintained between the anchored veneer and the supporting masonry or concrete walls.

1405.5.6 Stone veneer: Stone veneer units not exceeding ten inches in thickness are permitted to be anchored directly to masonry, concrete or to stud construction by one of the following methods.

1. With concrete or masonry backing, anchor ties shall not be less than No. 12 gage corrosion-resistant wire formed beyond the base of the backing. The legs of the loops shall not be less than six inches (153 mm) in length bent at right angles and laid in the mortar joint and spaced so that the eyes or loops are 12 inches (305 mm) maximum on center in both directions. There shall be provided not less than a No.12 gage corrosion-resistant wire tie threaded through the exposed loops for every two square feet (0.186 m^2) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length bent so that the tie will lie in the stone veneer mortar joint. The last two inches (51 mm) of each wire leg shall have a right-angle bend. One inch (25 mm) of cement grout shall be placed between the backing and the stone veneer.
2. With stud backing, a two-inch by two-inch No. 16 gage corrosion-resistant wire mesh with two layers of waterproof paper backing shall be applied directly to wood studs spaced a maximum of 16 inches (406 mm) on center. On studs, the mesh shall be attached with two-inch-long (51mm) corrosion-resistant steel wire furring nails at four inches (102 mm) on center providing a minimum 1⅛-inch (28 mm) penetration into each stud and with 8d common nails at eight inches (200 mm) on center into top and bottom plates. The corrosion-resistant wire mesh is permitted to be attached to steel studs with equivalent wire ties. There shall not be less than a No. 12 gage corrosion-resistant wire, looped through the mesh for every two square feet (0.186 m^2) of stone veneer. This tie shall be a loop having legs not less than 15 inches (38 mm) in length, so bent that the tie will lie in the stone veneer mortar joint. The last two inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.

1405.5.7 Slab-type veneer: Slab-type veneer units not exceeding two inches (51 mm) in thickness are permitted to be anchored directly to masonry, concrete or stud construction. For veneer units of marble, travertine, granite or other stone units of slab form, ties of corrosion-resistant dowels in drilled holes shall be located in the middle third of the edge of the units spaced a maximum of 24 inches (610 mm) apart around the perimeter of each unit with not less than four ties per veneer unit. Units shall not exceed 20 square feet (1.86 m^2) in area.

If the dowels are not tight fitting, the holes are permitted to be drilled not more than 1/16 inch (1.6 mm) larger in diameter than the dowel with the hole countersunk to a diameter and depth equal to twice the diameter of the dowel in order to provide a tight-fitting key of cement mortar at the dowel locations when the mortar in the joint has set. All veneer ties shall be corrosion-resistant metal capable of resisting in tension or compression a force equal to two times the weight of the attached veneer.

CHAPTER 16

STRUCTURAL LOADS

(This Chapter is entirely unique to Massachusetts)

780 CMR 1601.0 GENERAL

1601.1 Scope: The provisions of 780 CMR 16 shall control the structural design of all buildings and structures, or portions thereof, hereafter erected.

780 CMR 1602.0 DEFINITIONS

1602.1 General: The following words and terms shall, for the purposes of 780 CMR 16 and as used elsewhere in 780 CMR, have the meanings shown herein.

Load: Forces or other actions that arise on structural systems from the weight of all permanent construction, occupants and their possessions, environmental effects, differential settlement and restrained dimensional changes.

Dead load: The weight of all permanent structural and nonstructural components of a building, such as walls, floors, roofs, ceilings, *stairways* and fixed service equipment.

Duration of load: The period of continuous application of a given *load*, or the aggregate of periods of intermittent applications of the same *load*.

Earthquake load: The assumed lateral *load* acting in any horizontal direction on the structural frame due to the dynamic action of earthquakes.

Impact load: The *load* resulting from moving machinery, elevators, craneways, vehicles and other similar forces and kinetic *loads*.

Internal load: The forces resulting from the restraint of movement of construction materials or differential movement of a combination of materials caused by the effects of expansion or contraction due to temperature changes, shrinkage, moisture changes, creep, differential settlement or combinations thereof.

Lateral soil load: The lateral pressure in pounds per square foot (psf) (kilograms per square meter [kg/m^2]) due to the weight of the adjacent soil, including due allowance for hydrostatic pressure and possible surcharge from fixed or moving *loads*.

Live load: Those *loads* produced by the occupancy of the building, not including environmental *loads* such as *wind loads*, snow *loads*, *earthquake loads* or *dead loads*.

Wind load: The lateral pressure on the building or structure in pounds per square foot (psf) (kilograms per square meter [kg/m^2]) due to wind blowing in any direction.

Panel (part of a structure): The section of a floor or wall comprised between the supporting frame of two adjacent rows of columns and girders or column bands of floor construction.

Wall

Loadbearing wall: A wall supporting any vertical load in addition to its own weight.

Nonloadbearing wall: A wall which does not support vertical *loads* other than its own weight.

780 CMR 1603.0 CONSTRUCTION DOCUMENTS

1603.1 General: *Construction documents* shall show the size, and relative locations of all structural members with foundation, floor and roof levels, column centers and all offsets dimensioned. The design loads and other information pertinent to the structural design required by 780 CMR 1603.2 through 1603.7 shall be clearly indicated on the *construction documents* for all parts of the building or structure.

1603.2 Floor live load: The uniformly distributed floor *live load* utilized in the design shall be indicated for all floor areas (780 CMR1606.0). *Live load* reduction (780 CMR 1608.0), if utilized, shall be indicated.

1603.3 Roof live load: The roof *live load* utilized in the design shall be indicated for all roof areas (780 CMR 1609.0).

1603.4 Roof snow load: The basic snow *load* shall be indicated.

1603.5 Wind load: The following information related to *wind loads* shall be indicated, regardless of whether *wind loads* govern the lateral design of the building:

1. Wind Load Zone. If more than one wind direction is exposed, the applicable wind direction shall be indicated
2. Wind pressure, P.
3. Special exposures

1603.6 Earthquake design data: Where *earthquake loads* are applicable, the following earthquake design data shall be indicated on the *construction documents*:

1. The Seismic Hazard Exposure Group in accordance with 780 CMR 1612.2.5;
2. The Seismic Performance Category in accordance with 780 CMR 1612.2.7;

3. The soil-profile type in accordance with Table 1612.4.1;
4. The basic structural system and seismic-resisting system in accordance with Table 1612.4.4;
5. The response modification factor (R) and the deflection amplification factor (C_d) in accordance with Table 1612.4.4; and
6. The analysis procedure utilized in accordance with 780 CMR 1612.5 or 1612.6 as applicable.

1603.7 Other loads: Concentrated *loads* (780 CMR 1613.0), *impact loads* (780 CMR 1614.0) and special *loads* (780 CMR 1615.0) which are applicable to the design of the building or structure shall he indicated.

780 CMR 1604.0 DESIGN SAFE LOAD

1604.1 Safe support required: Buildings or other structures, and all parts thereof, shall be designed and constructed to support safely all *loads*, including *dead loads*, without exceeding the allowable stresses (or specified strengths when appropriate *load* factors are applied) for the materials of construction in the structural members and connections.

1604.2 Progressive collapse: Buildings and structural systems shall provide such structural integrity that the hazards associated with progressive collapse are reduced to a level consistent with good engineering practice. Structures shall be able to sustain local damage or failure, with the structure as a whole remaining stable. Compliance with the applicable provisions of ASCE 7 listed in ***Appendix A*** shall be deemed to meet the requirements of 780 CMR 1604.0.

1604.3 In-situ load tests: The code official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with 780 CMR 1707.0 or 1709.0.

780 CMR 1605.0 DESIGN DEAD LOAD

1605.1 Weights of materials and construction: In estimating *dead loads* for the purposes of structural design, the actual weights of materials and constructions shall be utilized, but not less than the unit *dead loads* prescribed in Appendix G, or ASCE 7 listed in ***Appendix A***. In the absence of definite information, any values assumed by the designers shall be subject to the approval of the code official.

1605.2 Weight of fixed service equipment: In estimating *dead loads* for the purposes of design, the weight of fixed service equipment such as plumbing stacks and risers, electrical feeders, heating, *ventilating*, air conditioning and *fire protection systems*, shall be included.

1605.3 Partition load: In offices and other buildings in which subdividing partitions are subsequently erected, rearranged or relocated, provisions shall be made to support the actual weight of such partitions where the partitions occur, or for an equivalent uniform *load*, which shall be assumed to be not less than 20 psf (97.64 kg/m^2) of floor area in addition to the specified uniformly distributed *live load*. Provisions for partition weight shall be made whether or not partitions are shown on the *construction documents*, unless the specified *live load* exceeds 80 psf (390.56 kg/m^2).

780 CMR 1606.0 UNIFORMLY DISTRIBUTED LIVE LOADS

1606.1 Uniform live load: The minimum uniformly distributed *live load* in pounds per square foot shall be as provided for in Table 1606.1, and for all concentrated *loads* wherever such *loads* occur as provided for in 780 CMR 1613.0. The *live loads* in Table 1606.1 are the minimum *loads* to be used for the occupancies listed. Where the building will be subjected to greater *live loads*, such *loads* shall be utilized for design.

1606.1.1 Trucks and buses: Minimum *live loads* for *garages* having trucks or buses shall be in accordance with lane *loads* of AASHTO HB- 15 listed in ***Appendix A***, but shall not be less than 50 psf (244 kg/m^2).

1606.1.2 Residential attics: All *live load* shall be applied to joists or to bottom chords of trusses or trussed rafters only in those portions of *attic* space having a clear height of 42 inches (1067 mm) or more between joist and rafter in conventional rafter construction; and between bottom chord and any other member in trusses or trussed rafter construction. However, joists or the bottom chords of trusses or trussed rafters shall be designed to sustain the imposed *dead load* or ten psf (49 kg/m^2), whichever is greater, uniformly distributed over the entire span.

A further ceiling dead-load reduction to a minimum of five psf (24 kg/m^2) or the actual *dead load*, whichever is greater, applied to joists in conventional rafter construction or to the bottom chords of trusses or trussed rafters is permitted under either or both of the following conditions:

1. Where the clear height is not over 30 inches (762 mm) between joist and rafter in conventional construction and between the bottom chord and any other member for trusses or trussed rafter construction.
2. Where a clear height of greater than 30 inches (762 mm), as defined in 780 CMR 1606.1 item 1, does not exist for a horizontal distance of more than 12 inches (305 mm) along the member.

Table 1606.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS

Occupancy	Live load (psf)[a]
Apartments (see Residential)	
Armories and drill rooms	150
Assembly areas & theatres:	
Fixed seats	60
Movable seats	100
Platforms (assembly)	100
Stage floors	150
Balcony, decks (exterior)	100
One-and two-family dwellings only	60
Bowling centers, poolrooms and billiard rooms	75
Cornices	60
Corridors, except as otherwise indicated	100
Dwellings (see Residential)	
Fire escapes	100
Single-family residential buildings only	40
Garages:	
Passenger cars	50
Trucks and buses - see also 780 CMR 1606.1.1	50
Grandstands (see Reviewing stands)	
Gymnasiums, main floors and balconies	100
Hospitals	
Operating Rooms Laboratories	100
Private Rooms	40
Wards	40
Corridors above first floor	80
Hotels (see Residential)	
Institutional - residential care (see Residential)	
Libraries:	
Reading Rooms	60
Stack rooms (books and shelves @ 40 pcf but not less than)	150
Manufacturing	
Light	125
Heavy	150
Marquees	75
Office buildings:	
Offices	50
Lobbies	100
Corridors, above first floor	80
File and computer rooms require heavier *loads* based upon anticipated occupancy	
Penal Institutions:	
Cell Blocks	40
Corridors	100
Residential:	
Attics - see 780 CMR 1606.1.2	20
Multiple - family dwellings:	
Dwelling units	40
Public rooms	100
Corridors	80
One-and two-family dwellings (areas other than sleeping rooms)	40
Sleeping rooms	30
Decks, balconies, etc.	60
Hotels:	
Guestrooms	40
Public rooms	100
Corridors serving public rooms	100
Corridors	80
Reviewing stands, grandstands and bleachers - see 780 CMR 1614.5	100
Schools	
Classrooms	50
Corridors	80
Flexible open plan areas	100
Sidewalks, vehicular driveways, subject to trucking	250
Skating rinks	100
Stairs and exits	100
Storage areas:	
Light	125
Heavy	250
Stores:	
Retail - 1st floor	100
Retail - upper flloors	75
Wholesale	100
Yards and terraces, pedestrians	100

Note a. 1 psf = 4.882 kg/m^2.

780 CMR 1607.0 DESIGN LIVE LOAD

1607.1 Required live load: The *live loads* to be assumed in the design of buildings and structures shall be the greatest *load* produced by the intended occupancy, but not less than the minimum uniformly distributed unit *loads* required in 780 CMR 1606.0 for specific use groups.

1607.2 Loads not specified: The code official shall approve the required *live load* for any occupancy not specifically provided for in Table 1606.1.

1607.3 Partial loading: The full intensity of the appropriately reduced live load applied only to a portion of the length of a structure or member shall be considered if such applied load produces a more unfavorable effect than the same intensity applied over the full length of the structure or member.

780 CMR 1608.0 LIVE LOAD REDUCTION

1608.1 General: The design live loads specified in 780 CMR 1607.0 may be reduced as permitted and specified herein, except that the design live load shall not be reduced on the following types of structural members:

1. One-way precast or cast-in-place solid, ribbed and hollow core concrete slabs.

   Exception: Ribs of ribbed or hollow core slabs may be treated as individual beams, and live load may be reduced on the ribs the same as for beams.

2. Two-way concrete flat slabs and grid slabs, with or without capitals or drop panels.

   Exception: live load may be reducted on slab panels if there are beams on all sides of the

panels, and load is transferred to the columns from these beams entirely by "beam shear".

3. Hangers

1608.2 Design live loads of 100 psf or less: Except for places of public assembly (as defined in 780 CMR 210.) garages, and open parking structures, a structural member having a tributary area A_T that is greater than A_B may be designed for a reduced live load determined by the following formulas:

$$L = NL_O$$

N = the largest of the following:

1. $1 - 0.0008 (A_T - A_B)$
2. $0.75 - 0.20 (D_o/L_o)$
3. 0.50 for members supporting load from more than one floor, or 0.60 for members supporting load from one floor only, in which:

L = reduced design live load for the member

L_o = basic design live load

D_o = dead load on the member

A_T = loaded area tributary to the member, square feet

A_B = basic tributary area, square feet, defined as follows:

A_B = 100 square feet for members supporting load from more than one floor

A_B = 250 square feet for members supporting load from one floor only

1608.3 Design live loads greater than 100 psf and design live loads for garages and open parking structures: Structrual members supporting load from more than one floor may be designed for a reduced live load equal to 80% of the design live load.

1608.4 For determination of the number of floors supported by a member in 780 CMR 1608.1, 1608.2 and 1608.3 a roof may be considered to be a floor if the design live load of the roof is equal to or greater than the design live load of the floor below.

780 CMR 1609.0 ROOF LOADS

1609.1 General: The structural supports of roofs and marquees shall be designed to resist *wind* (see 780 CMR 1611.0) and, where applicable, snow (see 780 CMR 1610.0) and *earthquake loads* (see 780 CMR 1612.0) in addition to the *dead load* of construction and the appropriate *live loads* as prescribed in 780 CMR 1609.0, or in Table1606.1

1609.2 Definitions: The following words and terms shall, for the purposes of 780 CMR 1609.0 and as used elsewhere in 780 CMR, have the meanings shown herein.

Fabric awning: A fabric awning is an architectural projection that provides weather protection, identity or decoration and is wholly supported by the building to which it is attached. An awning is comprised of a lightweight, rigid or retractable skeleton structure over which a fabric cover is attached.

Fabric canopy: A fabric canopy is an architectural projection that provides weather protection, identity or decoration and is ground supported in addition to being supported by the building to which the canopy is attached. A canopy is comprised of a lightweight skeleton structure over which a fabric cover is attached. A fabric canopy is not a primary structure or a roof.

1609.3 Minimum roof loads: Ordinary roofs, either flat, pitched or curved, shall be designed for the *live loads* as specified in Table 1609.3 or the snow *load*, whichever is greater.

1609.4 Overhanging eaves: In other than occupancies in Use Group R-3, and except where the overhang framing is a continuation of the roof framing, overhanging eaves, cornices and other roof projections shall be designed for a minimum uniformly distributed *live load* of 60 psf (292.92 kg/m^2).

Table 1609.3
MINIMUM ROOF LIVE LOADS[a]

Roof slope	Tributary loaded area in square feet[b] for any structural member		
	0 to 200	201 to 600	Over 600
Flat, or rise less than 4 inches per foot (1:3) Arch or dome with rise less than ⅛ of span	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1) Arch or dome with rise ⅛ of span or less than ⅜ of span	16	14	12
Rise 12 inches per foot (1:1) and greater Arch or dome with rise ⅜ of span or greater	12	12	12

Note a: *loads* are expressed in pounds per square foot of horizontal projection

Note b: 1 square foot = 0.093 m^2·1 psf = 4.882 kg/m^2

1609.5 Ponding: Roofs shall be designed for the maximum possible depth of water that would pond thereon as determined by the relative levels of roof deck and overflow weirs, scuppers, edges or serviceable drains in combination with the deflected structural elements. In determining the maximum possible depth of water, all primary roof drainage means shall be assumed to be blocked.

1609.6 Special purpose roofs: Where occupied for incidental promenade purposes, roofs shall be designed for a minimum *live load* of 60 psf (292.92 kg/m^2); and 100 psf (488.20 kg/m^2) where designed for roof gardens or assembly or educational occupancies.

1. Remove all objectionable material.
2. Effectively protect the steel surface from pile cutoff grade to a grade 15 feet (4.6 m) below the bottom of the objectionable material by means of:
   a. cathodic protection as approved by the code official;
   b. an approved encasement of not less than three inches (76 mm) of dense concrete;
   c. an effective protective coating subject to the approval of the code official; or
   d. providing an excess steel thickness of ⅛ inch (3.2 mm) beyond design requirements on all exposed steel surfaces.

1816.4.2 Timber piles: The preservative treatment of timber piles shall comply with the provisions of 780 CMR 1822.2.

1816.5 Lateral support: Any soil shall be deemed to afford sufficient lateral support to permit the design of any type of pile as a short column. When piles are driven through soil which will be removed subsequent to the completion of the foundation, the resistance offered by such material shall not be considered to contribute to the lateral supporting capacity.

1816.5.1 Column action: The portion of a pile that is not laterally supported shall be designed as a column in accordance with 780 CMR 19 taking into consideration the conditions of end fixity.

1816.6 Group action: In cohesive soils, the compressive load capacity of a group of friction piles shall be analyzed by a generally accepted engineering method, and, where such analysis indicates, the individual allowable pile load shall be reduced accordingly.

1816.7 Stability:

1816.7.1 Wall foundations: All piles in wall foundations shall be staggered about the center of gravity of the wall load at a minimum distance of ½ the pile top diameter therefrom. A foundation wall restrained laterally so as to ensure stability both during and after construction may be supported by a single row of piles.

1816.7.2 Columns: Individual columns supported on piles shall be designed for eccentricity between the column and the centroid of the supporting piles equal to a minimum of three inches (76 mm) or the actual eccentricity, whichever is greater. The design shall account for such eccentricity through one of the following methods:
   a. By supporting the column on a minimum of three piles in a triangular pattern.
   b. By designing walls, grade beams or structural floors to resist the bending moment induced by the eccentricity.
   c. By designing the piles, column or both to resist the bending moment induced by the eccentricity and providing adequate lateral restraint at the top of the piles to resist the lateral thrust due to the bending moment.

1816.8 Structural integrity: Piles shall be installed in such a manner and sequence as to prevent distortion or damage to piles being installed or already in place, to the extent that such distortion or damage affects the structural integrity of the piles.

When piles have been damaged in driving, or have been driven in locations and alignment other than those indicated on the plans, or have capacities less than required by the design, the affected pile groups and pile caps shall be investigated, and if necessary, the pile groups or pile caps shall be redesigned or additional piles shall be driven to replace the defective piles.

1816.9 Spacing: The minimum center-to-center spacing of piles shall be not less than twice the average diameter of a round pile, nor less than 1¾ times the diagonal dimension of a rectangular pile. When driven to or penetrating into rock, the spacing shall be not less than 24 inches (610 mm). When receiving principal support from end-bearing on materials other than rock or through frictional resistance, the spacing shall be not less than 30 inches (762 mm) or as provided in 780 CMR 1820.4.6 for Pressure Injected Footings.

1816.10 Splices: Splices shall be avoided insomuch as practicable. When used, slices shall be constructed so as to provide and maintain true alignment and position of the component parts of the pile during installation and subsequent thereto, and shall be of adequate strength to transmit the vertical and *lateral loads* and moments occurring at the location of the splice during driving and under service loading. Splices shall develop not less than 50% of the capacity of the pile in bending. Additionally, all pile splices occurring in the upper ten feet (3 m) of the embedded portion of the pile shall be capable of resisting at allowable working stresses the moment and shear that results from an assumed eccentricity of the pile load of three inches (76 mm); or the pile shall be braced in accordance with 780 CMR 1816.7 to other piles that do not have splices in the upper ten feet (3 m) of embedment.

1816.11 Pile caps: Pile caps shall be of reinforced concrete. The soil immediately below the pile cap shall not be considered as carrying any vertical load. The tops of all piles shall be embedded not less than three inches (76 mm) into pile caps, and the caps shall extend at least four inches (102 mm) beyond the edges of all piles. The tops of all piles shall be cut back to sound material before capping.

1816.11.1 Pile cap seismic connection: All concrete piles shall be connected to the pile cap so

that reinforcement is embedded in the pile cap for a distance equal to the development length as specified in ACI 318 listed in *Appendix A*.

Field-placed dowels anchored in the concrete piles are acceptable. The development length to be provided is the full development length for compression without reduction in length for excess area. Where seismic confinement reinforcement at the top of the pile is required, alternative measures for laterally confining concrete and maintaining toughness and ductile-like behavior at the top of the pile shall be permitted provided consideration is given to forcing the hinge to occur in the confined region.

Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of the pile, provisions shall be made so that those specified lengths or extents are maintained after pile cut-off.

1816.11.2 Pile foundation seismic ties: Piles or pile caps shall be interconnected by ties capable of resisting, in tension or compression, a force equal to 10% of the larger column *dead* plus *live load*. Individual tie beams are not required when it is demonstrated that equivalent restraint will be provided by structural members within slabs on grade or reinforced concrete slabs on grade or confinement by competent rock, cohesive soils, very dense granular soils or other approved means.

1816.12 Pre-excavation: Jetting, augering and other methods of pre-excavation must be approved by the code official and carried out in the same manner as used for piles subject to load test and in a manner which will not impair the carrying capacity of the piles already in place or the safety of existing adjacent structures. Pre-excavation shall be of the same method as carried out on piles subject to load tests. Immediately after completion of jetting or augering, the pile shall be advanced to the maximum depth of pre-excavation and driven below this depth to the required load resistance. Where load tests are required, pre-excavation of test piles will be of the same manner as proposed for production piles.

1816.13 Inspection: The owner shall engage a *registered design professional* who shall submit his qualifications in writing to the code official. This design professional, or his representative, who must be qualified by experience and training, shall be present at all times while piles are being driven to observe all work in connection with the piles. The design professional or his representative shall make an accurate record of the material and the principal dimensions of each pile, of the weight and fall of the ram, the type, size and make of hammer, cushion blocks, the number of blows per minute, the energy per blow, the number of blows per inch for the last six inches (150 mm) of driving, together with the grades at point and cutoff and any other pertinent details. A copy of these records shall be signed by the *registered design professional*, and filed in the office of the code official.

1816.14 Identification: All pile materials shall be identified for conformity to the specified grade with this identification maintained continuously from the point of manufacture to the point of installation or shall be tested by an *approved agency* to determine conformity to the specified grade and the *approved agency* shall furnish an affidavit of compliance to the code official .

1816.15 Pile location plan: A plan showing the location and designation of all piles by an identification system shall be filed with the code official prior to installation of such piles. All detailed records for individual piles shall bear an identification corresponding to that shown on the plan.

1816.16 Use of existing piles: Piles left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the code official which indicates that the piles are sound and meet all of the requirements of 780 CMR. Such piles shall be load tested or redriven to verify their capacities. The design load applied to such piles shall be the lowest allowable load as determined by tests or redriving data.

1816.17 Pile driveability: Pile cross sections shall be of sufficient size and strength to withstand handling and driving stresses without damage to the pile and to provide sufficient stiffness to transmit the required driving forces. Driven piles of uniform cross section or tapered piles shall have a minimum nominal diameter of eight inches (200 mm) except as provided in 780 CMR 1820.6.4 for small diameter grouted piles, 780 CMR 1822.3.3 for timber piles and 780 CMR 1821.1 for precast concrete piles. Tapered shoes or points of lesser dimensions may be attached to the pile unit.

1816.18 Pile heave: Adequate provision shall be made to observe pile heave. Accurate reference points shall be established on each pile immediately after installation; for cast-in-place piles with unfilled corrugated shells, the reference point shall be at the bottom of the pile. If, following the installation of other piles in the vicinity, heaving of ½ inch (13 mm) or more occurs, the heaved piles shall be re-driven to develop the required capacity and penetration, or the capacity of the pile may be verified by load tests in accordance with 780 CMR 1817.4.

1908.7.2 Unacceptable concrete: Concrete that has partially hardened or has been contaminated by foreign materials shall not be deposited in the structure.

1908.7.3 Retempering: Retempered concrete or concrete that has been remixed after initial set shall not be used unless approved by the *registered design professional.*

1908.7.4 Continuous concreting: Once started, concreting shall be carried on as a continuous operation until the placement of a panel or section, as defined by panel or section boundaries or predetermined joints, is completed except as provided for in 780 CMR 1909.4.

1908.7.5 Placement in walls: Top surfaces of vertically formed lifts shall be generally level.

1908.7.6 Construction joints: Where construction joints are required, such joints shall be made in accordance with 780 CMR 1909.4.

1908.7.7 Consolidation: All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.

1908.8 Curing: Concrete (other than high-early-strength) shall be maintained above 50°F (10°C) and in a moist condition for at least the first seven days after placement, except when cured in accordance with 780 CMR 1908.8.2.

1908.8.1 High-early-strength concrete: High-early-strength concrete shall be maintained above 50°F (10°C) and in a moist condition for at least the first three days after placement, except when cured in accordance with 780 CMR 1908.8.2.

1908.8.2 Accelerated curing: If curing is to be accelerated, such curing shall be done in accordance with ACI 318.

1908.9 Cold-weather requirements: Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather.

1908.9.1 Frost: All concrete materials and all reinforcement, forms, fillers and ground with which concrete is to come in contact shall be free from frost.

1908.9.2 Ice: Frozen materials or materials containing ice shall not be used.

1908.10 Hot-weather requirements: During hot weather, attention shall be given to ingredients, production methods, handling, placing, protection and curing to prevent excessive concrete temperatures or water evaporation that would impair required strength or serviceability of the member or structure.

780 CMR 1909.0 FORMWORK, EMBEDDED PIPES AND CONSTRUCTION JOINTS

1909.1 Design of formwork: The design, fabrication and erection of forms shall result in a final structure that conforms to shapes, lines and dimensions of the members as required by the *construction documents.*

1909.1.1 Form strength: Forms shall be substantial and shall be sufficiently tight to prevent leakage of concrete.

1909.1.2 Form bracing: Forms shall be properly braced or tied together to maintain position and shape.

1909.1.3 Form placement: Forms and their supports shall be designed so as not to damage previously placed structures.

1909.2 Removal of forms and shores: Construction *loads* shall not be supported on, nor any shoring removed from, any part of the structure under construction except where that portion of the structure, in combination with the remaining forming and shoring system, has sufficient strength to support safely its weight and *loads* placed thereon.

1909.2.1 Structural analysis: Sufficient strength shall be demonstrated by structural analysis considering proposed *loads*, strength of the forming and shoring system, and concrete strength data. Concrete strength data shall be based on tests of field-cured cylinders or, where approved, on other procedures to evaluate concrete strength. Structural analysis and concrete-strength test data shall be furnished to the code official when so required.

1909.2.2 Construction loads: Construction *loads* exceeding the combination of superimposed *dead load* plus specified *live load* shall not be supported on any unshored portion of the structure under construction, unless analysis indicates adequate strength to support such additional *loads*.

1909.2.3 Safety: Forms shall be removed in such a manner so as not to impair safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

1909.2.4 Prestressed members: Form supports for prestressed concrete members shall not be removed unless sufficient prestressing has been applied to enable prestressed members to carry their *dead load* and anticipated construction *loads*.

1909.3 Conduits and pipes embedded in concrete: Where conduits, pipes and sleeves of any material not harmful to concrete and within limitations of

780 CMR 1909 are embedded in concrete with the approval of the engineer, such embedments shall not be considered to replace structurally the displaced concrete, except as provided for in 780 CMR 1909.3.5.

1909.3.1 Aluminum conduit and pipe: Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum concrete reaction or electrolytic action between aluminum and steel.

1909.3.2 Structural effect: Conduits, pipes and sleeves passing through a slab, wall or beam shall not impair significantly the strength of the construction.

1909.3.3 Columns: Conduits and pipes, including fittings, embedded within a column, shall not displace more than 4% of the area of the cross section on which strength is calculated or which is required for fire protection.

1909.3.4 Slabs, walls or beams: Except where *construction documents* for conduits and pipes are approved by the *registered design professional* and the code official, conduits and pipes embedded within a slab, wall or beam (other than those merely passing through) shall:

1. Not be larger in outside dimension than ⅓ of the overall thickness of the slab, wall or beam in which such conduits and pipes are embedded.
2. Not be spaced closer than three diameters or widths on center.
3. Not impair significantly the strength of the construction.

1909.3.5 Displaced concrete: Conduits, pipes and sleeves shall not be considered in compression as replacing structurally the displaced concrete unless such conduits, pipes and sleeves:

1. Are not exposed to rusting or other deterioration.
2. Are of uncoated or galvanized iron or steel not thinner than standard Schedule 40 steel pipe.
3. Have a nominal inside diameter not over two inches and are spaced not less than three diameters on center.

1909.3.6 Additional considerations: In addition to the other requirements of 780 CMR 1909.3, pipes that will contain liquid, gas or vapor which are embedded in structural concrete shall conform to the following conditions:

1. Pipes and fittings shall be designed to resist effects of the material, pressure and temperature to which the pipes and fittings will be subjected.
2. Liquid, gas or vapor except water not exceeding 90°F (32°C) or 50 psi (345 kPa) pressure, shall not be placed in the pipes until the concrete has attained design strength.
3. In solid slabs, piping that is not used for radiant heating or snow melting shall be placed between top and bottom reinforcement.
4. Concrete cover for pipes, conduit and fittings shall not be less than 1½ inches (38 mm) for concrete exposed to earth or weather conditions or ¾ inch (19 m) for concrete not exposed to weather conditions or in contact with ground.
5. Reinforcement with an area of not less than 0.002 times the area of the concrete section shall be provided normal to piping.
6. Piping and conduit shall be fabricated and installed so that cutting, bending or displacement of reinforcement from the proper location will not be required.

1909.4 Construction joints: Construction joints shall be created using the procedures set forth in 780 CMR 1909.4.1 through 1909.4.6.

1909.4.1 Surface cleaning: Surface of concrete construction joints shall be cleaned and laitance removed.

1909.4.2 Preparation of joint: Immediately before new concrete is placed, all construction joints shall be wetted and standing water shall be removed.

1909.4.3 Effect on strength: Construction joints shall be so made and located as not to impair the strength of the structure. Provisions shall be made for the transfer of shear and other forces through construction joints.

1909.4.4 Location of joints: Construction joints in floors shall be located within the middle third of the spans of slabs, beams and girders. Joints in girders shall be offset a minimum distance of two times the width of intersecting beams.

1909.4.5 Support conditions: Beams, girders or slabs supported by columns or walls shall not be cast or erected until concrete in the vertical support members is not in a plastic state.

1909.4.6 Monolithic pours: Beams, girders, haunches, drop panels and capitals shall be placed monolithically as part of a slab system, unless otherwise shown on the *construction documents*.

780 CMR 1910.0 DETAILS OF REINFORCEMENT

1910.1 General: Details of reinforcement shall comply with the requirements of 780 CMR 1910.0 and ACI 318. Where unidentified reinforcement is approved for use, such reinforcement shall be tested in accordance with the following:

Not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the project.

1910.2 Bending reinforcement: All reinforcement shall be bent cold, unless otherwise permitted by the *registered design professional* and approved. Reinforcement partially embedded in concrete shall

NON-TEXT PAGE

diagonal wood sheathing, wood structural panels or *particleboard* panels are installed, or where other sheathing as specified in 780 CMR 2305.13 is applied vertically in panels of not less than four feet by eight feet with approved fasteners complying with Table 2305.2. Other sheathing materials shall be permitted when tested in accordance with ASTM E72 listed in ***Appendix A***.

The lateral *load* resistance shall be established by the lesser of: the values determined by dividing the maximum *load* reported in the test by 2.5; or the *load* at which the deflection reported in the test exceeds *h*/480, where *h* is the height of the test assembly.

2305.8 Seismic bracing: Where structural analysis of the seismic force-resisting system is not provided, buildings shall meet the provisions of 780 CMR 2305.0 and shall have roof and exterior wall *dead loads* less than or equal to 15 psf (73 kg/m^2) and floor *dead loads* less than or equal to 10 psf (49 kg/m^2).

Table 2305.8
WALL SPACING AND HEIGHT LIMITATIONS FOR WOOD AND FRAME CONTRUCTION

Seismic Performance Category	Maximum distance between interior bracing walls (feet)	Maximum Stories (height) permitted
C	25	2 (30 feet)
D[a]	25	1 (20 feet)

Note a: Applies only to Seismic Hazard Exposure Group I; engineering analysis required for Seismic Hazard Exposure Group II

2305.8.1 Wall bracing required: All exterior walls and required interior bracing walls shall be braced by one of the types of sheathing prescrided in table 2305.8.1 for each 25 lineal feet (or 7.6 m) of exterior wall or required interior bracing wall length. The required length of sheathing shall be distributed along the length of the bracing wall with a minimum four foot panel of sheathing at, or within four feet of, each end. Construction of bracing walls shall comply with the requirements of 780 CMR 2305.9

Table 2305.8.1
MINIMUM SEISMIC WALL BRACING PER 25 LINEAL FEET OF INTERIOR AND EXTERIOR WALL LENGTH[a,c]

Story location	Sheathing[b]	$A_v = 0.12$
Top or only story	GP	7'-0"
	W/SP	4'-0"
First of two stories or second of three stories	GP	13'-0"
	W/SP	7'-0"
First of three stories	GP	Note c.
	W/SP	

Note a. Interpolation of the tabular values is permitted where the length of wall between exterior walls or interior-braced walls is less than 25 feet.
Note b. GP = Gypsum or *particleboard* sheathing; W/SP = Diagonal wood boards or wood structural panels.
Note c. Analysis of the seismic force-resisting system required.
Note d. One foot = 304.8 mm.

2305.8.2 Double-sheathed walls: Where braced walls are sheathed on both sides with identical sheathing, the required length of sheathing in Table 2305.8.1 is permitted to be taken as ½ the tabular length. Where different sheathing materials are used on either side of a wall, the required length of sheathing in Table 2305.8.1 is permitted to be taken as ½ of the tabular length for the material requiring the greater length. Double-sheathed walls shall have a minimum length of four feet (1219 mm).

2305.8.3 Stud walls: Stud walls that are less than the full height of the story shall be braced as required for exterior walls or interior-braced walls and shall be considered an additional story.

2305.8.4 Sheathing installation: Sheathing shall be installed in accordance with the provisions of Table 2305.13 where acting as wall bracing. To be considered effective as bracing, the sheathing shall be at least 48 inches in width covering three 16-inch stud spaces or two 24-inch stud spaces and be fastened to the wall studs in accordance with Table 2305.2. Sheathing shall be fastened to the wall studs, sole plate and top plate in accordance with Table 2305.2. All vertical joints of panel sheathing shall occur over studs and all horizontal joints shall occur over blocking at least equal in size to the studs. All framing in connection with sheathing used for bracing shall not be less than two inches nominal in thickness.

2305.9 Braced wall: All exterior walls and interior-braced walls required by Table 2305.8, shall be constructed to transfer forces from roofs and floors to braced walls and from the braced walls in upper stories to the braced walls in the story below. Braced wall lines from the story above to the story below are permitted to be offset a maximum of 24 inches (610 mm). Blocking, where required by 780 CMR 2305.9, need only be provided for the length of the wall specified in Table 2305.8.1.

2305.9.1 Roof to braced wall connections: Roof to interior-braced wall connections for buildings with maximum dimensions not over 50 feet (15240 mm) are permitted to be made at the intersection of exterior walls. Double top plates shall be lapped at the intersection and nailed in accordance with Table 2305.2. For buildings with maximum dimensions greater than 50 feet (15240 mm), the interior-braced walls shall be fastened directly to the ceiling joist in accordance with 780 CMR 2305.9.2 or 2305.9.3.

2305.9.2 Parallel floor joist and braced wall connections: Where the floor framing is parallel to the braced wall line, joists shall be doubled directly beneath the braced wall line and nailed in accordance with Table 2305.2.

Where the upper and lower braced walls are offset, the joist spaces between the offset braced walls shall be blocked with a minimum blocking size of two inches by six inches, spaced at 32 inches (813 mm) on center, within the joist cavity under the braced wall, and positioned in the upper portion of the cavity. The upper braced wall is permitted to be nailed to the blocking with two 16d nails at each piece of blocking. The lower braced wall shall be toe nailed, in accordance with Table 2305.2, to a joist located directly above the top plates.

2305.9.3 Perpendicular floor joist and braced wall connections: Where the floor framing is perpendicular to the braced wall line, solid blocking for the full depth of the floor joist shall be provided for the length of bracing required. The interior-braced wall shall be nailed to the blocking in accordance with Table 2305.2.

Where the upper and lower braced walls are offset, a minimum of two-inch by six-inch blocking shall be located in the upper portion of the joist space, directly beneath the upper braced wall and in the lower portion of the joist space, directly above the lower braced wall.

2305.10 Multiple stories: Where the frame is more than one story in *height* and studs and posts are not continuous from sill to roof, the members shall be secured together with approved clips, splices or other connections to insure a continuous, well-integrated structure. Sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistant material equivalent to 0.040-inch nominal thickness steel sheets for two-inch framing members and not less than 0.052-inch nominal thickness steel sheets for three-inch structural members. For four-inch and larger members, column splices and beam and girder supports shall comply with 780 CMR 2304.1.

2305.11 Framing over openings: Headers, double joists, trusses or other approved assemblies which are of adequate size to transfer all superimposed *loads* to the vertical members shall be provided over all window and door openings in loadbearing walls and partitions.

2305.12 Framing around flues and chimneys: Combustible framing shall be a minimum of two inches (51 mm), but shall not be less than the distance specified in 780 CMR 2114.0 and the mechanical code listed in ***Appendix A***, from all flues, chimneys and fireplaces, and six inches (152 mm) away from flue openings.

2305.13 Wall sheathing: Except as provided for in 780 CMR 1405.3 for weatherboarding or where stucco construction that complies with 780 CMR 2506.0 is installed, all enclosed buildings shall be sheathed with one of the materials of the nominal thickness specified in Table 2305.13 or any other approved material of equivalent strength and durability.

Table 2305.13
MINIMUM THICKNESS OF WALL SHEATHING

Sheathing type	Minimum thickness	Maximum shear wall stud spacing[a]
Wood boards	5/8 inch	24 inches on center
Fiberboard	7/16 inch	16 inches on center
Wood structural panel	In accordance with Table 2307.3.5	
2-M-1 or 2-M-W Particleboard	In accordance with Table 2308.5(2)	
Gypsum sheathing	½ inch	16 inches on center
Gypsum wallboard	½ inch	24 inches on center
Reinforced cement mortar	1 inch	24 inches on center

Note a.1 inch = 25.4 mm.

2305.13.1 Wood structural panel wall bracing: In buildings assigned to Seismic Performance Category D, where wood structural panel sheathing is installed structurally as covering on the exterior of outside walls, such sheathing shall be of the exterior type. Where used elsewhere structurally, wood structural panel sheathing shall be bonded by intermediate or exterior glue.

2305.13.2 Paper-backed lath sheathing: In occupancies in Use Group R-3 and one-story commercial buildings with brick or similar veneers, the sheathing shall conform to 780 CMR 2305.13 or shall consist of a layer of paper-backed lath complying with 780 CMR 2505.0 and a one-inch (25 mm) intermediate space which shall be mortar filled as each course of veneering is applied.

2305.14 Flooring: The flooring of wood frame construction shall be of adequate strength and stiffness to support required *loads* and, where necessary for strength and for lateral support of the building, subflooring shall be provided.

2305.14.1 Floor spans: Design stresses of floor joists shall be determined in accordance with AFPA NDS listed in ***Appendix A***. Metal-plate-connected floor trusses shall be designed in accordance with TPI *Design Specifications for Metal Plate Connected Parallel Chord Wood Trusses* and AFPA NDS listed in ***Appendix A***.

CHAPTER 27

ELECTRIC WIRING, EQUIPMENT AND SYSTEMS

(780 CMR 27 is Entirely Unique to Massachusetts)

2701.0: *M.G.L. c. 143, § 3L, provides that all installation, repair and maintenance of wiring and electrical fixtures used for light, heat and power purposes in buildings and structures shall be in conformance with the Massachusetts Electrical Code (527 CMR 12.00) listed in Appendix A and promulgated by the Board of Fire Prevention Regulations of the Commonwealth of Massachusetts, Department of Fire Services.*

NON-TEXT PAGE

facing material. The dimensional limitation of 120 square feet (11.16 m^2) shall not apply to *sign* facing sections made from flameresistant-coated fabric (ordinarily known as "flexible *sign* face *plastic*") that weighs less than 20 ounces per square yard (678 g/m^2) and which, when tested in accordance with NFiPA 701 listed in ***Appendix A*** meets the requirements of both the small-scale test and the large-scale test, or which, when tested in accordance with an approved test method, exhibits an average burn time for ten specimens of two seconds or less and a burning extent of 15 centimeters or less.

3102.6.5 Animated devices: *Signs* that contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than 15 inches (381 mm). The fail-safe device shall be in addition to the mechanism and the mechanism's housing which operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

3102.7 Ground signs: The structural frame of ground *signs* shall not be erected of combustible materials to a height of more than 35 feet (10668 mm) above the ground. In all locations, where constructed entirely of noncombustible material, ground *signs* shall not be erected to a height of greater than 100 feet (30480 mm) above the ground. Greater heights are permitted where approved and located so as not to create a hazard or danger to the public.

3102.8 Roof signs: Roof *signs* shall comply with 780 CMR 3102.8.1 through 3102.8.4.

3102.8.1 Materials: All roof *signs* shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 3102.6.4. Provisions shall be made for electric grounding of all metallic parts. Where combustible materials are permitted in letters or other ornamental features, all wiring and tubing shall be kept free and insulated therefrom.

3102.8.2 Bottom clearance: There shall be a clear space of not less than six feet (1829 mm) between the lowest part of the *sign* and the roof level, except for necessary structural supports.

3102.8.3 Closed signs: A closed roof *sign* shall not be erected to a height greater than 50 feet (15240 mm) above the roof of buildings of Types 1 and 2 construction, nor more than 35 feet (10668 mm) above the roof of buildings of Types 3, 4 and 5 construction.

3102.8.4 Open signs: An open roof *sign* shall not exceed a height of 100 feet (30480 mm) above the roof of buildings of Types 1 and 2 construction; and not more than 60 feet (18288 mm) above the roof of buildings of Types 3, 4 and 5 construction.

3102.9 Wall signs: Wall *signs* shall comply with 780 CMR 3102.9.1 and 3102.9.2.

3102.9.1 Materials: Wall *signs* which have an area exceeding 40 square feet (3.72 m^2) shall be constructed of metal or other approved noncombustible material, except for nailing rails and as provided for in 780 CMR 3102.6.4.

3102.9.2 Extension: Wall *signs* shall not be erected to extend above the top of the wall, nor to extend beyond the ends of the wall to which the *signs* are attached unless such *signs* conform to all of the requirements for roof *signs*, projecting *signs* or ground *signs*.

3102.10 Projecting signs: Projecting *signs* shall comply with 780 CMR 3102.10.1 through 3102.10.4.

3102.10.1 Materials: Projecting *signs* shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 3102.6.4.

3102.10.2 Maximum projection: A projecting *sign* shall not extend beyond a vertical plane that is two feet (610 mm) inside the curb line.

3102.10.3 Clearance: A vertical clearance of not less than eight feet (2438 mm) shall be provided below all parts of projecting *signs*.

3102.10.4 Additional loads: Projecting *sign* structures which will be used to support an individual on a ladder or other servicing device – whether or not specifically designed for the servicing device – shall be capable of supporting the anticipated additional *load*, but not less than a 100-pound (45.4 kg) concentrated horizontal *load* and a 300-pound (136.2 kg) concentrated vertical *load* applied at the point of assumed or most eccentric *loading*. The building component to which the projecting *sign* is attached shall also be designed to support the additional *loads*.

3102.11 Marquee signs: Marquee *signs* shall comply with 780 CMR 3102.11.1 through 3102.11.3.

3102.11.1 Materials: Marquee *signs* shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 3102.6.4.

3102.11.2 Attachment: Marquee *signs* shall be attached to approved marquees that are constructed in accordance with 780 CMR 3203.11.

3102.11.3 Dimensions: Marquee *signs* shall not project beyond the perimeter of the marquee.

3102.12 Temporary signs: Temporary *signs* shall comply with 780 CMR 3102.12.1 through 3102.12.4.

3102.12.1 Banner and cloth signs: Temporary *signs* and banners which are attached to or suspended from a building, and which are constructed of cloth or other combustible material, shall be constructed in an approved manner and shall be securely supported. Such *signs* and banners shall be removed as soon as torn or damaged, and not later than 60 days after erection. Permits for temporary *signs* that are suspended from or attached to a canopy or marquee shall be limited to a period of ten days.

3102.12.2 Maximum size: Temporary *signs* of combustible construction shall not be more than 10 feet (3048 mm) in one dimension nor more than 500 square feet (46.5 m^2) in area.

3102.12.3 Supports: Where more than 100 square feet (9.3 m^2) in area, temporary *signs* and banners shall be constructed and fastened to supports that are capable of withstanding the design *loads* listed in 780 CMR 1610.0.

3102.12.4 Special permits: Temporary *signs* used for holidays, public demonstrations or promotions of civic welfare or charitable purposes, which extend across streets or other public spaces shall be subject to special approval of the authority having jurisdiction.

3102.13 Illuminated signs: Illuminated *signs* shall comply with 780 CMR 3102.13.1 through 3102.13.3.

3102.13.1 Certificates: All electrically illuminated *signs* shall be certified as to electric wiring and devices by the agency having jurisdiction, and all wiring and accessory electrical equipment shall conform to the requirements of 527 CMR 12.00 listed in *Appendix A*.

3102.13.2 Additional permits: Electrical permits shall be issued for the erection or maintenance of illuminated *signs*.

3102.13.3 Relettering signs: The requirements of 780 CMR 3102.13 shall not apply to the relettering of illuminated *signs*, except where such relettering requires a change of wiring or piping of the *sign*.

3102.14 Portable signs: Portable *signs* shall conform to all requirements for ground, roof, projecting, flat and temporary *signs* where such *signs* are used in a similar capacity. The requirements of 780 CMR 3102.14 shall not be construed to require portable *signs* to have connections to surfaces, tie-downs or foundations where provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

3102.14.1 Electrical: Portable *signs* that require electrical service shall have a positive connecting device on the *sign*. Electrical service lines to the *sign* shall be protected from damage from all anticipated traffic.

780 CMR 3103.0 MEMBRANE STRUCTURES

3103.1 General: The provisions of 780 CMR 3103.0 shall apply to air-supported, air-inflated, *membrane*-covered cable and *membrane*-covered frame structures, collectively known as *membrane* structures, erected for a period of 90 days or longer. Those erected for a shorter period of time shall comply with the applicable provisions of the fire prevention code, 527 CMR, listed in *Appendix A* and 780 CMR 3104.0. *Membrane* structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants and similar facilities not used for human occupancy, are required to meet only the requirements of 780 CMR 3103.3.2 and 3103.6.

3103.2 Definitions: The following words and terms shall, for the purposes of 780 CMR 3103.0 and as used elsewhere in 780 CMR, have the meanings shown herein.

Membrane: As it pertains to membrane structures, a thin, flexible, impervious material capable of being supported by an air pressure of 1.5 inches of water column (373 P).

Membrane structures

Air-inflated structure: A building where the shape of the structure is maintained by air pressurization of cells or tubes to form a barrel vault over the usable area. Occupants of such a structure do not occupy the pressurized area used to support the structure.

Air-supported structure: A building wherein the shape of the structure is attained by air pressure and occupants of the structure are within the elevated pressure area. Air-supported structures are of two basic types:

Double skin: Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an air space which serves for insulation, acoustic, aesthetic or similar purposes.

Single skin: Where there is only the single outer skin and the air pressure is directly against that skin.

Cable-restrained, air-supported structure: A structure in which the uplift is resisted by cables or webbings which are anchored to either

3307.2 Removal of dust: Dust, sand blasts or other harmful agents which are used or which occur in construction operations shall be disposed of at or near the point of origin to prevent diffusion over adjoining premises or streets.

3307.3 Protective equipment: Facilities shall be provided in approved closed containers for housing the necessary vision, respiratory and protective equipment required in welding operations, and in accordance with the regulations of the administrative authority.

780 CMR 3308.0 PROTECTION OF ADJOINING PROPERTY

3308.1 General: Adjoining property shall be completely protected from any damage caused by the construction of a structure when the owner of the adjoining property permits free access to the structure at all reasonable times to provide the necessary safeguards in accordance with 780 CMR 3310.0.

780 CMR 3309.0 EXISTING BUILDINGS

3309.1 Protection: All adjoining public and private property shall be protected from damage caused by construction.

3309.2 Chimney, soil and vent stacks: Wherever a new building or structure is erected to greater or lesser *heights* than an adjoining building, the construction and extension of new or existing chimneys shall conform to the provisions of the mechanical code listed in ***Appendix A***, and the construction and extension of soil and vent stacks and the location of window openings shall comply with the provisions of ***248 CMR***.

3309.3 Adjoining walls: The owner of the new or *altered* structure shall preserve all adjoining independent and party walls from damage as provided for herein. The owner shall underpin where necessary and support the adjoining building or structure by proper foundations to comply with 780 CMR 3310.0.

3309.3.1 Maintenance: In case an existing party wall is intended to be used by the person who causes an excavation to be made, and such party wall is in good condition and sufficient for the use of both the existing and proposed building, such person shall preserve the party wall from injury and shall support the party wall by proper foundations at said person's own expense, so that the wall is and remains as safe and useful as the party wall was before the excavation was commenced. During the demolition, the party wall shall be maintained weatherproof and structurally safe by adequate bracing until such time as the permanent structural supports have been provided.

3309.3.2 Beam holes: Where a structure involving a party wall is being demolished, the owner of the demolished structure shall, at his or her own expense, bend over all wall anchors at the beam ends of the standing wall and shall brick up all open beam holes and otherwise maintain the safety and usefulness of the wall.

3309.3.3 Party wall exits: A party wall balcony or *horizontal exit* shall not be destroyed unless and until a substitute *means of egress* has been provided and approved.

3309.4 Adjoining roofs: Where a new building or demolition of an existing building is being conducted at a greater *height*, the roof, roof outlets and roof structures of adjoining buildings shall be protected against damage with adequate safeguards by the person doing the work.

780 CMR 3310.0 DEMOLITION AND EXCAVATION

3310.1 Notice of intent: The person intending to cause a demolition or an excavation shall deliver *written* notice of such intent to the owner of each potentially affected adjoining *lot*, building or structure at least one week prior to the commencement of work. The notice shall request license to enter the potentially affected *lot*, building or structure prior to the commencement of work and at reasonable intervals during the work to inspect and preserve the *lot*, building or structure from damage.

3310.2 Protection of adjoining property: If afforded the necessary license to enter the adjoining *lot*, building or structure, the person causing the demolition or excavation to be made shall at all times and at his or her own expense preserve and protect the *lot*, building or structure from damage or injury. If the necessary license is not afforded, it shall be the duty of the owner of the adjoining *lot*, building or structure to make safe his or her own property, for the prosecution of which said owner shall be granted the necessary license to enter the premises of the demolition or excavation.

3310.2.1 Removal of debris: All waste materials shall be removed in a manner which prevents injury or damage to persons, adjoining properties and public rights-of-way.

3310.3 Notice to the code official: If the person causing a demolition or excavation to be made is not afforded license to enter an adjoining structure, that person shall immediately notify in *writing* both the code official and the owner of the adjoining property that the responsibility of providing support to the adjoining *lot* building or structure has become the exclusive responsibility of the owner of the adjoining property.

3310.4 Grading of lot: Where a structure has been demolished or removed and a building permit has not been approved, the vacant *lot* shall be filled, graded and maintained in conformity to the established elevation of the street grade at curb level nearest to the point of demolition or excavation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

3310.5 Utility connections: All service utility connections shall be discontinued and capped in accordance with the *approved rules* and the requirements of the authority having jurisdiction.

780 CMR 3311.0 RETAINING WALLS AND PARTITION FENCES

3311.1 General: Where the adjoining grade is not higher than the legal level, the person causing an excavation to be made shall erect, where necessary, a retaining wall at his or her own expense and on his or her own land. Such wall shall be built to a height sufficient to retain the adjoining earth, shall be properly coped as required in 780 CMR 1825.0 and shall be provided with a guardrail or fence not less than 42 inches (1067 mm) in height.

780 CMR 3312.0 STORAGE OF MATERIALS AND CONSTRUCTION EQUIPMENT

3312.1 General: The term "construction equipment" shall mean the machinery, tools, derricks, hoists, scaffolds, platforms, runways, ladders and all material-handling equipment, safeguards and protective devices used in construction operations. The term "runway" shall mean an aisle or walkway constructed or maintained as a temporary passageway for pedestrians or vehicles. All construction materials and equipment required for the permitted construction shall be stored and placed so as not to endanger the public, the workers or adjoining property.

3312.2 Design capacity: Construction materials and equipment stored within the building, or on sidewalks or sheds, shall be placed so as not to overload any part of the construction beyond the design capacity, nor interfere with the safe prosecution of the work.

3312.3 Pedestrian walkways: Construction materials and equipment shall not be stored on the street without a permit issued by the administrative authority having jurisdiction. Where so stored, such materials or equipment shall not unduly interfere with vehicular traffic or the orderly travel of pedestrians on the highway or street. The piles shall be arranged to maintain a safe walkway not less than four feet (1219 mm) wide, unobstructed for its full length, and adequately lighted at night and at all necessary times for the use of the Public.

3312.4 Obstructions: Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, *standpipes*, fire or police alarm boxes, utility boxes, catch basins or manholes, nor shall such material and equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

780 CMR 3313.0 REMOVAL OF WASTE MATERIAL

3313.1 General: Material shall not be dropped by gravity or thrown outside the exterior walls of a building during demolition or erection. Wood or metal chutes shall be provided for the removal of such materials. Where the removal of any material will cause an excessive amount of dust, such material shall be wet down to prevent the creation of a nuisance.

780 CMR 3314.0 STAIRWAYS

3314.1 Temporary stairways: Where a building has been constructed to a *height* greater than 50 feet (15240 mm) or four stories, or where an existing building exceeding 50 feet (15240 mm) in *height* is *altered*, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.

780 CMR 3315.0 LIGHTING

3315.1 General: All *stairways* and parts of buildings under demolition, erection or repair shall be adequately lighted while persons are engaged at work, in accordance with the provisions of 780 CMR 1024.0 and ***527 CMR 12.00***.

3404.8 Means of egress lighting: *Means of egress* lighting shall be provided in accordance with 780 CMR 1024.0.

3404.9 Height and Area limitations: The height and area requirements of 780 CMR 5 shall apply to *existing buildings* when such *existing buildings* are modified by addition and/or change in use. Modifications to the height and area requirements as provided in 780 CMR 504.0 and 506.0 are permitted.

3404.10 Existing Fire and party walls: No further compliance is required with 780 CMR 707.0. The height above the roof of existing fire, party and exterior walls need not comply with 780 CMR 3404.0

3404.11 Fire Protection Systems: Fire Protection Systems: Design, installation and maintenance of fire protection systems shall be provided in accordance with 780 CMR 3404.3 and 780 CMR 3404.12 as applicable.

3404.12 Fire protection systems are required for the following cases:

1. Additions where required by 780 CMR 9.0 for the specific *use group.*
2. For *existing buildings* and additions to *existing buildings,* where required by 780 CMR 9 or where required by 780 CMR 506 to satisfy height and area requirements.
3. *Existing buildings*, or portions thereof which are *substantially altered* or *substantially renovated,* and where otherwise required by 780 CMR 9.0 for the specific *use group.*

Note: Notwithstanding the provisions of 780 CMR 3404.12, automatic Fire Suppression systems are required in municipalities which have adopted the provisions of MGL c148 § 26G, H or I (See *Official Interpretation* Number 45-96 listed in *Appendix B*).

3404.13 Enclosure of stairways: Open stairways are prohibited except in one- and two-family dwellings or unless otherwise permitted by 780 CMR 10. There shall be no minimum fireresistance rating required for an existing enclosure of a stairway. Partitions or other new construction which is added in order to fully and solidly enclose a stairway shall provide a minimum fireresistance rating of one hour. All doors in the enclosure shall be self-closing and tight-fitting with approved hardware. All doors in those portions of the stairway which are fireresistance rated shall comply to the applicable provisions of 780 CMR 9.

3404.14 Assembly Use Groups: Notwithstanding the provisions of 780 CMR 3404, Assembly Use Groups shall comply with the provisions of 780 CMR 3400.3, item 6.

3404.15 Institutional Use Groups: Notwithstanding the provisions of 780 CMR 3404, Institutional Use Groups shall comply with the provisions of 780 CMR 3400.3, item 7.

3404.16 Residential Use Groups: Notwithstanding the provisions of 780 CMR 3404, Residential Use Groups shall comply with the provisions of 780 CMR 3400.3, item 8.

3404.17 Fire hazard to adjacent buildings: Any proposed change in the use or occupancy of an existing building which has the effect of increasing the fire hazard to adjacent buildings shall comply with the requirements of Table 705.2 for exterior wall fire resistance rating requirements, or with approved *compliance alternatives.*

3404.18 Accessibility for Persons with Disabilities: Accessibility requirements shall be in accordance with 521 CMR as listed in *Appendix A.*

3404.19 Energy Conservation: Energy conservation requirements shall be in accordance with 780 CMR 3407.0.

780 CMR 3405.0 REQUIREMENT FOR CHANGE IN *USE GROUP* TO TWO OR MORE *HAZARD INDICES* GREATER

3405.1 General: When the existing use group is changed to a new use group of two or more hazard indices higher (as provided in Table 3403), the existing building shall conform to the requirements of the code for new construction, except as provided in 780 CMR 3408 or as otherwise allowed in 780 CMR 3407.0.

3405.2 Accessibility for Persons with Disabilities: Accessibility requirements shall be in accordance with 521 CMR as listed in *Appendix A.*

780 CMR 3406.0 *COMPLIANCE ALTERNATIVES*

3406.1 General: Where compliance with the provisions of the code for new construction, required by 780 CMR 34, is impractical because of construction difficulties or regulatory conflicts, *compliance alternatives* may be accepted by the building official.

Examples of *compliance alternatives* which have been used are provided in *Appendix F.* The building official may accept these *compliance alternatives* or others proposed.

3406.2 Documentation: In accordance with 780 CMR 3402.1.5, the building official shall ensure that the BBRS is provided with information regarding *compliance alternatives* accepted or rejected by the *building official.*

780 CMR 3407.0 ENERGY PROVISIONS FOR *EXISTING BUILDINGS*

3407.1 General: 780 CMR 3407.0 establishes the energy provisions for *existing buildings* governed by 780 CMR 3404.0 or 780 CMR 3405.0.

3407.2 Compliance: Alterations to any building component affecting energy conservation performance of an *existing building* shall comply with:

(a) 780 CMR 3407, Table 3407 (COMPONENT VALUES FOR ALTERED ELEMENTS) and all applicable subsections of 780 CMR 13.0, or;

(b) 780 CMR 1314.4 for thermal envelope requirements and all other applicable requirements of 780 CMR 13.0, or;

(c) 780 CMR 1314.5 for thermal envelope requirements and all other applicable requirements of 780 CMR 13.0, or;

(d) 780 CMR 1315.0 in its entirety, or;

(e) 780 CMR 1315.0 as supplemented by 780 CMR 1316.0

3407.3 Exempt buildings: Refer to 780 CMR 1301.4 for thermally exempt buildings and 780 CMR 1313.1.2 for lighting exemptions.

3407.4 Compliance exceptions

3407.4.1 Fenestration: When alterations to a wall assembly include only altering the fenestration component, the areas of fenestration may be decreased or replaced with an opaque wall element made to comply with the thermal transmittance value of the existing wall.

3407.4.2 *Ordinary repairs*: *Ordinary repairs* need not comply with the energy provisions.

3407.4.3 Roofs: Compliance of the roof/ceiling assembly is not required unless the existing roofing material is stripped off the roof deck. However, if a structural analysis by a registered professional engineer shows that the roof will not support the additional live loads imposed by compliance of the roof/ceiling assembly, or, if such analysis shows that addition of the required amount of insulation will cause ponding of water, then compliance of the roof/ceiling assembly is not required.

TABLE 3407
COMPONENT VALUES FOR ALTERED ELEMENTS

WALLS	All wall construction containing heated or mechanically cooled space	0.08	6,8
Foundation Walls Including Band	Containing heated or mechanically cooled space Containing unheated space	0.08 0.17	4
Roof/Ceiling Assembly	Wood plank and beam construction containing heated or mechanically cooled space	0.08	1
Roof/Ceiling Assembly	Construction other than wood plank and beam containing heated or mechanically cooled space	0.05	
Doors, Skylights and Windows	All construction enclosing heated or mechanically cooled space	0.65 0.65	2, 7 5 6
Floors	Floor sections over area exposed to outside air or unheated areas Unheated slab on grade Heated slab on grade	0.08 5.50 (R) 7.75 (R)	3
Mechanical Equipment	Heating, cooling, sizing and efficiency	780 CMR 1310.0, 1311.0	9
Equipment Controls	Humidistats, thermostats & zoning	780 CMR 1310.0	9
Duct and Pipe Insulation and Construction	Located in or on buildings	780 CMR 1310.0 1310.0	
Electrical Distribution.	-	780 CMR 1312.0 1312.3	
Lighting	Lighting	780 CMR 1313.0	

Note 1. Wood plank and beam assemblies are constructions in which the finished interior surface is the underside of the roof deck.

Note 2. Double glazing or storm windows will satisfy the required U Value of 0.65.

Note 3. Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of 0.17.

Note 4. The U value requirement of 0.17 for foundation walls may be omitted when floors over unheated spaces are provided with a U value of 0.08.

Note 5. Allowable air infiltration values for windows - .50 cfm/lin. ft. of operable sash crack; residential doors - (sliding) .50 cfm/sf., (entrance) 1.25 cfm/sf.; commercial doors 1 1 cfm/lin.ft.

CHAPTER 35

MANUFACTURED BUILDINGS, MANUFACTURED BUILDING COMPONENTS AND MANUFACTURED HOUSING

(This Chapter is entirely unique to Massachusetts)

780 CMR 3501.0 GENERAL

3501.1 Scope: The provisions of 780 CMR 35 shall govern the materials, design, manufacture, handling, storage, transportation, assembly, construction and/or installation of *manufactured buildings* and *manufactured building components* intended for installation in the Commonwealth of Massachusetts. *Manufactured buildings or manufactured building components* shall not be installed in any jurisdiction of the Commonwealth of Massachusetts unless such *manufactured buildings* or *manufactured building components* have been approved and certified in accordance with 780 CMR 35, applicable provisions of 780 CMR, and the Rules and Regulations for *Manufactured Buildings, Manufactured Building Components and Manufactured Housing*, 780 CMR R3, as listed in ***Appendix A***.

3501.2 Manufactured housing: When constructed in accordance with the Code of Federal Regulations (CFR) Title 24, Chapter XX - Office of Assistant Secretary for Housing - Federal Housing Commissioner, Department of Housing and Urban Development, Parts 3280, Manufactured home construction and safety standards, and 3282, Manufactured home procedural and enforcement regulations; manufactured housing shall be exempt from the provisions of 780 CMR 35.

Exceptions:

1. Foundations for *manufactured housing* shall conform to 780 CMR 1806 through 1813, or 780 CMR 3604 as applicable;
2. Additions, (when not a *manufactured home* as defined herein) and site built modifications shall conform to 780 CMR in its entirety, as applicable.

780 CMR 3502.0 DEFINITIONS

3502.1 General: The following words and terms shall, for the purposes of 780 CMR 35 and as used elsewhere in 780 CMR, shall have the meaning shown herein.

Approved: Approval by the State Board of Building Regulations and Standards (BBRS).

Manufactured Building Component: Any manufactured subsystem, manufactured sub-assembly, or other manufactured system designed for use in or part of a structure having concealed elements such as electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building systems.

Certification: Any manufactured building, manufactured building component or *manufactured housing* which meets the provisions of applicable codes and 780 CMR R3 pursuant thereto, as listed in ***Appendix A***; which has been labeled accordingly.

Code: 780 CMR (The Commonwealth of Massachusetts State Building Code) or specialized codes as defined herein, and as listed in ***Appendix A***.

Department (DPS): The Department of Public Safety, Division of Inspections.

Inspection Agency: An independent agency, sometimes referred to as the "third-party agency", retained by the manufacturer and approved by the BBRS to perform inspections and evaluations of manufactured building systems, compliance assurance programs, manufactured buildings and manufactured building components.

Installation: The process of affixing, or assembling and affixing a manufactured building, manufactured building component or manufactured housing unit(s) on the building site, and connecting it to utilities, and/or to an existing building. Installation may also mean the connecting of two or more manufactured housing units designed and approved to be so connected for use as a dwelling.

Installer of Manufactured Building: An individual, who on the basis of training and experience, has been certified by a specific manufacturer of manufactured buildings as competent to supervise the placement and connection required to install the manufactured products of that manufacturer. Said certification by the manufacturer shall be in writing, and the certified installer shall be issued picture identification by the manufacturer in verification of his\her certification.

Label: An approved device or seal evidencing certification in accordance with the applicable codes and rules and regulations promulgated pursuant thereto, and as listed in ***Appendix A***.

Local Enforcement Agency: A department or agency in a municipality charged with the enforcement of 780 CMR and appropriate specialized codes which include, but are not limited to, 248 CMR (the State Fuel Gas and Plumbing Code) and 527 CMR 12.00 (the State Electrical Code), as listed in ***Appendix A***.

Manufactured Building: Any manufactured building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation, and other systems affecting health and safety, and which is manufactured or assembled in accordance with 780 CMR and pertinent regulations, in manufacturing facilities, on or off the building site. Also, any manufactured building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer. "Manufactured building" does not mean "manufactured home".

Manufactured Homes (Housing): As defined in 24 CFR, Part 3280.2; a structure, transportable in one or more sections, which in the traveling mode, is eight body feet or more in width or forty body feet or more in length, or, when erected on site, is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning, and electrical systems contained therein. Calculations used to determine the number of square feet in a structure will be based on the structure's exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions will include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. (See 24 CFR, Part 3280.2 for a more detailed description of manufactured homes as defined by the Department of Housing and Urban Development.)

Specialized Code: All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair, or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts. The specialized codes shall include, but are not limited to, 248 CMR (the State Fuel Gas and Plumbing Code) and 527 CMR 12.00 (the Electrical Code), as listed in ***Appendix A***.

780 CMR 3503.0 CONSTRUCTION DOCUMENTS

3503.1 Building System Plans: The building system plans shall show in sufficient detail the approved system to which the manufactured building or building component was produced; including foundation connection details, component connection details, emergency escape window locations and sizes, structural design loads, the manufacturer's data plate, the location of all labels required of 780 CMR 35 and 780 CMR R3, and other details as may be required by the Division of Inspection. The building system plan shall bear evidence of the approval of the Division of Inspection and evidence of third party engineering review.

780 CMR 3504.0 APPROVAL

3504.1 General: The Commonwealth of Massachusetts, Department of Public Safety, Division of Inspection (hereinafter referred to as the "Division of Inspection" in 780 CMR 35) shall evaluate manufactured buildings and building components and recommend approval to the BBRS of those which it determines to be in compliance with applicable sections of 780 CMR 35, other applicable sections of 780 CMR, and 780 CMR R3, as listed in ***Appendix A***.

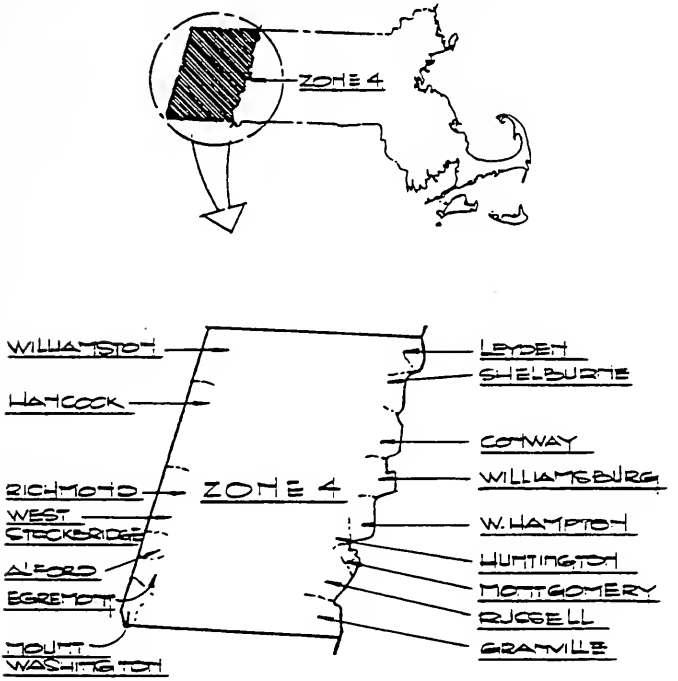
All approvals of plumbing, electrical or gas systems shall be made by the appropriate state agencies having jurisdiction, as specified in 780 CMR R3, as listed in ***Appendix A***.

3504.2 Approved tests: The Division of Inspection may utilize the results of approved tests to determine whether a manufactured building or manufactured building component meets the requirements of this chapter and the 780 CMR R3 as listed in ***Appendix A***, if that determination cannot be made from evaluation of plans, specifications and documentation alone.

3504.3 Approval of compliance assurance programs: The Division of Inspection shall evaluate manufacturers' compliance assurance programs and make recommendations for approval to the BBRS of those which it determines to be in compliance with this chapter and 780 CMR R3, listed in ***Appendix A***.

3504.4 Authorization to vary: A manufactured building, manufactured building component or a compliance assurance program heretofore approved in accordance with 780 CMR 3503.3, shall not be varied in any way without prior authorization by the BBRS in accordance with 780 CMR R3, as in ***Appendix A***.

Figure 3603.1.5d
MINIMUM UNIFORM SNOW LOAD MAP
ZONE 4



List of Towns in Minimum Uniform Snow Load Zones Zone 4

Adams	Colrain	Hancock	Monterey	Plainfield	Tolland
Alford	Conway	Hawley	Montgomery		Tyringham
Ashfield	Cummington	Heath	Mount Washington	Richmond	
		Hinsdale		Rowe	Washington
Becket	Dalton	Huntington	New Ashford	Russell	W. Stockbridge
Blandford			New Marlborough		Westhampton
Buckland	Egremont	Lanesborough		Sandisfield	Williamsburgh
		Lee	North Adams	Savoy	Williamstown
Charlemont	Florida	Lenox		Sheffield	Windsor
Cheshire		Leyden	Otis	Shelbourne	Worthington
Chester	Goshen			Stockbridge	
Chesterfield	Granville	Middlefield	Peru		
Clarksburg	Great Barrington	Monroe	Pittsfield		

Table 3603.1.6
ALLOWABLE LIVE LOAD DEFLECTION OF STRUCTURAL MEMBERS

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3 in 12 -no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors and veneer plastered ceilings	L/360
Gypsum panel ceilings and all other structural members	L/240

Notes:
L = Span length; H = Span height

780 CMR 3603.2 CONSTRUCTION IN AREAS SUBJECT TO FLOODING

3603.2.1 Flood Resistant Construction: Construction in areas designated as subject to flooding on the community Flood Insurance Rate Map (FIRM) shall be designed and constructed in accordance with the applicable provisions of 780 CMR 3107.

780 CMR 3603.3 FIRERESISTANCE RATING OF EXTERIOR WALLS

3603.3.1 Exterior walls: Exterior walls located less than three feet (0.914m) from property lines shall have a minimum of one-hour fire-resistive rating. The fire-resistive rating of exterior walls located less than three feet (0.914 m) from a property line shall be rated for exposure from both sides. Projections beyond the exterior wall shall not extend more than 12 inches (0.305 m) into areas where openings are prohibited.

3603.3.2 Openings: Openings shall not be permitted in exterior walls of dwellings located less than three feet (914 mm) from the property line. This distance shall be measured perpendicular to the vertical plane of the wall.

780 CMR 3603.4 DWELLING UNIT SEPARATION

3603.4.1 Two-family dwellings: Dwelling units in two-family dwellings shall be separated by wall and/or floor-ceiling assemblies of not less than one-hour fire-resistive rating when tested in accordance with ASTM E 119, as listed in ***Appendix A***. Fire-resistive-rated floor-ceiling and wall assemblies shall extend to, and be tight against, the exterior wall and wall assemblies shall extend to the underside of the roof sheathing.

3603.4.2 Supporting construction: When floor assemblies are required to be fire-resistive rated by 780 CMR 3603.4.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

3603.4.3 Sound transmission: Wall and floor-ceiling assemblies separating dwelling units shall provide airborne sound insulation for walls and both airborne and impact sound insulation for floor-ceiling assemblies.

3603.4.3.1 Airborne noise: Airborne sound insulation for wall and floor-ceiling assemblies shall meet a Sound Transmission Class (STC) of 45 when tested in accordance with ASTM E 90.

3603.4.3.2 Penetrations: Penetrations or openings in the assembly for pipes, ventilation or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings.

3603.4.3.3 Structural-borne noise: Impact sound insulation for floor-ceiling assemblies shall meet an Impact Insulation Class (IIC) of 45 when tested in accordance with ASTM E 492. Floor covering may be included in the assembly to obtain the required rating.

780 CMR 3603.5 GARAGE SEPARATION

3603.5.1 Opening protection: Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and dwelling shall be equipped with either solid wood doors not less than 1¾ inch (45 mm) in thickness or 20-minute fire-rated doors. Self closing devices and fire resistive rated door frames are not required. All door openings between the garage and the dwelling shall be provided with a raised sill with a minimum height of four inches.

3603.5.2 Fire Separation: The garage shall be separated from the residence and its attic area by means of minimum ⅝ inch (16 mm) type X gypsum board applied to the garage side. Wherever the attic area is continuous between the garage and the dwelling a firestop of ⅝ inch (16 mm) type X gypsum board with a minimum of one coat compound and tape shall be used to form a barrier to separate the garage and dwelling.

3603.5.3 Floor surface: Garage and carport floor surfaces shall be constructed of concrete or other approved noncombustible material. Slab on grade construction shall be in accordance with the provisions of 780 CMR 3605.5. The minimum floor thickness shall be 3½ inches. The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate drainage toward the main vehicle entry/exit doorway.

780 CMR 3603.6 LIGHT, VENTILATION AND HEATING

3603.6.1 Light required: Every room or space intended for human occupancy shall be provided with natural or artificial light.

Exception 1: Every bathroom and toilet room shall, as a minimum, be provided with artificial light.

Exception 2: All interior and exterior stairways shall be provided with artificial light providing direct or indirect illumination and capable of illuminating the entire length of the stairway and associated landings. The control for activation of the required interior stairway lighting shall be accessible at the top and bottom of each stair without traversing any step of the stair and shall otherwise be installed in accordance with the requirements of 527 CMR 12.00, the Massachusetts State Electrical Code, as listed in ***Appendix A***. The illumination of exterior stairs shall be controlled from inside the dwelling unit unless continuously illuminated or automatically activated.

3603.6.2 Ventilation required: Every room or space intended for human occupancy shall be provided with natural or mechanical ventilation.

Exception: Every bathroom and toilet room shall be equipped with a mechanical exhaust fan and associated ductwork with the fan exhausting, as a minimum, at 50 cfm if operated intermittently or 20 cfm if continuously operated. Such bathroom exhaust shall vent directly to the outside and no exhaust vent termination to attics or other interior portions of the building are allowed.

3603.6.3 Heating required: One and two family dwellings shall be designed with heating systems complying with the requirements of 780 CMR 3603.21.

3603.6.4 Natural light

3603.6.4.1 General: Should natural lighting be chosen as a lighting option, in the application of the provisions of 780 CMR 3603.0 for habitable and occupiable rooms, unless otherwise specifically required by the provisions of 780 CMR 4 for special occupancies, the requirements of 780 CMR 3603.6.4.2 through 780 CMR 3603.6.4.6 shall apply.

3603.6.4.2 Minimum glazing area: Every room or space intended for human occupancy shall have an exterior glazing area of not less than 8% of the floor area. ½ of the required area of glazing shall be openable. Glazed openings shall be located such that they open directly onto a street or public alley, or a yard or court, or other open space located on the same lot as the building. Glazed openings are permitted to face into a roofed porch where the porch abuts a street, yard or court, or other open area and the longer side of the porch is at least 65% open and unobstructed and the ceiling height of the porch is not less than seven feet (2134 mm).

Exceptions:

1. Glazed areas need not be openable where the opening is not required by 780 CMR 3603.10.4 and an approved mechanical ventilation system is provided which is capable of producing 0.35 air change per hour in the room or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cubic feet per minute (cfm) (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.
2. The glazed areas may be omitted in rooms where the opening is not required by 780 CMR 3603.10.4 and an approved mechanical ventilation system is provided capable of producing 0.35 air change per hour in the room or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cfm (7.08 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom, and artificial light is provided capable of producing an average illumination of six foot-candles (6.46 lx) over the area of the room at a height of 30 inches (762 mm) above the floor level.

3603.6.4.3 Adjoining spaces: Where natural light for rooms or spaces without exterior glazing areas is provided through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8% of the floor area of the interior room or space, but not less than 25 square feet (2.33 m^2). The exterior glazing area shall be based on the total floor area being served.

3603.6.4.4 Stairways: See 780 CMR 3603.6.1, Exception 2

3603.6.4.5 Hallways: Natural light shall be capable of penetrating the full length of the hallway.

3603.6.4.6 Bathrooms and toilet rooms: See 780 CMR 3603.6.1, Exception 1.

3603.6.5 Artificial light

3603.6.5.1 General: Artificial light shall be capable of providing the minimum illumination considered safe for the specific space application (an average illumination of six foot candles over the area of a room at a height of 30 inches above the floor is typically considered acceptable except for bathrooms and toilet rooms where three foot-candles, so measured is typically considered acceptable).

3603.6.6 Natural ventilation

3603.6.6.1 General: Natural ventilation of an occupied space shall be provided by means of windows, doors, louvers or other natural openings to the outdoor air.

3603.6.6.2 Ventilation area required: The minimum openable area to the outdoors shall be 4% of the floor area being ventilated.

3603.6.6.2.1 Adjoining spaces: Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8% of the floor area of the interior room or space, but not less than 25 square feet (2.33 m^2). The ventilation openings to the outdoors shall be based on the total floor area being ventilated.

3603.6.6.2.2 Bathrooms and toilet rooms: See 780 CMR 3603.6.2, Exception.

3603.6.6.2.3 Openings below grade: Openings below grade shall be acceptable for natural ventilation provided that the outside horizontal clear space measured perpendicular to the opening is 1½ times the depth below the average adjoining grade.

3603.6.6.3 Openings onto yards, courts or open areas: Natural ventilation shall be provided by openings onto yards, courts or other open space on the same lot.

3603.6.7 Mechanical ventilation

3603.6.7.1 General: Mechanical ventilation shall conform to the requirements of 780 CMR 36 and otherwise to the requirements of the BOCA National Mechanical Code listed in ***Appendix A***.

3603.6.8 Ventilation of special spaces

3603.6.8.1 Roof spaces: Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, shall have cross ventilation for each separate space by ventilation openings that are protected against the entrance of rain and snow. The openings shall be covered with corrosion-resistant mesh not less than ¼ inch (6 mm) nor more than ½ inch (13 mm) in any direction.

3603.6.8.1.1 Ventilating area: The minimum required net free ventilating area for such roof spaces shall be $^1/_{150}$ of the area of the space ventilated, except that the minimum required area shall be reduced to $^1/_{300}$, provided that: a vapor retarder having a permeance not exceeding one perm is installed on the warm side of the ceiling; or at least 50% and not more than 80%, of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least three feet (914 mm) above eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents.

3603.6.8.2 Basements, cellars and crawl spaces: All basements, cellars which are not used as *habitable, occupiable* space, and crawl spaces, other than crawl spaces used as an underfloor plenum, shall be ventilated by openings in exterior foundation walls, by openable windows or by approved mechanical means. Openings or openable windows shall be located as near as practical to provide cross ventilation. The openings shall be covered with corrosion resistant mesh not less than ¼ inch (6 mm) nor more than ½ inch (13 mm) in any direction, except than when openable windows are used for basement or cellar ventilation, standard window screens may be used as the corrosion resistant mesh.

Exception:
1. Basements or cellars used as *habitable, occupiable space* (Typically basements and cellars are not classified as habitable, occupiable space - see Definitions, 780 CMR 2 and 1202) shall satisfy the ventilation requirements of 780 CMR 3603.6.6 or 780 CMR 3603.6.7, as applicable.
2. All basements and cellars containing solid fuel fired or fossil fired appliances shall additionally satisfy combustion air requirements of 780 CMR 3611.1

3603.6.8.2.1 Opening size: Openings or openable windows shall have a net area of not less than one square foot (0.093 m^2) for each 150 square feet (13.95 m^2) of foundation floor area. Where an approved vapor retarder is installed over the ground surface, the required net area of openings shall be reduced to 0.1 square foot (0.093 m^2) for each 150 square feet (13.95 m^2) and where vents are provided, they shall have manually operable louvers.

Exception: Basements and cellars not used as habitable, occupiable space shall be provided with a minimum of four sliding type, or awning type basement windows for every 1500 square feet of floor area, or multiples thereof, and shall be located, as near as practical, to provide cross ventilation.

3603.6.8.3 Alternative mechanical ventilation: Enclosed attics, rafter, basement, cellar and crawl spaces which are not ventilated as herein required shall be equipped with a mechanical ventilation system conforming to the requirements of the BOCA National Mechanical Code listed in ***Appendix A***.

3603.20.3 Louvered windows or jalousies: Regular, float, wired or patterned glass in jalousies and louvered windows shall be no thinner than nominal 3/16 inch (4.76 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth. Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

3603.20.4 Safety glazing:

3603.20.4.1 Human impact loads: Individual glazed areas, including glass mirrors, in hazardous locations such as those indicated in 780 CMR 2405.2 shall pass the test requirements of CPSC 16 CFR; 1201 ***and shall conform to the requirements of M.G.L. c. 143, §§ 3T, 3U and 3V, as applicable,*** listed in ***Appendix A.*** The requirements of this section and 780 CMR 2405.2 and 2407.0 shall apply equally to replacement glass and new glass installation. Additional requirements as specified in 780 CMR 2407.2 are to be satisfied for glass used in locations where the hazard is of a continuous nature, such as glass enclosures for sporting activities as identified in 780 CMR.

Exceptions:

1. Polished wired glass used in required fire resistance rated assemblies ***or polished wire glass used in hazardous locations such as those indicated in 780 CMR 3603.20.4.2, items 6,7,8 and 9*** shall comply with ANSI Z97.1, listed in ***Appendix A.***
2. Plastic glazing shall meet the weathering requirements of ANSI Z97.1 listed in ***Appendix A.***
3. Glass-block walls shall comply with 780 CMR 2115.0.

3603.20.4.1.1 Identification: Each light of safety glazing material installed in hazardous locations as defined in 780 CMR 3603.20.4.2 shall bear a permanent identifying mark issued by an approved agency which specifies the marking agency, whether manufacturer or installer, and the test standard.

Exceptions:

1. Polished wire glass is exempt from a permanent identifying mark provided that the distributor or the installer provides an affidavit certifying that the polished wire glass complies with ANSI Z97.1 listed in Appendix A.

2. Laminated glass is exempt from a permanent identifying mark provided that the distributor or installer provides an affidavit certifying that the laminated glass complies with CPSC 16 CFR 1201, listed in Appendix A.

3603.20.4.2 Specific hazardous locations: The following shall be considered specific hazardous locations for the purposes of glazing:

1. Glazing in ingress and means of egress doors except jalousies (see 780 CMR 2402.5).
2. Glazing in fixed and sliding panels of sliding (patio) door assemblies and panels in swinging doors.
3. Glazing in storm doors.
4. Glazing in all unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any portion of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1525 mm) above a standing surface.
6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1525 mm) above the walking surface.
7. Glazing in an individual fixed or operable panel, other than in those locations described in 780 CMR 3603.20.4.2 items 5. and 6., which meets all of the following conditions:
   a. Exposed area of an individual pane greater than nine square feet (0.84 m^2);
   b. Exposed bottom edge less than 18 inches (460 mm) above the floor:
   c. Exposed top edge greater than 36 inches (915 mm) above the floor; and
   d. One or more walking surface(s) within 36 inches (915 mm) horizontally of the plane of the glazing.
8. All glazing in guards and railings regardless of area or height above a walking surface. Included are structural baluster panels and nonstructural in-fill panels.
9. Glazing in walls and fences enclosing indoor and outdoor swimming pools where the bottom edge of the glazing on the pool side is less than 60 inches (1525 mm) above a walking surface and within 36 inches (914 mm) horizontally of a walking surface. This shall apply to single glazing and all panes in multiple glazing.

Exception: The following products, materials and uses shall not be considered specific hazardous locations:

1. Glazed openings in doors through which a three-inch (76 mm) sphere is unable to pass.
2. Assemblies of leaded glass or faceted glass and items of carved glass used for decorative purposes in locations described in 780 CMR 3603.20.4.2, items 1., 6. or 7.

3. Glazing as described in 780 CMR 3603.20.4.2, item 6., where there is an intervening wall or some other permanent barrier that will prevent a person approaching the door from accidentally striking the glazing.

4. Glazing as described in 780 CMR 3603.20.4.2, item 7., where a protective bar is installed 34 inches to 38 inches (864 mm to 965 mm) above the floor on the side of the glazing having access thereto. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1½ inches (38 mm) in height. ***The protective bar may be an applied bar or an integral part of the glazed framing dividing an upper lite from a lower lite.***

5. Outboard panes in insulating glass units and other multiple-glazed panels as described in 780 CMR 3603.20.4.2, item 7., where the bottom exposed edge of the glass is 25 feet (7620 mm) or more above any grade, roof, walking surface or other horizontal or sloped (within 45 degrees of horizontal) surface adjacent to the glass exterior.

6. Louvered windows and jalousies complying with the requirements of 780 CMR 3603.20.3.

7. Glazing, including mirrors, mounted or hung on a surface that provides a continuous backing support.

3603.20.5 Sloped glazing and skylights

Note: Also refer to 780 CMR 2404.0 and 2405.0.

3603.20.5.1 Sloped glazing: Any installation of glass or other transparent, translucent or opaque glazing material which is installed at a slope of 15 degrees (0.26 rad) or more from the vertical plane —including skylights, roofs and sloped walls—shall comply with 780 CMR 3603.20.5.

3603.20.5.2 Allowable glazing materials: Sloped glazing shall be any of the following materials, subject to the limitations specified in 780 CMR 3603.20.5.3 and the exceptions specified in 780 CMR 3603.20.5.4:

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (762 µm) polyvinyl butyral interlayer, wired glass, approved plastic materials, heat-strengthened glass or fully tempered glass.

2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in 780 CMR 3603.20.5.2, item 1.

For additional requirements for plastic skylights, see 780 CMR 2608.0.

3603.20.5.3 Limitations: Where used in monolithic glazing systems, heat-strengthened glass and fully tempered glass shall have screens installed below the glazing material, subject to the exceptions in 780 CMR 3603.20.5.4, to protect building occupants from falling glass should breakage occur. The screens shall be capable of supporting the weight of the glass and shall be substantially supported below and installed within four inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B & S Gage (0.0808 inch) with a mesh not larger than one inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent non-corrosive atmosphere, structurally equivalent non-corrosive screening materials shall be used. Where used in multiple-layer glazing systems as the bottom glass layer over the walking surface, heat-strengthened glass, fully tempered glass and wired glass shall be equipped with screening that conforms to the requirements specified for monolithic glazing systems.

3603.20.5.4 Exceptions: In monolithic and multiple-layer sloped glazing systems, the following exceptions apply:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass ten feet (3048 mm) or less above the walking surface.

2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.

3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of detached greenhouses, provided that the height of the greenhouse at the ridge does not exceed 20 feet (6096 mm) above grade. Greenhouse frames shall be noncombustible if the height of the sloped glazing exceeds 20 feet (6096 mm) above grade.

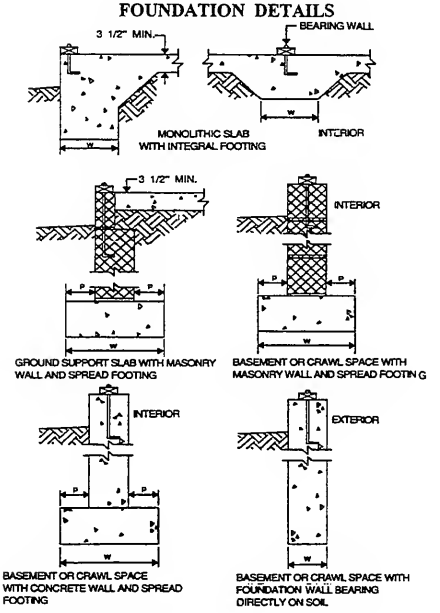
4. Screens shall not be required where fully tempered glass ***or laminated glass with a 15 mil polyvinyl butyral interlayer*** is used as single glazing or as both panes in an insulating glass unit, and all of the following conditions are met:

a. Each pane of glass is 16 square feet (1.5 m^2) or less in area;

b. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other area having access thereto; and

c. The glass thickness is $^3/_{16}$ inch (5 mm) or less.

FIGURE 3604.3.1a
CONCRETE AND MASONRY
FOUNDATION DETAILS

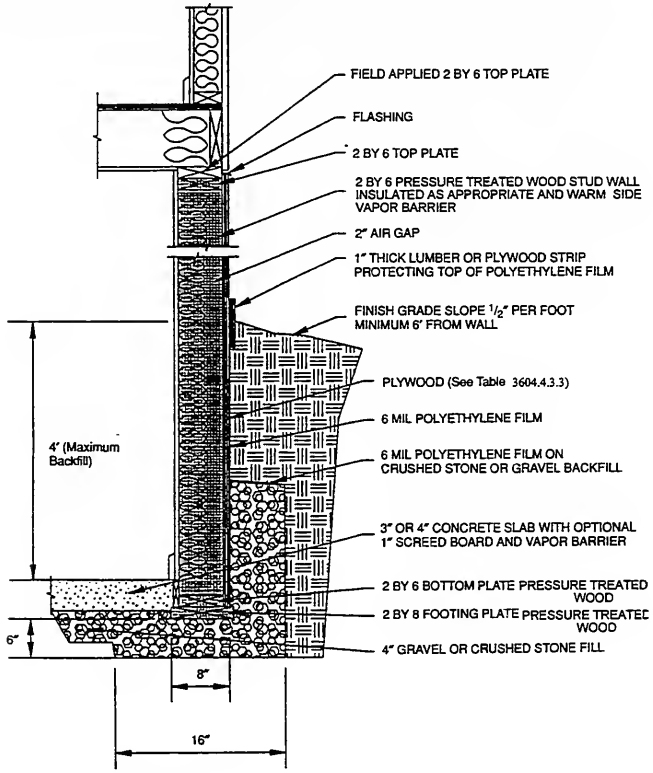


For SI 1 inch = 25.4 mm, 1 foot = 304.8 mm.

NOTES:

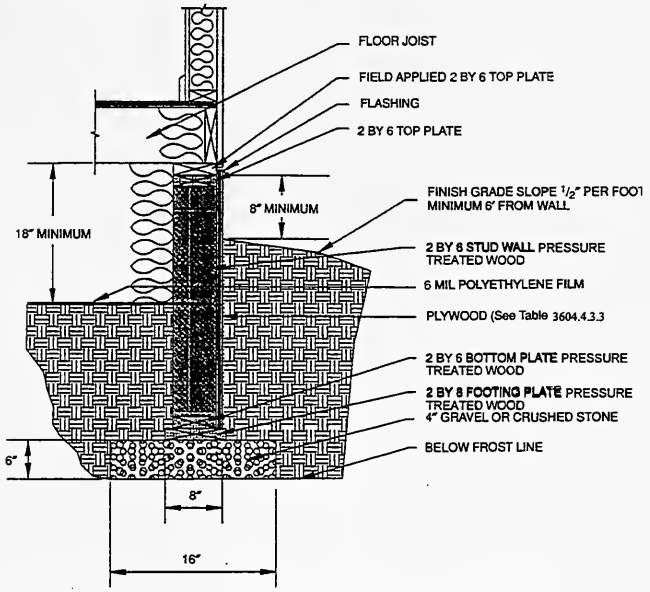
1. Exterior footings shall extend to below the frost line unless otherwise protected against frost heave. In no case shall exterior footings be less than 12 inches below grade.
2. Footing widths (*W*) shall be based on the load-bearing value of the soil in accordance with Table 3604.1.4 or shall be designed in accordance with accepted engineering practice.
3. Spread footings shall be a minimum of six inches thick, and footing projections (*P*) shall be a minimum two inches and shall not exceed the footing thickness.
4. Footings shall be supported on undisturbed natural soil or engineered fill.
5. The sill plate or floor system shall be anchored to the foundation with ½-inch-diameter bolts placed six feet on center and not more than 12 inches from corners. Bolts shall extend a minimum of 15 inches into masonry or eight inches into concrete. Sill plates shall be protected against decay where required by 780 CMR 3603.22.
6. Pier and column footing sizes shall be based on the tributary load and allowable soil pressure in accordance with Table 3605.2.3.3b.

FIGURE 3604.3.1b
TYPICAL DETAILS FOR WOOD FOUNDATION BASEMENT WALL



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 3604.3.1c
TYPICAL DETAILS FOR WOOD FOUNDATION CRAWL SPACE WALLS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

TABLE 3604.3.1
MINIMUM WIDTH OF CONCRETE OR MASONRY FOOTINGS (inches)

	LOAD-BEARING VALUE OF SOIL (psf)					
	1,500	2,000	2,500	3,000	3,500	4,000
Conventional Wood Frame Construction						
1-story	16	12	10	8	7	6
2-story	19	15	12	10	8	7
3-story	22	17	14	11	10	9
4-inch Brick Veneer over Wood Frame or 8-inch Hollow Concrete Masonry						
1-story	19	15	12	10	8	7
2-story	25	19	15	13	11	10
3-story	31	23	19	16	13	12
8-inch Solid or Fully Grouted Masonry						
1-story	22	17	13	11	10	9
2-story	31	23	19	16	13	12
3-story	40	30	24	20	17	15

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

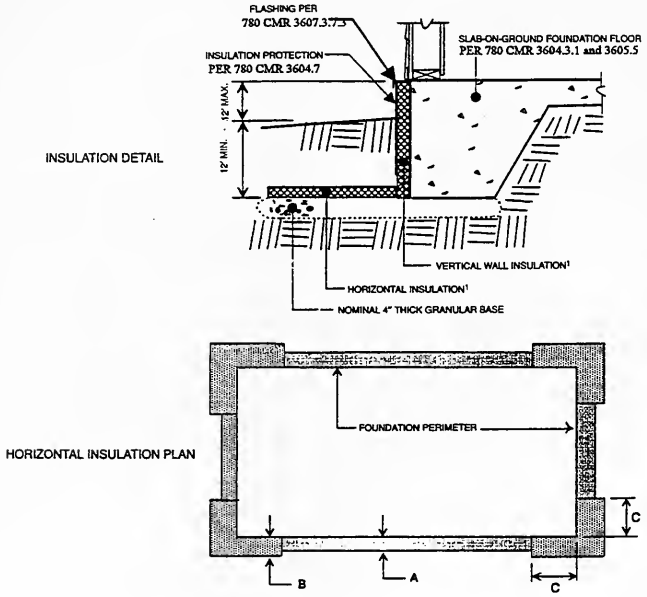
TABLE 3604.3.3
MINIMUM INSULATION REQUIREMENTS FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS

VERTICAL INSULATION *R*-VALUE[2,4]	HORIZONTAL INSULATION *R*-VALUE[3,5]		HORIZONTAL INSULATION DIMENSIONS PER FIGURE 3604.3.3 (inches)		
	along walls	at corners	A	B	C
4.5	NR	NR	NR	NR	NR

For SI: 1 inch = 25.4 mm, °F = 1.8°C + 32

1. Insulation requirements are for protection against frost damage in heated buildings. Greater values may be required to meet energy conservation standards. Interpolation between values is permissable.
2. Air Freezing Index values based on 1,500 °F days.
3. Insulation materials shall provide the stated minimum R-values under the long term exposure to moist, below-ground conditions in freezing climates. The following R-values shall be used to determine insulation thickness required for this application: Type II expanded polystyrene - 2.4R per inch; Type IV extruded polystyrene - 4.5R per inch; Type VI extruded polystyrene - 4.5R per inch; Type IX expanded polystyrene - 3.2R per inch; Type X extruded polystyrene - 4.5R per inch. NR indicates that insulation is not required.
4. Vertical insulation shall be expanded polystyrene insulation or extruded insulation.
5. Horizontal insulation shall be extruded polystyrene insulation.

FIGURE 3604.3.3a
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS



For SI: 1 inch = 25.4 mm.
1. See table 3604.3.3 for required dimensions and *R*-values for vertical and horizontal insulation.

780 CMR 3604.4 FOUNDATION WALLS

3604.4.1 Concrete and masonry foundation walls: Foundation walls shall be constructed in accordance with the provisions of 780 CMR 3604.4 or in accordance with ACI 318, ACI 318.1, NCMA TR68-A or ACI 530/ASCE 5/TMS 402 ***as listed in Appendix A,*** or other approved structural systems.

3604.4.1.1 Masonry and concrete wall construction: Masonry and concrete foundation walls shall be constructed as ***in accordance with*** Table ***3604.4.1.1a***.

Exception: Where unstable soil conditions exist or where the foundation extends to or below the seasonal high groundwater table, foundation walls shall be constructed in accordance with Table ***3604.4.1.1b***.

3604.4.1.2 Design: Foundation walls subject to more pressure than would be exerted by backfill having an equivalent fluid weight of 30 pounds per cubic foot (141 kN/m^3) shall be designed in accordance with accepted engineering practice by a registered professional engineer or registered architect.

3604.4.1.3 Grade Clearance: Foundation walls shall extend at least ***eight inches*** above the finished grade adjacent to the foundation at all points.

Exception: Where masonry veneer is used, foundation walls shall extend a minimum of four inches (102 mm) above the finished grade.

TABLE 3604.4.1.1a
MINIMUM THICKNESS AND ALLOWABLE DEPTH OF UNBALANCED FILL FOR UNREINFORCED MASONRY AND CONCRETE FOUNDATION WALLS[1,2] WHERE UNSTABLE SOIL OR GROUNDWATER CONDITIONS DO NOT EXIST

FOUNDATION WALL CONSTRUCTION	NOMINAL THICKNESS[3] (inches)	MAXIMUM DEPTH OF UNBALANCED FILL[1] (feet)
Masonry of Hollow Units, Ungrouted	8	4
	10	5
	12	6
Masonry of Solid Units	6	3
	8	5
	10	6
	12	7
Masonry of Hollow or Solid Units, Fully Grouted	8	7
	10	8
	12	8
Plain Concrete	6[4]	6
	8	7
	10	8
	12	8
Rubble Stone Masonry	16	8
Masonry of hollow units reinforced vertically, with No. 4 bars and grout at 24 inches on center. Bars located not less than 4½ inches from pressure side of wall.	8	7

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm.
1. Unbalanced fill is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced fill shall be measured from the exterior finish ground level to the top of the interior concrete slab.
2. The height between lateral supports shall not exceed eight feet.
3. The actual thickness shall not be more than ½ inch less than the required nominal thickness specified in the table.
4. Six-inch plain concrete walls shall be formed on both sides.

TABLE 3604.4.1.1 b
REQUIREMENTS FOR MASONRY OR CONCRETE FOUNDATION WALLS SUBJECTED TO NO MORE PRESSURE THAN WOULD BE EXERTED BY BACKFILL HAVING AN EQUIVALENT FLUID WEIGHT OF 30 POUNDS PER CUBIC FOOT OR SUBJECTED TO UNSTABLE SOIL CONDITIONS

MATERIAL TYPE	HEIGHT OF UNBALANCED FILL IN FEET[1]	LENGTH OF WALL BETWEEN SUPPORTING MASONRY OR CONCRETE WALLS IN FEET	MINIMUM[2] WALL THICKNESS IN INCHES[3]	REQUIRED REINFORCING	
				Horizintal Bar in Upper 12 inches of wall	Size and Spacing of Vertical Bars
Hollow Masonry	4 or less	unlimited	8	not required	not required
	more than 4	design required	design required	design required	design required
Concrete or Solid Masonry[4]	4 or less	unlimited	8	noot required	not required
	more than 4	less tha 8	8	2-No. 3	No. 3 @ 18" o.c.
	8 or less	8 to 10	8	2-No. 4	No. 3 @ 18" o.c.
	8 or less	10 to 12	8	2-No. 5	No. 3 @ 18" o.c.
	more than 8	design required	design required	design required	design required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per cubic foot (pcf) = 0.1572 kN/m^3.
1 Backfilling shall not be commenced until after the wall is anchored to the floor or adequate bracing is in place.
2. Thickness of concrete walls may be six inches, provided reinforcing is placed not less than one inch or more than two inches from the face of the wall not against the earth.
3. The actual thickness shall not be more than ½ inch less than the required thickness specified in the table.
4. Solid masonry shall include solid brick or concrete units and hollow masonry units with all cells grouted.

3604.4.1.3.1 Backfill placement: Backfill adjacent to the wall shall not be placed until the wall has sufficient strength ***in accordance with 780 CMR 3604.2.2*** and has been anchored to the floor, or has been sufficiently braced to prevent damage by the backfill.

Exception: Such bracing is not required for walls *retaining* less than three feet (914 mm) of unbalanced backfill.

3604.4.2 Design required: Foundation walls subject to more lateral pressure than would be exerted by backfill consisting of freely draining sands and gravel classified as Group I according to the United States Soil Classification System or soils having an equivalent fluid weight of greater than 30 pounds per cubic foot (4.72 kN/m^3) shall be designed in accordance with accepted engineering practices by a registered professional engineer or registered architect.

3604.4.3 Wood foundation walls: Wood foundation walls shall be constructed in accordance with the provisions of *780 CMR 3604.4.3.1* through *3604.4.3.5* and with the details shown in Figures *3604.3.1b* and *3604.3.1c*.

3604.4.3.1 Wood grade: All load-bearing lumber and plywood shall conform to applicable standards or grading rules and be identified by a grade mark or certificate of inspection issued by an approved lumber or plywood grading or inspection bureau or agency. Lumber shall conform to DOC PS 20-94.

TABLE 3604.4.3.3
PLYWOOD GRADE AND THICKNESS FOR WOOD FOUNDATION CONSTRUCTION
(30 pcf equivalent-fluid weight soil pressure)

HEIGHT OF FILL (inches)	STUD SPACING (inches)	FACE GRAIN ACROSS STUDS			FACE GRAIN PARALLEL TO STUDS		
		Grade[1]	Minimum Thickness	Identification Index	Grade[1]	Minimum Thickness[2,3]	Identification Index
24	12	B	15/32	32/16	A	15/32	32/16
					B	15/32[3]	32/16
	16	B	15/32	32/16	A	15/32[3]	32/16
					B	19/32[3] (4,5 ply)	40/20
36	12	B	15/32	32/16	A	15/32	32/16
					B	15/32[3] (4,5 ply)	32/16
					B	19/32 (4, 5 ply)	40/20
	16	B	15/32[3]	32/16	A	19/32	40/20
					B	23/32	48/24
48	12	B	15/32	32/16	A	15/32[3]	32/16
					B	19/32[3] (4, 5 ply)	40/20
	16	B	19/32	40/20	A	19/32[3]	40/20
					A	23/32	48/24

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 0.1572 kN/m^3.

1. Plywood shall be of the following minimum grades in accordance with DOC PS1 or DOC PS2:
   (i) DOC PS 1 Plywood grades marked:
      a. Structural I C-D (Exposure 1)
      b. C-D (Exposure 1)
   (ii) DOC PS 2 Plywood grades marked:
      a. Structural I Sheathing (Exposure 1)
      b. Sheathing (Exposure 1)
   (iii) Where a major portion of the wall is exposed above ground and a better appearance is desired, the following plywood grades marked Exterior are suitable:
      a. Structural I A-C, Structural I B-C or Structural I C-C (Plugged) in accordance with DOC PS 1
      b. A-C Group 1, B-C Group 1, C-C (Plugged) Group 1 or MDO Group 1 in accordance with DOC PS 1
      c. Single Floor in accordance with DOC PS 2
2. Minimum thickness 15/32 inch, except crawl space sheathing may be 3/8 inch for face grain across studs 16 inches on center and maximum two foot depth of unequal fill.
3. For this fill height, thickness and grade combination, panels which are continuous over less stud spacings require blocking 16 inches above the bottom plate. Offset adjacent blocks and fasten through corrosion-resistant nails at each end.

3604.4.3.2 Stud size: The studs used in foundation walls shall be two by six (51 by 153) members. When spaced 16 inches on center, a wood species with an F_b value of not less than 1,250 psi (8612 kPa) as listed in Table *3605.2.3.1d* shall be used. When spaced 12 inches (305 mm) on center, an F_b of not less than 875 (6029 kPa) shall be required.

3604.4.3.3 Height of backfill: The height of backfill against a foundation wall shall not exceed four feet (1219 mm). When the height of fill is

eight-inch (153 mm to 203 mm) layers and compacted to consolidate the fill.

3604.6.3.5 Final grading: ***Finished grades shall conform to 780 CMR 3604.1.3.***

780 CMR 3604.7 FOUNDATION INSULATION

3604.7.1 Protection of exposed foundation insulation: Foundation walls and the edges of slab-on-ground floors with exterior applied insulation shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of thermal performance. The protective covering shall cover the exposed insulation and extend to a minimum of six inches (153 mm) below grade.

780 CMR 3604.8 COLUMNS

3604.8.1 Wood column protection: Wood columns shall be protected against decay as set forth in ***780 CMR 3603.22.***

3604.8.2 Steel column protection: All surfaces (inside and outside) of steel columns shall be given a shop coat of rust-inhibitive paint, except for corrosion-resistant steel and steel treated with coatings to provide corrosion resistance.

3604.8.3 Structural requirements: ***All*** columns shall be restrained to prevent lateral displacement. Wood columns shall not be less in nominal size than four inches by four inches (102 mm by 102 mm) and steel columns shall not be less than three-inch-diameter (76 mm) standard pipe or approved equivalent.

780 CMR 3604.9 CRAWL SPACE

3604.9.1 Ventilation: The space between the bottom of the floor joists and the earth under any building (except such space as is occupied by a basement or cellar) shall be provided with ***a sufficient number of*** ventilation openings through foundation walls or exterior walls. ***Such*** ventilation openings shall be covered with corrosion-resistant wire mesh, the least dimension ***shall not exceed*** ⅛ inch (3.2 mm). The minimum net area of ventilation openings shall not be less than one square foot for each 150 square feet (0.67 m^2 for each 100 m^2) of crawl space area. One such ventilating opening shall be within three feet (914 mm) of each corner of the building, ***and the ventilation openings shall be positioned to provide cross ventilation.***

Exceptions:

1. The total area of ventilation openings may be reduced to 1/1,500 of the under-floor area where the ground surface is treated with an approved vapor barrier material and one such ventilation opening is within three feet (914 mm) of each corner of said buildings. The vents may have operable louvers.
2. ***If design conditions warrants,*** ventilation openings may be omitted on one side.
3. Under-floor spaces used as supply plenums for distribution of heated and cooled air shall comply with the requirements of ***780 CMR 3621 as applicable.***
4. Ventilation openings may be omitted when continuously operated mechanical ventilation is provided at a rate of 1.0 cfm for each 50 square feet (1.02 L/s for each 10 m^2) of crawl space floor area and ground surface is covered with an approved vapor barrier material.

3604.9.2 Access: An access crawl hole 18 inches by 24 inches (457 mm by 610 mm) shall be provided to the under-floor space.

3604.9.3 Removal of debris: The under-floor grade shall be cleaned of all vegetation and organic material. All wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose.

3604.9.4 Finished grade: The finished grade of under-floor surface may be located at the bottom of the footings; however. where there is evidence that the groundwater table can rise to within six inches (153 mm) of the finished floor at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the under-floor space shall be as high as the outside finished grade. unless an approved drainage system is provided.

3604.10 Foundation anchorage: Wall sill plates, minimum of two-inch by four-inch members, shall be sized and anchored to foundation walls or piers and at intermediate intervals as required to resist wind uplift. Foundation anchorage shall be provided by the installation of anchor bolts or other approved anchoring method. Anchor bolts shall be of a minimum diameter of ½ inch. The bolts shall be embedded in foundations to a depth of not less than eight inches (203 mm) of cast-in-place concrete, and not less than 15 inches (381 mm) in grouted unit masonry. There shall be a minimum of two anchor bolts per section of plate and anchor bolts shall be placed 12 inches (305 mm) from the end of each section of plate, with intermediate bolts spaced a maximum of six feet (1829 mm) on center for one- and two-story buildings and not more than four feet (1219 mm) on center for buildings over two stories in height.

NON-TEXT PAGE

FLOORS

780 CMR 3605.1 GENERAL

3605.1.1 Application: The provisions of 780 CMR 3605.0 shall control the design and construction of the floors for all buildings. The use of materials or methods of construction not specified in 780 CMR 3605.0 accomplishing the purposes intended by 780 CMR 36 and approved by the building official in accordance with 780 CMR 109 shall be accepted as complying with 780 CMR 36.

3605.1.2 Requirements: Floor construction shall be capable of ***supporting*** all loads imposed according to ***780 CMR 3603.1*** and transmitting the resulting loads to other supporting elements.

780 CMR 3605.2 FLOOR FRAMING

3605.2.1 General: Load-bearing dimension lumber for joists, beams and girders shall conform to DOC PS 20, ***as listed in Appendix A,*** and to other applicable standards or grading rules and shall be so identified by a grade mark or certificate of inspection issued by an approved agency. The grade mark or certificate shall provide adequate information to determine *Fb*, the allowable stress in bending, and *E*, the modulus of elasticity.

Exception: *Use of Native Lumber shall be allowed in accordance with 780 CMR 2303.0.*

3605.2.1.1 Preservative-treated lumber: Preservative-treated dimension lumber shall also be identified by the quality mark of an approved agency.

3605.2.1.2 Blocking and subflooring: Blocking shall be a minimum of Utility grade lumber. Subflooring may be a minimum of Utility Grade lumber or No. 4 Common grade boards.

3605.2.1.3 End jointed lumber: Approved end-jointed lumber may be used interchangeably with solid-sawn members of the same species and grade.

3605.2.2 Design and construction: Floors of wood construction shall be designed and constructed in accordance with the provisions of 780 CMR 3605.2 and Figure ***3605.2.2.***

3605.2.3 Allowable spans: Joists, girders and floor sheathing shall comply with ***780 CMR 3605.2.3.1*** through ***3605.2.3.3*** and ***780 CMR 3605.3.***

3605.2.3.1 Allowable joist spans: The clear span of floor joists shall not exceed the values set forth in Tables ***3605.2.3.1a, 3605.2.3.1b*** and ***3605.2.3.1c.*** The modulus of elasticity, E, and the actual stress in bending, F_b, shown in the tables shall not exceed the values specified in Tables ***3605.2.3.1d*** and ***3605.2.3.1e*** listed at the end of 780 CMR 3605.2. The values for F_b, specified as "repetitive member use" may be used when floor joists are spaced not more than 24 inches (610 mm) on center.

3605.2.3.2 Joists under bearing partitions: Joists under parallel bearing partitions shall be doubled or a beam of adequate size to support the load shall be provided. Double joists which are separated to permit the installation of piping or vents shall be ***provided with*** solid blocking spaced not more than four feet (1219 mm) on center.

3605.2.3.3 Allowable girder spans: The allowable spans of girders shall not exceed the values set forth in Tables ***3605.2.3.3a*** and ***3605.2.3.3b.***

3605.2.4 Bearing: The ends of ***all*** joists, beams or girders shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry except where supported on a one-inch-by-four-inch (25 mm by 102 mm) ribbon strip and nailed to the adjacent stud or ***shall be supported by*** the use of approved joist hangers.

3605.2.4.1 Floor systems: Joists ***that are framed from opposite sides and extend over a*** bearing support shall be tied together by lapping ***the ends of each*** joist a minimum of three inches (76 mm), or with a wood or metal splice ***plate,*** or ***shall be secured by overlapping the floor sheathing at least three inches (76 mm) beyond the end of each floor joist,*** or by other approved methods.

3605.2.4.2 Joist framing: Joists framing into the side of a wood girder shall be supported by approved framing anchors or on ledger strips ***measuring*** not less than nominal two inches by two inches (51 mm by 51 mm).

3605.2.5 Lateral restraint at supports: Joists shall be supported laterally at the ends by full-depth solid blocking not less than two inch (51 mm) ***nominal*** thickness; or by attachment to a header, band or rim joist, or to an adjoining stud; or shall be otherwise provided with lateral support to prevent rotation. Such lateral support is not required over intermediate supports such as center girders or bearing walls.

3605.2.5.1 Bridging: Joists having a depth-to-thickness ratio exceeding 6:1 based on nominal

dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal), or a continuous one-inch-by-three-inch (25 mm by 76 mm) strip ***set perpendicularly*** across the bottom of joists ***and appropriately nailed. Bridging shall be installed*** at intervals not exceeding ***eight*** feet (2438 mm).

Exception: Cantilevered joists shall be laterally braced at points of support.

3605.2.6 Cutting and notching: It shall be unlawful to notch, cut or pierce wood beams, joists, rafters or studs in excess of the limitations specified in 780 CMR 3605.2.6, unless proven safe by structural analysis or suitably reinforced to transmit all calculated *loads.*

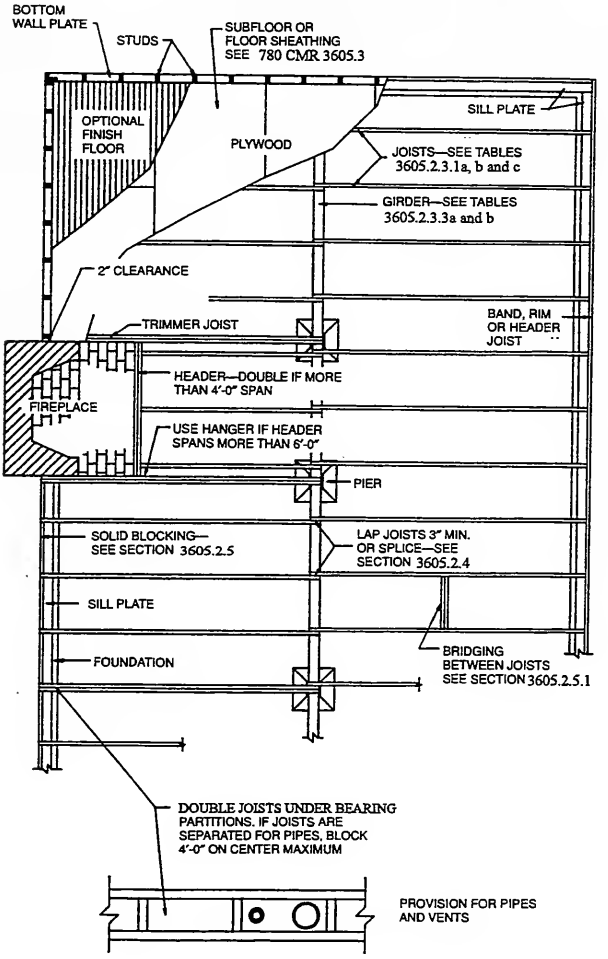
3605.2.6.1 Drilling and notches: Notches in the top or bottom of joists shall not exceed one-sixth of the depth of the joist, ***shall not be longer than one-third the depth of the member*** and shall not be located in the middle third of the span. ***Notch depth at the ends of the member*** shall not exceed one-fourth the joist depth.

Exceptions:
1. A notch over the support is permitted to extend the full width of the support.
2. Notches on cantilevered portions of the member are permitted to extend the full length of the cantilever if the strength and deflection of the cantilever is calculated based on the reduced member section.
3. The tension side of beams, joists and rafters which are four inches or greater in nominal thickness, shall not be notched, except at ends of members.

3605.2.7 Holes: Holes drilled, bored ***or cut*** into joists shall ***not be closer than*** two inches (51 mm) to the top or bottom of the joists, ***or to any other hole located in the joist. Where the joist is notched, the hole shall not be closer than two inches to the notch. The*** diameter ***of the hole*** shall not exceed one-third the depth of the joist.

3605.2.8 Fastening: Floor framing shall be nailed in accordance with Table ***3606.2.3a.*** Where posts and beam or girder construction is used to support floor framing, positive connections shall be provided to ensure against uplift and lateral displacement.

FIGURE 3605.2.2
FLOOR CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

TABLE 3605.2.3.1a
ALLOWABLE SPANS FOR FLOOR JOISTS
40 Lbs. per Sq. Ft. Live Load
(All rooms except those used for sleeping areas and attic floors.)

DESIGN CRITERIA:

Strength- Live load of 40 lbs. per sq. ft. plus dead load of 10 lbs. per sq. ft. determines the fiber stress value shown.

Deflection-For 40 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

HOW TO USE TABLES: Enter table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

Joist Size and Spacing		MODULUS OF ELASTICITY, "E," IN 1,000,000 PSI																		
inches	inches	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
2 X 6	12.0	6-9	7-3	7-9	8-2	8-6	8-10	9-2	9-6	9-9	10-0	10-3	10-6	10-9	10-11	11-2	11-4	11-7	11-11	12-3
		450	520	590	660	720	780	830	890	940	990	1,040	1,090	1,140	1,190	1,230	1,280	1,320	1,410	1,490
	16.0	6-2	6-7	7-0	7-5	7-9	8-0	8-4	8-7	8-10	9-1	9-4	9-6	9-9	9-11	10-2	10-4	10-6	10-10	11-2
		500	580	650	720	790	860	920	980	1,040	1,090	1,150	1,200	1,250	1,310	1,360	1,410	1,460	1,550	1,640
	24.0	5-4	5-9	6-2	6-6	6-9	7-0	7-3	7-6	7-9	7-11	8-2	8-4	8-6	8-8	8-10	9-0	9-2	9-6	9-9
		570	660	750	830	900	980	1,050	1,120	1,190	1,250	1,310	1,380	1,440	1,500	1,550	1,610	1,670	1,780	1,880
2 X 8	12.0	8-11	9-7	10-2	10-9	11-3	11-8	12-1	12-6	12-10	13-2	13-6	13-10	14-2	14-5	14-8	15-0	15-3	15-9	16-2
		450	520	590	660	720	780	830	890	940	990	1,040	1,090	1,140	1,190	1,230	1,280	1,320	1,410	1,490
	16.0	8-1	8-9	9-3	9-9	10-2	10-7	11-0	11-4	11-8	12-0	12-3	12-7	12-10	13-1	13-4	13-7	13-10	14-3	14-8
		500	580	650	720	790	850	920	980	1,040	1,090	1,150	1,200	1,250	1,310	1,360	1,410	1,460	1,550	1,640
	24.0	7-1	7-7	8-1	8-6	8-11	9-3	9-7	9-11	10-2	10-6	10-9	11-0	11-3	11-5	11-8	11-11	12-1	12-6	12-10
		570	660	750	830	900	980	1,050	1,120	1,190	1,250	1,310	1,380	1,440	1,500	1,550	1,610	1,670	1,780	1,880
2 X 10	12.0	11-4	12-3	13-0	13-8	14-4	14-11	15-5	15-11	16-5	16-10	17-3	17-8	18-0	18-5	18-9	19-1	19-5	20-1	20-8
		450	520	590	660	720	780	830	890	940	990	1,040	1,090	1,140	1,190	1,230	1,280	1,320	1,410	1,490
	16.0	10-4	11-1	11-10	12-5	13-0	13-6	14-0	14-6	14-11	15-3	15-8	16-0	16-5	16-9	17-0	17-4	17-8	18-3	18-9
		500	580	650	720	790	850	920	980	1,040	1,090	1,150	1,200	1,250	1,310	1,360	1,410	1,460	1,550	1,640
	24.0	9-0	9-9	10-4	10-10	11-4	11-10	12-3	12-8	13-0	13-4	13-8	14-0	14-4	14-7	14-11	15-2	15-5	15-11	16-5
		570	660	750	830	900	980	1,050	1,120	1,190	1,250	1,310	1,380	1,440	1,500	1,550	1,610	1,670	1,780	1,880
2 X 12	12.0	13-10	14-11	15-10	16-8	17-5	18-1	18-9	19-4	19-11	20-6	21-0	21-6	21-11	22-5	22-10	23-3	23-7	24-5	25-1
		450	520	590	660	720	780	830	890	940	990	1,040	1,090	1,140	1,190	1,230	1,280	1,320	1,410	1,490
	16.0	12-7	13-6	14-4	15-2	15-10	16-5	17-0	17-7	18-1	18-7	19-1	19-6	19-11	20-4	20-9	21-1	21-6	22-2	22-10
		500	580	650	720	790	860	920	980	1,040	1,090	1,150	1,200	1,250	1,310	1,360	1,410	1,460	1,550	1,640
	24.0	11-10	11-10	12-7	13-3	13-10	14-4	14-11	15-4	15-10	16-3	16-8	17-0	17-5	17-9	18-1	18-5	18-9	19-4	19-11
		570	660	750	830	900	980	1,050	1,120	1,190	1,250	1,310	1,380	1,440	1,500	1,550	1,610	1,670	1,780	1,880

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m^2.

NOTE: The extreme fiber stress in bending, "F_b," in pounds per square inch is shown below each span.

TABLE 3605.2.3.1d
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

These "F_b" values are for use where three or more repetitive members are spaced not more than 24 inches apart. For wider spacing or for single or double member headers or beams, the "F_b" values should be reduced 13%. Values for surfaced dry or surfaced green lumber apply at 19% maximum moisture content in use.

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
ASPEN						
Select Structural	2" x 4"	1,510	1,735	1,885	1,100,000	Northeastern Lumber Manufacturers Association Northern Softwood Lumber Bureau Western Wood Products Association (See Footnotes 1 and 2)
No. 1		1,080	1,240	1,350	1,100,000	
No. 2		1,035	1,190	1,295	1,000,000	
No. 3		605	695	755	900,000	
Stud		600	690	750	900,000	
Construction		805	925	1,005	900,000	
Standard		430	495	540	900,000	
Utility		200	230	250	800,000	
Select Structural	2"x 6"	1,310	1,505	1,635	1,100,000	
No. 1		935	1,075	1,170	1,100,000	
No. 2		895	1,030	1,120	1,000,000	
No. 3		525	600	655	900,000	
Stud		545	630	685	900,000	
Select Structural	2" x 8"	1,210	1,390	1,510	1,100,000	
No. 1		865	990	1,080	1,100,000	
No. 2		830	950	1,035	1,000,000	
No. 3		485	555	605	900,000	
Select Structural	2"x 10"	1,105	1,275	1,385	1,100,000	
No. 1		790	910	990	1,100,000	
No. 2		760	875	950	1,000,000	
No. 3		445	510	555	900,000	
Select Structural	2" x 12"	1,005	1,155	1,260	1,100,000	
No. 1		720	825	900	1,100,000	
No. 2		690	795	865	1,000,000	
No. 3		405	465	505	900,000	
BEECH - BIRCH - HICKORY						
Select Structural	2" x 4"	2,500	2,875	3,125	1,700,000	Northeastern Lumber Manufacturers Association (See Footnotes 1 and 2)
No. 1		1,810	2,085	2,265	1,600,000	
No. 2		1,725	1,985	2,155	1,500,000	
No. 3		990	1,140	1,240	1,300,000	
Stud		980	1,125	1,225	1,300,000	
Construction		1,325	1,520	1,655	1,400,000	
Standard		750	860	935	1,300,000	
Utility		345	395	430	1,200,000	
Select Structural	2"x 6"	2,170	2,495	2,710	1,700,000	
No. 1		1,570	1,805	1,960	1,600,000	
No. 2		1,495	1,720	1,870	1,500,000	
No. 3		860	990	1,075	1,300,000	
Stud		890	1,025	1,115	1,300,000	
Select Structural	2" x 8"	2,000	2,300	2,500	1,700,000	
No. 1		1,450	1,665	1,810	1,600,000	
No. 2		1,380	1,585	1,725	1,500,000	
No. 3		795	915	990	1,300,000	
Select Structural	2"x 10"	1,835	2,110	2,295	1,700,000	
No. 1		1,330	1,525	1,660	1,600,000	
No. 2		1,265	1,455	1,580	1,500,000	
No. 3		725	835	910	1,300,000	
Select Structural	2" x 12"	1,670	1,920	2,085	1,700,000	
No. 1		1,210	1,390	1,510	1,600,000	
No. 2		1,150	1,325	1,440	1,500,000	
No. 3		660	760	825	1,300,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
COTTONWOOD						
Select Structural	2" x 4"	1,510	1,735	1,885	1,200,000	Northern Softwood Lumber Bureau (See Footnotes 1 and 2)
No. 1		1,080	1,240	1,350	1,200,000	
No. 2		1,080	1,240	1,350	1,100,000	
No. 3		605	695	755	1,100,000	
Stud		600	690	750	1,000,000	
Construction		805	925	1,005	1,000,000	
Standard		460	530	575	900,000	
Utility		200	230	250	900,000	
Select Structural	2"x 6"	1,310	1,505	1,635	1,200,000	
No. 1		935	1,075	1,170	1,200,000	
No. 2		935	1,075	1,170	1,100,000	
No. 3		525	600	655	1,000,000	
Stud		545	630	685	1,000,000	
Select Structural	2" x 8"	1,210	1,390	1,510	1,200,000	
No. 1		865	990	1,080	1,200,000	
No. 2		865	990	1,080	1,100,000	
No. 3		485	555	605	1,000,000	
Select Structural	2"x 10"	1,105	1,275	1,385	1,200,000	
No. 1		790	910	910	1,200,000	
No. 2		790	910	990	1,100,000	
No. 3		445	510	555	1,000,000	
Select Structural	2" x 12"	1,005	1,155	1,260	1,200,000	
No. 1		720	825	900	1,200,000	
No. 2		720	825	900	1,100,000	
No. 3		405	465	505	1,000,000	
DOUGLAS FIR - LARCH						
Select Structural	2" x 4"	2,500	2,875	3,125	1,900,000	West Coast Lumber Inspection Bureau Western Wood Products Association (See Footnotes 1 and 2)
No. 1 & Btr		1,985	2,280	2,480	1,800,000	
No. 1		1,725	1,985	2,155	1,700,000	
No. 2		1,510	1,735	1,885	1,600,000	
No. 3		865	990	1,080	1,400,000	
Stud		855	980	1,065	1,400,000	
Construction		1,150	1,325	1,440	1,500,000	
Standard		635	725	790	1,400,000	
Utility		315	365	395	1,300,000	
Select Structural	2"x 6"	2,170	2,495	2,710	1,900,000	
No. 1 & Btr		1,720	1,975	2,150	1,800,000	
No. 1		1,495	1,720	1,870	1,700,000	
No. 2		1,310	1,505	1,635	1,600,000	
No. 3		750	860	935	1,400,000	
Stud		775	895	970	1,400,000	
Select Structural	2" x 8"	2,000	2,300	2,500	1,900,000	
No. & Btr		1,585	1,825	1,985	1,800,000	
No. 1		1,380	1,585	1,725	1,700,000	
No. 2		1,210	1,390	1,510	1,600,000	
No. 3		690	795	865	1,400,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
Select Structural	2" x 10"	1,835	2,110	2,295	1,900,000	
No. 1 & Btr		1,455	1,675	1,820	1,800,000	
No. 1		1,265	1,455	1,580	1,700,000	
No. 2		1,105	1,275	1,385	1,600,000	
No. 3		635	725	790	1,400,000	
Select Structural	2' x 12"	1,670	1,920	2,085	1,900,000	
No.1 & Btr		1,325	1,520	1,655	1,800,000	
No.1		1,150	1,325	1,440	1,700,000	
No.2		1,005	1,155	1,260	1,600,000	
No.3		575	660	720	1,400,000	
DOUGLAS FIR - LARCH (NORTH)						
Select Structural	2" x 4"	2,245	2,580	2,805	1,900,000	National Lumber Grades Authority (See Footnotes 1 and 2)
No. 1/ No. 2		1,425	1,635	1,780	1,600,000	
No. 3		820	940	1,025	1,400,000	
Stud		820	945	1,030	1,400,000	
Construction		1,095	1,255	1,365	1,500,000	
Standard		605	695	755	1,400,000	
Utility		290	330	360	1,300,000	
Select Structural	2"x 6"	1,945	2,235	2,430	1,900,000	
No. 1/ No. 2		1,235	1,420	1,540	1,600,000	
No. 3		710	815	890	1,400,000	
Stud		750	860	935	1,400,000	
Select Structural	2" x 8"	1,795	2,065	2,245	1,900,000	
No. 1/ No. 2		1,140	1,310	1,425	1,600,000	
No. 3		655	755	820	1,400,000	
Select Structural	2"x 10"	1,645	1,890	2,055	1,900,000	
No. 1/ No. 2		1,045	1,200	1,305	1,600,000	
No. 3		600	690	750	1,400,000	
Select Structural	2" x 12"	1,495	1,720	1,870	1,900,000	
No. 1/ No. 2		950	1,090	1,185	1,600,000	
No. 3		545	630	685	1,400,000	
DOUGLAS FIR - SOUTH						
Select Structural	2" x 4"	2,245	2,580	2,805	1,400,000	Western WoodProducts Association (See footnotes 1 and 2)
No. 1		1,555	1,785	1,940	1,300,000	
No. 2		1,425	1,635	1,780	1,200,000	
No. 3		820	940	1,025	1,100,000	
Stud		820	945	1,030	1,100,000	
Construction		1,065	1,225	1,330	1,200,000	
Standard		605	695	755	1,100,000	
Utility		290	330	360	1,000,000	
Select Structural	2" x 6"	1,945	2,235	2,430	1,400,000	
No. 1		1,345	1,545	1,680	1,300,000	
No. 2		1,235	1,420	1,540	1,200,000	
No. 3		710	815	890	1,100,000	
Stud		750	860	935	1,100,000	
Select Structural	2" x 8"	1,795	2,065	2,245	1,400,000	
No. 1		1,240	1,430	1,555	1,300,000	
No. 2		1,140	1,310	1,425	1,200,000	
No. 3		655	755	820	1,100,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
Select Structural	2" x 10"	1,645	1,890	2,055	1,400,000	
No. 1		1,140	1,310	1,425	1,300,000	
No. 2		1,045	1,200	1,305	1,200,000	
No. 3		600	690	750	1,100,000	
Select Structural	2" x 12"	1,495	1,720	1,870	1,400,000	
No. 1		1035	1,190	1,295	1,300,000	
No. 2		950	1,090	1,185	1,200,000	
No. 3		545	630	685	1,100,000	
EASTERN SOFTWOODS						
Select Structural	2" x 4"	2,155	2,480	2,695	1,200,000	Northeastern Lumber Manufacturers Association Northern Softwood Lumber Bureau (See Footnotes 1 and 2)
No. 1		1,335	1,535	1,670	1,100,000	
No. 2		990	1,140	1,240	1,100,000	
No. 3		605	695	755	900,000	
Stud		570	655	710	900,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility		200	230	250	800,000	
Select Structural	2"x 6"	1,870	2,150	2,335	1,200,000	
No. 1		1,160	1,330	1,450	1,100,000	
No. 2		860	990	1,075	1,100,000	
No. 3		525	600	655	900,000	
Stud		520	595	645	900,000	
Select Structural	2" x 8"	1,725	1,985	2,155	1,200,000	
No. 1		1,070	1,230	1,335	1,100,000	
No. 2		795	915	990	1,100,000	
No. 3		485	555	605	900,000	
Select Structural	2"x 10"	1,580	1,820	1,975	1,200,000	
No. 1		980	1,125	1,225	1,100,000	
No. 2		725	835	910	1,100,000	
No. 3		445	510	555	900,000	
Select Structural	2" x 12"	1,440	1,655	1,795	1,200,000	
No. 1		890	1,025	1,115	1,100,000	
No. 2		660	760	825	1,100,000	
No. 3		405	465	505	900,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
EASTERN WHITE PINE						
Select Structural	2" x 4"	2,155	2,480	2,695	1,200,000	Northeastern Lumber Manufacturers Association Northern Softwood Lumber Bureau (See Footnotes 1 and 2)
No. 1		1,335	1,535	1,670	1,100,000	
No. 2		990	1,140	1,240	1,100,000	
No. 3		605	695	755	900,000	
Stud		570	655	710	900,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility		200	230	250	800,000	
Select Structural	2" x 6"	1,870	2,150	2,335	1,200,000	
No. 1		1,160	1,330	1,450	1,100,000	
No. 2		860	990	1,075	1,100,000	
No. 3		525	600	655	900,000	
Stud		520	595	645	900,000	
Select Structural	2" x 8"	1,725	1,985	2,155	1,200,000	
No. 1		1,070	1,230	1,335	1,100,000	
No. 2		795	915	990	1,100,000	
No. 3		485	555	605	900,000	
Select Structural	2" x 10"	1,580	1,820	1,975	1,200,000	
No. 1		980	1,125	1,225	1,100,000	
No. 2		725	835	910	1,100,000	
No. 3		445	510	555	900,000	
Select Structural	2" x 12"	1,440	1,655	1,795	1,200,000	
No. 1		890	1,025	1,115	1,100,000	
No. 2		660	760	825	1,100,000	
No. 3		405	465	505	900,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
EASTERN HEMLOCK - TAMARACK						
Select Structural	2" x 4"	2,155	2,480	2,695	1,200,000	Northeastern Lumber Manufacturers Association Northern Softwood Lumber Bureau (See Footnotes 1 and 2)
No. 1		1,335	1,535	1,670	1,100,000	
No. 2		990	1,140	1,240	1,100,000	
No. 3		605	695	755	900,000	
Stud		570	655	710	900,000	
Construction		775	895	970	1,000,000	
Standard		430	495	540	900,000	
Utility		200	230	250	800,000	
Select Steuctural	2" x 6"	1,870	2,150	2,335	1,200,000	
No. 1		1,160	1,330	1,450	1,100,000	
No. 2		860	990	1,075	1,100,000	
No. 3		525	600	655	900,000	
Stud		520	595	645	900,000	
Select Structural	2" x 8"	1,725	1,985	2,155	1,200,000	
No. 1		1,070	1,230	1,335	1,100,000	
No. 2		795	915	990	1,100,000	
No. 3		485	555	605	900,000	
Select Structural	2" x 10"	1,580	1,820	1,975	1,200,000	
No. 1		980	1,125	1,225	1,100,000	
No. 2		725	835	910	1,100,000	
No. 3		445	510	555	900,000	
Select Structural	2" x 12"	1,440	1,655	1795	1,200,000	
No. 1		890	1,025	1115	1,100,000	
No. 2		660	760	825	1,100,000	
No. 4		405	465	505	900,000	
HEM - FIR						
Select Structural	2" x 4"	2,415	2,775	3,020	1,600,000	
No. 1 & Btr		1,810	2,085	2,265	1,500,000	
No. 1		1,640	1,885	2,050	1,500,000	
No. 2		1,465	1,685	1,835	1,300,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
Select Structural	2" x 8"	1,725	1,985	2,155	1,500,000	National Lumber Grades Authority (See Footnotes 1 and 2)
No. 1/ No. 2		1,210	1,390	1,510	1,400,000	
No. 3		690	795	865	1,200,000	
Select Structural	2"x 10"	1,580	1,820	1,975	1,500,000	
No. 1/ No. 2		1,105	1,275	1,385	1,400,000	
No. 3		635	725	790	1,200,000	
Select Structural	2" x 12"	1,440	1,655	1,795	1,500,000	
No. 1/ No. 2		1,005	1,155	1,260	1,400,000	
No. 3		575	660	720	1,200,000	
No 3. open grain		540	620	670	900,000	
SPRUCE - PINE - FIR (SOUTH)						
Select Structural	2" x 4"	2,245	2,580	2,805	1,300,000	Northeastern Lumber Manufacturers Association Northern Softwood Lumber Bureau West Coast Lumber Inspection Bureau Western Woods Products Association (See Footnotes 1 and 2)
No. 1		1,465	1,685	1,835	1,200,000	
No. 2		1,295	1,490	1,615	1,100,000	
No. 3		735	845	915	1,000,000	
Stud		725	835	910	1,000,000	
Construction		980	1,125	1,220	1,000,000	
Standard		545	630	685	900,000	
Utility		260	300	335	900,000	
Select Structural	2"x 6"	1,945	2,235	2,430	1,300,000	
No. 1		1,270	1,460	1,590	1,200,000	
No. 2		1,120	1,290	1,400	1,100,000	
No. 3		635	730	795	1,000,000	
Stud		660	760	825	1,000,000	
Select Structural	2" x 8"	1,795	2,065	2,245	1,300,000	
No. 1		1,175	1,350	1,465	1,200,000	
No. 2		1,035	1,190	1,295	1,100,000	
No. 3		585	675	735	1,000,000	
Select Structural	2"x 10"	1,645	1,890	2,055	1,300,000	
No. 1		1,075	1,235	1,345	1,200,000	
No. 2		950	1,090	1,185	1,100,000	
No. 3		540	620	670	1,000,000	
Select Structural	2" x 12"	1,495	1,720	1,870	1,300,000	
No. 1		980	1,125	1,220	1,200,000	
No. 2		865	990	1,080	1,100,000	
No. 3		490	560	610	1,000,000	
WESTERN CEDARS						
Select Structural	2" x 4"	1,725	1,985	2,155	1,100,000	West Coast Lumber Inspection Bureau Western Woods Products Association (See Footnotes 1 and 2)
No. 1		1,250	1,440	1,565	1,000,000	
No. 2		1,210	1,390	1,510	1,000,000	
No. 3		690	795	865	900,000	
Stud		695	800	870	900,000	
Construction		920	1,060	1,150	900,000	
Standard		520	595	645	800,000	
Utility		260	300	325	800,000	
Select Structural	2"x 6"	1,495	1,720	1,870	1,100,000	
No. 1		1,085	1,245	1,355	1,000,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
No. 2	2" x 6"	1,045	1,205	1,310	1,000,000	West Coast Lumber Inspection Bureau Western Woods Products Association (See Footnotes 1 and 2)
No. 3		600	690	750	900,000	
Stud		635	725	790	900,000	
Select Structural	2" x 8"	1,380	1,585	1,725	1,100,000	
No. 1		1,000	1,150	1,250	1,000,000	
No. 2		965	1,110	1,210	1,000,000	
No. 3		550	635	690	900,000	
Select Structural	2"x 10"	1,265	1,455	1,580	1,100,000	
No. 1		915	1,055	1,145	1,000,000	
No. 2		885	1,020	1,105	1,000,000	
No. 3		505	580	635	900,000	
Select Structural	2" x 12"	1,150	1,325	1,440	1,100,000	
No. 1		835	960	1,040	1,000,000	
No. 2		805	925	1,005	1,000,000	
No. 3		460	530	575	900,000	
WESTERN WOODS						
Select Structural	2" x 4"	1,150	1,735	1,885	1,200,000	West Coast Lumber Inspection Bureau Western Woods Products Association (See Footnotes 1 and 2)
No. 1		1,120	1,290	1,400	1,100,000	
No. 2		1,120	1,290	1,400	1,000,000	
No. 3		645	745	810	900,000	
Stud		635	725	790	900,000	
Construction		835	960	1,040	1,000,000	
Standard		460	530	575	900,000	
Utility		230	265	290	800,000	
Select Structural	2"x 6"	1,310	1,505	1,635	1,200,000	
No. 1		970	1,120	1,215	1,100,000	
No. 2		970	1,120	1,215	1,000,000	
No. 3		560	645	700	900,000	
Stud		575	660	720	900,000	
Select Structural	2" x 8"	1,210	1,390	1,510	1,200,000	
No. 1		895	1,030	1,120	1,100,000	
No. 2		895	1,030	1,120	1,000,000	
No. 3		520	595	645	900,000	
Select Structural	2"x 10"	1,105	1,275	1,385	1,200,000	
No. 1		820	945	1,030	1,100,000	
No. 2		820	945	1,030	1,000,000	
No. 3		475	545	595	900,000	
Select Structural	2" x 12"	1,005	1,155	1,260	1,200,000	
No. 1		750	860	935	1,100,000	
No. 2		750	860	935	1,000,000	
No. 3		430	495	540	900,000	
WHITE OAK						
Select Structural	2" x 4"	2,070	2,380	2,590	1,100,000	
No. 1		1,510	1,735	1,885	1,000,000	
No. 2		1,465	1,685	1,835	900,000	
No. 3		820	940	1,025	800,000	
Stud		820	945	1,030	800,000	
Construction		1,095	1,255	1,365	900,000	

TABLE 3605.2.3.1d - continued
DESIGN VALUES FOR DIMENSION LUMBER - VISUAL GRADING

SPECIES AND GRADE	SIZE	NORMAL DURATION	DESIGN VALUE IN BENDING "*Fb*"		MODULUS OF ELASTICITY "E"	GRADING RULES AGENCY
			Snow Loading	7-Day Loading		
Standard	2" x 4"	605	695	755	800,000	Northern Lumber Manufacturers Association (See Footnotes 1 and 2)
Utility		290	330	360	800,000	
Select Structural	2"x 6"	1,795	2,065	2,245	1,100,000	
No. 1		1,310	1,505	1,635	1,000,000	
No. 2		1,270	1,460	1,590	900,000	
No. 3		710	815	890	800,000	
Stud		750	860	935	800,000	
Select Structural	2" x 8"	1,655	1,905	2,070	1,100,000	
No. 1		1,210	1,390	1,510	1,000,000	
No. 2		1,175	1,350	1,465	900,000	
No. 3		655	755	820	800,000	
Select Structural	2"x 10"	1,520	1,745	1,900	1,100,000	
No. 1		1,105	1,275	1,385	1,000,000	
No. 2		1,075	1,235	1,345	900,000	
No. 3		600	690	750	800,000	
Select Structural	2" x 12"	1,380	1,585	1,725	1,100,000	
No. 1		1,005	1,155	1,260	1,000,000	
No. 2		980	1,125	1,220	900,000	
No. 3		545	630	685	800,000	
YELLOW POPLAR						
Select Structural	2" x 4"	1,725	1,985	2,155	1,500,000	Northern Softwood Lumber Bureau (See Footnotes 1 and 2)
No. 1		1,250	1,440	1,565	1,400,000	
No. 2		1,210	1,390	1,510	1,300,000	
No. 3		690	795	865	1,200,000	
Stud		695	800	870	1,200,000	
Construction		920	1,060	1,150	1,300,000	
Standard		520	595	645	1,100,000	
Utility		230	265	290	1,100,000	
Select Structural	2"x 6"	1,495	1,720	1,870	1,500,000	
No. 1		1,085	1,245	1,355	1,400,000	
No. 2		1,045	1,205	1,310	1,300,000	
No. 3		600	690	750	1,200,000	
Stud		635	725	790	1,200,000	
Select Structural	2" x 8"	1,380	1,585	1,725	1,500,000	
No. 1		1,000	1,150	1,250	1,400,000	
No. 2		965	1,110	1,210	1,300,000	
No. 3		550	635	690	1,200,000	
Select Structural	2"x 10"	1,265	1,455	1,580	1,500,000	
No. 1		915	1,055	1,145	1,400,000	
No. 2		885	1,020	1,105	1,300,000	
No. 3		505	580	635	1,200,000	
Select Structural	2" x 12"	1,150	1,325	1,440	1,500,000	
No. 1		835	960	1,040	1,400,000	
No. 2		805	925	1,005	1,300,000	
No. 3		460	530	575	1,200,000	

For SI: 1 inch = 25.4 mm, 1 psi = 6.895 kPa.

1. When dimension lumber is used where moisture content will exceed 19% for an extended time period, F_b shall be multiplied by 0.85 if F_b exceeds 1,150 psi, and E shall be multiplied by 0.9.
2. Following is a list of agencies certified by the American Lumber Standards Committee Board of Review (as of 1991) for inspection and grading of untreated lumber under the rules indicated.

Rules in Writing Agencies	Rules for which grading is authorized
National Lumber Grades Authority (NLGA) 260-1055 W. Hastings Street Vancouver, BC V6E 2E9 Canada	NLGA
Northeastern Lumber Manufacturers Association (NELMA) 272 Tuttle Road, P.O. Box 87A Cumberland Center, Maine 04021	NELMA, NLGA, WCLIB, WWPA, NLGA
Northern Softwood Lumber Bureau (NSLB) 272 Tuttle Road, P.O. Box 87A Cumberland Center, Maine 04021	WSLB, WCLIB, WWPA, NLGA
Redwood Inspection Service (RIS) 405 Enfrente Drive, Suite 200, Novato, California 94949	RIS,WCLIB, WWPA
Southern Pine Inspection Bureau (SPIB) 4709 Scenic Highway, Pensacola, Florida 32504	SPIB, NELMA, WCLIB, WWPA, NLGA
West Coast Lumber Inspection Bureau (WCLIB) 6980 SW Varnes Road, P.O. Box 23145 Portland, Oregon 97223	WCLIB, RIS, WWPA, NLGA, SPIB
Western Wood Products Association (WWPA) 522 S.W. 5th Avenue Yeon Building, Portland, OR 97204	WWPA, WCLIB, NLGA, RIS, SPIB
Non-Rules Writing Agencies	
California Lumber Inspection Services	RIS, WCLIB, WWPA, NLGA, SPIB
Pacific Lumber Inspection Bureau, Inc.	RIS,WCLIB,WWPA, NLGA
Timber Products Inspection	RIS, SPIB, WCLIS, WWPA
Alberta Forest Products Association	NLGA
Canadian Lumbermen's Association	NLGA, NELMA
Cariboo Lumber Manufacturers Association	NLGA
Central Forest Products Association	NLGA
Council of Forest Industries of British Columbia	NLGA
Interior Lumber Manufacturers Association	NLGA
Macdonald Inspection	NLGAS
Maritime Lumber Bureau	NLGA, NELMA
Ontario Lumber Manufacturers Association	NLGA, NELMA
Pacific Lumber Inspection Bureau	NLGA
Quebec Lumber Manufacturers Association	NLGA, NELMA

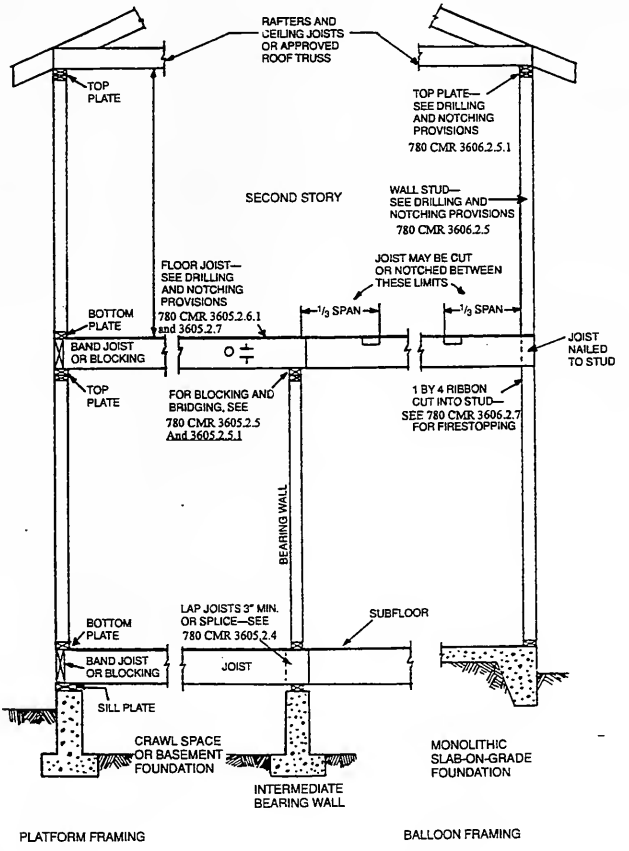
inch thick (51 mm) double headers in bearing walls shall not exceed the spans set forth in Table *3606.2.6*. The table shall not be used where concentrated loads are supported by the headers.

3606.2.6.1 Single headers: Nominal two-inch thick (51 mm) single headers ***shall not be used in*** load-bearing walls.

3606.2.6.2 Plywood box headers: Plywood box headers shall be constructed in accordance with Figure *3606.2.6.2* and Table *3606.2.6.2*.

3606.2.6.3 Non-bearing walls: Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat two-inch-by-four-inch (51 mm by 102 mm) member may be used as a header in interior or exterior nonbearing walls for openings up to eight feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches (610 mm). *Cripple spacing shall be the same as spacing of studs.*

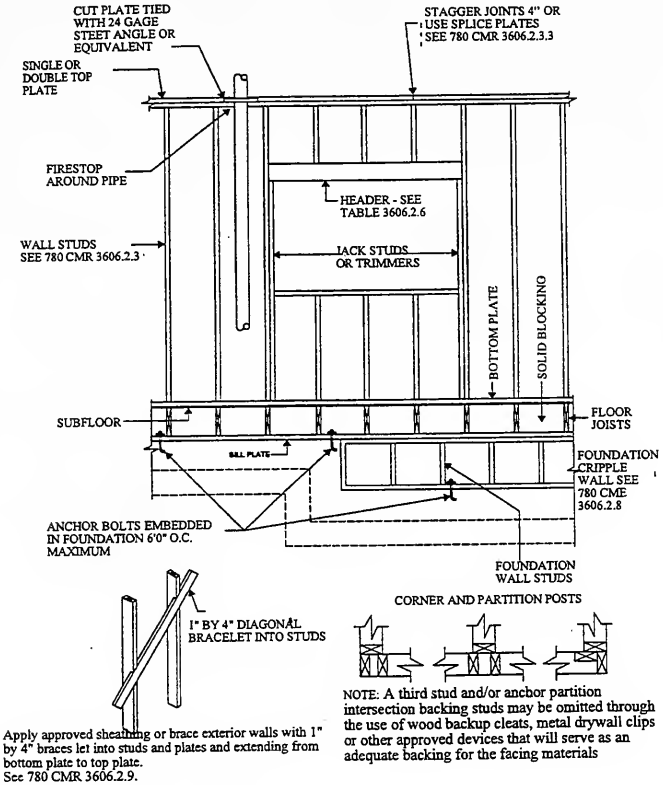
FIGURE 3606.2.3a
TYPICAL WALL, FLOOR AND ROOF FRAMING



NOTE: See Figure 3604.3.1a for other foundation types

For SI: 1 inch = 25.4 mm.

FIGURE 3606.2.3b
FRAMING DETAILS



For SI: 1 inch = 25.4 mm, 1 foot = 204.8 mm.

TABLE 3606.2.6
MAXIMUM SPANS FOR HEADERS LOCATED OVER OPENINGS IN WALLS

SIZE OF HEADER[1,2]	HEADERS IN BEARING WALLS[2]			HEADERS IN WALLS NOT SUPPORTING FLOORS OR ROOFS
	Supporting Roof Only	One Story Above	Two Stories Above	
2 - 2 x 4	4	-	-	-
2 - 2 x 6	6	4	-	-
2 - 2 x 8	8	6	-	10
2 - 2 x 10	10	8	6	12
2 - 2 x 12	12	10	8	16

For SI: 1 inch = 25.4 mm, 1 foot 304.8 mm.

1. Nominal four-inch thick single headers may be substituted for double members.
2. Spans are based on No. 2 Grade Lumber with ten-foot tributary floor and roof loads.

WALL COVERING

780 CMR 3607.1 - GENERAL

3607.1.1 Application: The provisions of 780 CMR 3607.1 shall control the design and construction of the interior and exterior wall covering for all buildings. The use of materials or methods of construction not specified in 780 CMR 3607.1 accomplishing the purposes intended by 780 CMR 36 and approved by the building of in accordance with ***780 CMR 109*** shall be accepted as complying with 780 CMR 36.

3607.1.2 Installation: Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover.

780 CMR 3607.2 INTERIOR COVERING

3607.2.1 General: Interior coverings shall be installed in accordance with this ***section*** and Tables ***3607.2.1a, 3607.2.1b, 3607.2.1c and 3607.2.3.4.*** Interior finishes and materials shall conform to the flame spread and smoke-density requirements of ***780 CMR 3603***.

3607.2.2 Interior plaster: Gypsum plaster or portland cement plastering materials shall conform to ASTM C 5, C 28, C 35, C 37, C 59, C 61, C 587, C 588, C 631, C847, C 897, C 933, C 1032 and C 1047, and shall be installed or applied in conformance with ASTM C 843, C 844 and C 1063, ***each as listed in Appendix A.*** Plaster shall not be less than three coats when applied over metal lath and not less than two coats when applied over other bases permitted by 780 CMR 3607.2, except that veneer plaster may be applied in one coat not to exceed $^{3}/_{16}$ inch (4.76 mm) thickness, provided the total thickness is as set forth in Table ***3607.2.1a.***

3607.2.2.1 Support: Support spacing, ***spacing of fasteners and size of fasteners*** for gypsum and metal lath shall conform with Table ***3607.2.3.4.*** Gypsum lath shall be installed at right angles to support framing with end joints staggered.

3607.2.3 Gypsum wallboard:

3607.2.3.1 Materials: All gypsum wallboard materials and accessories shall conform to ASTM C 36, C 475, C 514, C 960, C 1002 and C 1047 ***as listed in Appendix A,*** and shall be installed in accordance with the provisions of 780 CMR 3607.2. Adhesives for the installation of gypsum wallboard shall conform to ASTM C 557 ***as listed in Appendix A.***

3607.2.3.2 Wood framing: Wood framing supporting gypsum wallboard shall not be less than two inches (51 mm) nominal thickness in the least dimension except that wood furring strips not less than one-inch-by-two inch (25 mm by 51 mm) nominal dimension may be used over solid backing or framing spaced not more than 24 inches (610 mm) on center.

3607.2.3.3 Steel framing: Steel framing shall not be less than 1¼ inches (32 mm) wide in the least dimension. Light-gage nonload-bearing steel framing shall comply with ASTM C 645 ***as listed in Appendix A.*** Load-bearing steel framing and steel framing from 0.033 inch to 0.112 inch (0.838 mm to 2.84 mm) thick shall comply with ASTM C 955 ***as listed in Appendix A.***

3607.2.3.4 Application: Support spacing and size and spacing of fasteners shall comply with Table ***3607.2.3.4.*** Gypsum wallboard may be applied at right angles or parallel to framing members. All edges and ends of gypsum wallboard shall occur on the framing members, except those edges and ends which are perpendicular to the framing members. Interior gypsum wallboard shall not be installed where it is exposed to the weather construction.

3607.2.3.5 Fastening: Screws for attaching gypsum wallboard to wood shall be Type W in accordance with ASTM C 1002 ***as listed in Appendix A*** and shall penetrate the wood not less than ⅝ inch (15.9 mm). Screws for attaching gypsum wallboard to light-gage steel shall be Type S in accordance with ASTM C 1002 ***as listed in Appendix A*** and shall penetrate the steel not less than ¼ inch (6.4 mm). Screws for attaching gypsum wallboard to steel 0.033 inch to 0.112 inch (0.838 mm to 2.84 mm) thick shall comply with ASTM C 954 ***as listed in Appendix A.***

3607.2.4 Bathtub and shower spaces: Bathtub and shower floors and walls shall be finished with a smooth, hard and nonabsorbent surface. Ceramic tile surfaces shall be installed in accordance with ANSI A 108.1, A108.4, A108.5, A108.6, A108.11, A118.1, A 118.3, A 136.1 and A 137.1 ***as listed in Appendix A.*** Such wall surfaces shall extend to a height of not less than six feet (1829 mm) above the floor.

3607.2.4.1 Ceramic tile: Gypsum board utilized as the base or backer board for adhesive application of ceramic tile or other nonabsorbent

finish material shall conform with ASTM C 630 *as listed in Appendix A*. Water-resistant gypsum backing board shall be permitted to be used on ceilings where framing spacing does not exceed 12 inches (305 mm) on center. All cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

3607.2.5 Other finishes: Wood veneer or hardboard paneling not less than ¼-inch (6.4 mm) nominal thickness [$^{13}/_{64}$-inch (5.2 mm) actual] shall conform to HPMA (ANSI) HP for wood veneer and AHA (ANSI) A135.5 for hardboard paneling. These finishes may be installed directly to studs with a maximum 16 inches on center spacing: wood veneer or hardboard paneling less than ¼ inch nominal thickness must not have less than ⅜ inch gypsum board backer, unless the qualifying tests were made with the material suspended from noncombustible backing, and stud spacing may not exceed 16 inches on center.

3607.2.6 Wood shakes and shingles: Wood shakes and shingles shall conform to CSSB "Grading Rules for Wood Shakes and Shingles" ***as listed in Appendix A.***

TABLE 3607.2.1a
THICKNESS OF PLASTER

PLASTER BASE	FINISHED THICKNESS OF PLASTER FROM FACE TO LATH, MASONRY, CONCRETE	
	Gypsum Plaster	Portland Cement Mortar
Expanded metal lath	⅝" minimum[1]	⅝" minimum[1]
Wire lath	⅝" minimum[1]	¾" minimum (interior)[2] ⅞" minimum (exterior)[2]
Gypsum lath	½" minimum	
Masonry walls[3]	½" minimum	½" minimum
Monolithic concrete walls[3,4]	⅝" maximum	⅞" maximum
Monolithic concrete ceilings[3,4]	⅜" maximum[5]	½" maximum
Gypsum veneer base[6]	$^{1}/_{16}$" minimum[1]	

For SI: 1 inch = 25.4 mm

1. When measured from back plane of expanded metal lath, exclusive of ribs, or self -furring lath, plaster thickness shall be ¾ inch minimum.
2. When measured from face of support or backing.
3. Because masonry and concrete surfaces may vary in plane, thickness of plaster need not be uniform.
4. When applied over a liquid bonding agent, finish coat may be applied directly to concrete surface.
5. Approved acoustical plaster may be applied directly to concrete or over base coat plaster, beyond the maximum plaster thickness shown.
6. Attachment shall be in accordance with Table 3607.2.3.4.

TABLE 3607.2.1b
GYPSUM PLASTER PROPORTIONS

NUMBER	COAT	PLASTER BASE OR LATH	MAXIMUM VOLUME AGGREGATE PER 100 POUNDS NEAT PLASTER[2] (cubic feet)	
			Damp Loose Sand[1]	Perlite or Vermiculite[3]
Two-coat work	Base coat	Gypsum lath	2½	2
	Base coat	Masonry	3	3
Three-coat work	First coat	Lath	2[4]	2
	Second coat	Lath	3[4]	2[5]
	First and second coats	Masonry	3	3

For SI: 1 inch = 25.4 mm, 1 cubic foot = 0.0283 m^3, 1 pound = 0.454 kg.

1. Wood-fibered gypsum plaster may be mixed in the proportions of 100 pounds of gypsum to not more than one cubic foot of sand where applied on masonry or concrete.
2. When determining the amount of aggregate in set plaster, a tolerance of 10% shall be allowed.
3. Combinations of sand and lightweight aggregate may be used, provided the volume and weight relationship of the combined aggregate to gypsum plaster is maintained.
4. If used for both first and second coats, the volume of aggregate may be 2½ cubic feet.
5. Where plaster is one inch or more in total thickness, the proportions for the second coat may be increased to three cubic feet.

TABLE 3607.2.1c
PORTLAND CEMENT PLASTER

COAT	MAXIMUM VOLUME AGGREGATE PER VOLUME CEMENTITIOUS MATERIAL[1]			MINIMUM PERIOD MOIST COATS	MINIMUM INTERVAL BETWEEN
	Portland Cement Plaster[2] Maximum Volume Aggregate per Volume Cement	Portland Cement-lime Plaster[3] Maximum Volume Lime per Volume Cement	Portland Cement-lime Plaster[3] Maximum Volume Sand per Volume Cement and Lime	Approximate Minimum Thickness[4] Curing		
First	4	¾	4	⅜[5]	48[6] Hours	48[7] Hours
Second	5	¾	5	First and Second coats	48 Hours	7 Days[8]
Finished	3[9]	-	3[9]	⅛	-	-[8]

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg.

1. When determining the amount of aggregate in set plaster, a tolerance of 10% may be allowed.
2. From ten to 20 pounds of dry hydrated lime (or an equivalent amount of lime putty) may be added as a plasticizing agent to each sack of Type I and Type II standard portland cement in base coat plaster.
3. No additions of plasticizing agents shall be made.
4. See Table 3607.2.1a
5. Measured from face of support or backing to crest of scored plaster.
6. 24 hour minimum period for moist curing of interior portland cement plaster.
7. 24 hour minimum interval between coats of interior portland cement plaster.
8. Finish coat plaster may be applied to interior portland cement base coat after a 48-hour period.
9. For finish coat, plaster up to an equal part of dry hydrated lime by weight (or an equivalent volume of lime putty) may be added to Type I, Type II and Type III standard portland cement.

TABLE 3607.2.3.4
APPLICATION AND MINIMUM THICKNESS OF GYPSUM WALLBOARD

THICKNESS OF GYPSUM WALLBOARD (inch)	PLANE OF FRAMING SURFACE[4]	LONG DIMENSION OF GYPSUM WALLBOARD SHEETS IN RELATION TO DIRECTION OF FRAMING MEMBERS	MAXIMUM SPACING OF FRAMING MEMBERS (center-to-center in inches)	MAXIMUM SPACING OF FASTENERS (center-to-center, in inches)		NAILS[1] TO WOOD
				Nails[1,2]	Screws	
Fastening required without adhesive application.						
3/8	Horizontal[4]	Perpendicular	16	7	12	No. 13 gage 1¼" long, 19/64" head; 0.098" diameter, 1¼" long, annular-ringed; 4d cooler nail
	Vertical	Either direction	16	8	12	
½	Horizontal[5]	Either direction	16	7	12	No. 13 gage 1⅜" long, 19/64" head; 0.098"diameter, 1¼" long, annular-ringed; 5d cooler nail
	Horizontal[3]	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
5/8	Horizontal	Either direction	16	7	12	No. 13 gage 1⅝" long, 19/64" head; 0.098" diameter, 1⅜" long, annular-ringed; 6d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
With adhesive application.						
3/8	Horizontal[4]	Perpendicular	16	16	16	Same as above for 3/8"
	Vertical	Either direction	16	16	24	
½ or 5/8	Horizontal	Either direction[3]	16	16	16	As required for ½" and 5/8" gypsum wallboard, see above
		Perpendicular	24	12	16	
	Vertical	Either direction	24	24	24	
2 3/8 layers	Horizontal	Perpendicular	24	16	16	Base ply nailed as required for ½" gypsum wallboard and face ply placed with adhesive
	Vertical	Either direction	24	24	24	

For SI: 1 inch = 25.4 mm

1. Where the metal framing has a clinching design formed to receive the nails by two edges of metal, the nails shall not be less than 5/8 inch longer than the wallboard thickness and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, 13½ gage, 1⅝ inches long, 15/64-inch head for ½-inch gypsum wallboard; 6d, 13 gage, 1⅞ inches long, 15/64 -inch head for 5/8-inch gypsum wallboard.
2. Two nails spaced not less than two inches apart, or more than 2½ inches apart may be used where the pairs are spaced 12 inches on center except around the perimeter of the boards.
3. 3/8-inch single-ply gypsum board shall not be installed if water-based textured finish is applied or to support insulation above a ceiling. On horizontal applications to receive a water-based texture material, either hand or spray applied, gypsum board shall be applied perpendicular to framing and board thickness increased from 3/8 inch to ½ inch for 16-inch o.c. framing, and from ½ inch to 5/8 inch for 24-inch o.c. framing.
4. Horizontal refers to applications such as ceilings. Vertical refers to applications such as walls.

3607.2.6.1 Attachment: Nails, staples or glue are permitted for use in attaching shakes or shingles to the wall, and the shakes or shingles shall be permitted to be attached directly to the surface provided the fasteners are appropriate for the type of wall surface material. When nails or staples are used, two fasteners shall be provided and shall be placed so that they are covered by the course above.

3607.2.6.2 Furring strips: Where furring strips are used, they shall be one inch by two inches or one inch by three inches (25 mm by 51 mm or 25

mm by 76 mm), spaced a distance on center equal to the shake or shingle exposure, and shall be attached to the wall by nailing through other wall material into the studs of the interior spaces.

3607.2.6.3 Bottom course: The bottom course shall be doubled.

780 CMR 3607.3 EXTERIOR COVERING

3607.3.1 General: All exterior walls shall be covered with approved materials designed and installed to provide a barrier against the weather and insects to enable environmental control of the interior spaces. The exterior coverings in 780 CMR 3607.0 shall be installed in the specified manner unless otherwise approved.

3607.3.2 Weather-resistant sheathing paper: Asphalt-saturated felt, free from holes and breaks and weighing not less than 14 pounds per 100 square feet (0.683 kg/m^2) or other approved weather-resistant material shall be applied over studs or sheathing of all exterior walls as required by Table *3607.3.4*. Such felt or material shall be applied horizontally, with the upper layer lapped over the lower layer not less than two inches (51 mm). Where joints occur, felt shall be lapped not less than six inches (153 mm).

3607.3.2.1 Felt or material: Such felt or material may be omitted.

1. In detached accessory buildings.
2. Under panel siding with shiplap joints or battens.
3. Under exterior wall finish materials as permitted in Table *3607.3.4*.
4. Under paperbacked stucco lath.
5. Over water-repellent sheathing materials.

3607.3.3 Wood, plywood and wood structural panel siding: Joints in wood, plywood or wood structural panel siding shall be made as follows unless otherwise approved. Vertical joints in panel siding shall occur over framing members, unless wood or wood structural panel sheathing is used, and shall be shiplapped or covered with a batten. Horizontal joints in panel siding shall be lapped a minimum of one inch (25 mm) or shall be flashed with Z-flashing.

3607.3.3.1 Horizontal siding: Horizontal siding shall be lapped a minimum of one inch (25 mm), or ½ inch (12.7 mm) if rabbeted, and shall have the ends caulked, covered with a batten, or sealed and installed over a strip of flashing.

3607.3.4 Attachments: Unless specified otherwise, all wall coverings shall be securely fastened in accordance with Table *3607.3.4* or with other approved aluminum, stainless steel, zinc-coated, or other approved corrosion-resistive fasteners.

3607.3.5 Wood shakes and shingles: Wood shakes and shingles shall conform to CSSB "Grading Rules for Wood Shakes and Shingles."

3607.3.5.1 Application: Wood shakes or shingles shall be applied either single-course or double-course over nominal ½-inch (12.7 mm) wood-based sheathing or to furring strips over ½-inch (12.7 mm) nominal non-wood sheathing. A weather-resistant permeable membrane shall be provided over the sheathing, with horizontal overlaps in the membrane of not less than two inches (51 mm) and vertical overlaps of not less than six inches (153 mm). Where furring strips are used, they shall be one inch by three inches or one inch by four inches (25 mm by 76 mm or 25 mm by 102 mm) and shall be fastened horizontally to the studs with 7d or 8d box nails and shall be spaced a distance on center equal to the actual weather exposure of the shakes or shingles, not to exceed the maximum exposure specified in Table *3607.3.5.2*. The spacing between adjacent shingles to allow for expansion shall not exceed ¼ inch (6.4 mm), and between adjacent shakes, shall not exceed ½ inch (12.7 mm). The offset spacing between joints in adjacent courses a minimum of 1½ inches (38 mm).

3607.3.5.2 Weather exposure: The maximum weather exposure for shakes and shingles shall not exceed that specified in Table *3607.3.5.2*.

3607.3.5.3 Attachment: Each shake or shingle shall be held in place by two hot-dipped zinc-coated, stainless steel, or aluminum nails or staples. The fasteners shall be long enough to penetrate the sheathing or furring strips by a minimum of ½ inch (12.7 mm) and shall not be overdriven.

3607.3.5.3.1 Staple attachment: Staples shall not be less than 16 gage and shall have a crown width of not less than $^7/_{16}$ inch (11 mm), and the crown of the staples shall be parallel with the butt of the shake or shingle. In single-course application, the fasteners shall be concealed by the course above and shall be driven approximately one inch (25 mm) above the butt line of the succeeding course and ¾ inch (19 mm) from the edge. In double-course applications, the exposed shake or shingle shall be face-nailed with two casing nails, driven approximately two inches (51 mm) above the butt line and ¾ inch (19 mm) from each edge. Staples shall not be permitted for face-nailing. With shingles wider than eight inches (203 mm), two additional nails shall be required and shall be nailed approximately one inch (25 mm) apart near the center of the shingle.

3607.3.6 Exterior lath: All lath and lath attachments shall be of corrosion-resistant materials.

Expanded metal or woven wire lath shall be attached with 1½ inch (38 mm) long, 11 gage nails having a $^{7}/_{16}$-inch (11 mm) head, or ⅞ inch (22 mm) long, 16 gage staples, spaced at no more than six inches (153 mm), or as otherwise approved.

3607.3.7 Masonry veneer, general: All masonry veneer shall be installed in accordance with 780 CMR 3607.3.7, Table ***3607.3.4*** and Figure ***3607.3.7***. Exterior masonry veneer shall not be laterally supported by wood frame at any point more than 35 feet (7620 mm) above the adjacent ground elevation.

Exceptions:

1. Veneers used as interior wall finishes may be supported on wood floors which are designed to support the loads imposed.
2. Exterior masonry veneers ***with*** an installed weight of 40 pounds per square foot (195 kg/m^2) or less may be supported on wood construction. When the masonry veneer is supported by wood construction that adjoins the masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the wood construction and the foundation. The wood construction supporting the masonry veneer shall be designed to limit deflection to $^{1}/_{600}$ of the span for the supporting members.

3607.3.7.1 Lintels: Masonry veneer shall not support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported on lintels of noncombustible materials and the allowable span shall not exceed the values set forth in Table ***3607.3.7.1***. The lintels shall have a length of bearing of not less than four inches (102 mm).

3607.3.7.2 Attachment: Masonry veneer shall be attached to the supporting wall with corrosion-resistant metal ties.

3607.3.7.2.1 Size and spacing: Veneer ties, if strand wire, shall not be less in thickness than No. 9 U.S. gage wire and shall have a hood embedded in the mortar joint, or if sheet metal, not less than No. 22 U.S. gage by ⅞ inch (22 mm) corrugated. Each tie shall be spaced not more than 24 inches (610 mm) on center horizontally and shall support not more than 3¼ square feet (0.302 m^2) of wall area.

Exception: In wind areas of more than 30 pounds per square foot (1.44 kN/m^2), each tie shall support not more than two square feet (0.186 m^2) of wall area.

TABLE 3607.3.4
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL	NOMINAL THICNESS[1] (inches)	JOINT TREATMENT	SHEATHING PAPER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[2,3,4]				
				Wood, or Wood structural Panel Sheathing	Fiberboard Sheathing into Stud	Gypsum Sheathing into Stud	Direct to Studs	Number or Spacing of Fasteners
Horizontal aluminum[5] Without insulation	0.019[6]	Lap	No	0.120 nail 1½" long	0.120 nail 2" long	0.120 nail 2" long	Not allowed	Same as stud spacing
Horizontal aluminum[5] Without insulation	0.024	Lap	No	0.120 nail 1½" long	0.120 nail 2" long	0.120 nail 2" long	Not allowed	Same as stud spacing
Horizontal aluminum[5] With insulation	0.019	Lap	No	0.120 nail 1½" long	0.120 nail 2½" long	0.120 nail 2½" long	0120 nail 1½" long	Same as stud spacing
Brick veneer Concrete masonry veneer	2 2	780 CMR 3607.3	Yes (13)	See 780 CMR 3607.3 and Figure 3607.3.7[8]				
Hardboard[12] Board and batten-vertical	7/16	(7)	(7)	0.099 nail 2" long	0.099 nail 2½" long	0.099 nail 2" long	0.099 nail 1¾" long	6" panel edges 8" inter. sup.
Hardboard[12] Lap-siding-horizontal	7/16	(7)	(7)	0.099 nail 2" long	0.099 nail 2½" long	0.099 nail 2¼" long	0.099 nail 2" long	Same as stud spacing 2 per bearing
Steel[9]	29 ga.	Lap	No	0.113 nail 1¾" Staple 1¾"	0.113 nail 2¾" Staple 2½"	0.113 nail 2½" Staple 2¼"	Not allowed	Same as stud spacing
Stone veneer	2	780 CMR 3607.3	Yes	See 780 CMR 3607.3 and Figure 3607.3.7				
Particalboard panels	3/8 - ½	(7)	(7)	6d box nail	6d box nail	6d box nail	6d box nail, ⅜ not allowed	6" panel edges 12" inter. sup.
Particalboard panels	5/8	(7)	(7)	6d box nail	8d box nail	8d box nail	6d box nail	
Plywood panel[10] (exterior grade)	3/8	(7)	(7)	0.099 nail 2" Staple 1⅜"	0.113 nail 2½" Staple 2¼"	0.099 nail 2" Staple 2"	0.099 nail 2" Staple 1⅜"	6" on edges 12" inter. sup.
Vinyl Siding[14]	0.035	Lap	No	0.120 nail 1½" Staple 1¾"	0.120 nail 2" Staple 2½"	0.120 nail 2" Staple 2½"	Not allowed	Same as stud spacing
Wood[11] Rustic drop Shiplap	3/8 Minimum 19/32 Average	Lap	No	Fastener penetration into stud - 1"			0.113 nail 2½" Staple 2"	Face nailig up to 6" widths, 1 nail per bearing: 8" widrhs and over, 2 nails per bearing
Bevel	7/16	Lap	No					
Butt tip	3/16	Lap	No					

For SI: 1 inch = 25.4 mm.

1. Based on stud spacing of 16 inches o.c. Where studs are spaces 24 inches, siding may be applied to sheathing approved for that spacing.
2. Nail is a general description and may be T-head, modified round head, or round head with smooth or deformed shanks.
3. Staples shall have a minimum crown width of 7/16-inch O.D. and be manufactured of minimum No. 16 gage wire.
4. Nails or staples must be aluminum, galvanized, or rust-preventive coated and shall be driven into the studs for fiberboard or gypsum backing.
5. Aluminum nails shall be used to attach aluminum siding.
6 Aluminum (0.019 inch) may be unbacked only when the maximum panel width is ten inches and the maximum flat area is eight inches. The tolerance for aluminum siding shall be ±0.002 inch of the nominal dimension.
7. If boards are applied over sheathing or weather resistant membrane, joints need not be treated. Otherwise, vertical joints must occur at studs and be covered with battens or be lapped.
8. All attachments shall be coated with a corrosion-resistive coating.
9. Shall be of approved type.
10. ⅜-inch plywood may be applied directly to studs spaced 16 inches on center. ½-inch plywood may be applied directly to studs spaced at 24 inches on center.
11. Woodboard sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches o.c. Nails shall penetrate 1½ inches into studs, studs and wood sheathing combined, or blocking. A weather-resistant membrane shall be installed weatherboard fashion under the vertical siding unless the siding boards are lapped or battens are used.
12. Hardboard siding shall comply with AHA A135.6
13. For masonry veneer, a weather-resistant membrane or building paper is not required over water-repellent sheathing materials when a one-inch air space is provided between the veneer and the sheathing. When the one-inch space is

filled with mortar, a weather-resistant membrane or building paper is required over studs or sheathing.
14. Vinyl siding shall comply with ASTM D 3679.

TABLE 3607.3.5.2
MAXIMUM WEATHER EXPOSURE FOR WOOD SHAKES AND SHINGLES ON EXTERIOR WALLS
(Dimensions are in

LENGTH	EXPOSURE FOR SINGLE COURSE	EXPOSURE FOR DOUBLE COURSE
SHINGLES[1]		
16	7½	12[2]
18	8½	14[3]
24	11½	16
SHAKES[1]		
18	8½	14
24	11½	18

For SI: 1 inch = 25.4 mm
1. Dimensions given are for No. 1 Grade.
2. A maximum ten-inch exposure is permitted for No. 2 Grade.
3. A maximum 11-inch exposure is permitted for No. 2 Grade.

3607.3.7.2.2 Paper backing required: When applied over stud construction, the studs shall be spaced a maximum of 24 inches (610 mm) on center and approved paper shall first be applied over the sheathing or wires between the studs, except as otherwise provided in ***780 CMR 3607.3.2*** and mortar shall be slushed into the one-inch (25 mm) space between facing and paper.

Exception: As an alternate, an air space of at least one inch (25 mm) may be maintained between the backing and the veneer, in which case a weather-resistant membrane or felt sheathing paper or approved water-repellent sheathing shall be applied over the studs.

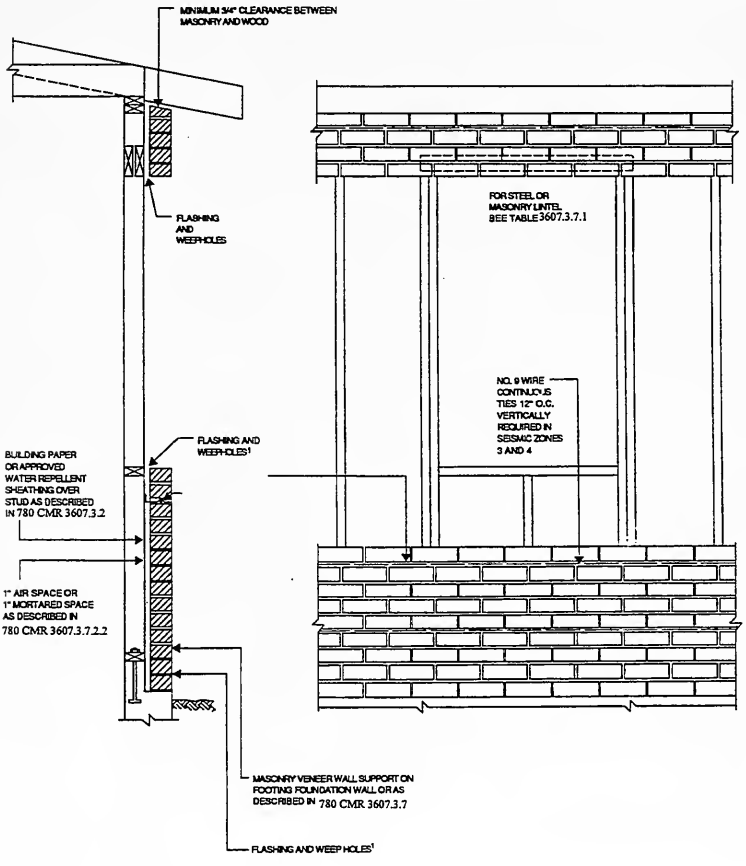
3607.3.7.2.3 Veneer grouting: In lieu of such wire ties, an approved method of grouting the veneer to a paperbacked reinforcement attached directly to the studs may be used.

3607.3.7.3 Flashing: Flashing shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab, and at other points of support, including structural floors, shelf angles and lintels when masonry veneers are designed in accordance with ***780 CMR 3607.3.7. See 780 CMR 3607.3.8*** for additional requirements.

3607.3.7.4 Weepholes: Weepholes shall be provided in the outside of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weepholes shall not be less than $^{3}/_{16}$ inch (4.8 mm) in diameter. Weepholes shall be located immediately above the flashing.

3607.3.8 Flashing: Approved corrosion-resistive flashing shall be provided at top and sides of all exterior window and door openings in such a manner as to be leak-proof, except that self-flashing windows having a continuous lap of not less than 1⅜ inches (28 mm) over the sheathing material around the perimeter of the opening, including corners, do not require additional flashing; jamb flashing may also be omitted when specifically approved by the building official. Similar flashings shall be installed at the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings; under and at the ends of masonry, wood or metal copings and sills; continuously above all projecting wood trim; where exterior porches. decks or stairs attach to a wall or floor assembly of wood-frame construction; at wall and roof intersections.

FIGURE 3607.3.7
MASONRY VENEERED WALL DETAIL



For SI: 1 inch = 25.4 mm.

1. Location of flashing and weepholes as described in 780 CMR 3607.3.7.3 and 3607.3.7.4.

TABLE 3607.3.7.1
ALLOWABLE SPANS FOR LINTELS SUPPORTING MASONRY VENEER

SIZE OF STEEL ANGLE[1,3]	NO STORY ABOVE	ONE STORY ABOVE	TWO STORIES ABOVE	NO OF ½" OR EQUIVALENT REINFORCING BARS[2]
3 x 3 x ¼	6'-0"	3'-6"	3'-0"	1
4 x 3 x ¼	8' - 0"	5'-0"	3'-0"	1
6 x 3½ x ¼	14' - 0"	8'-0"	3'-6"	2
2-6 x 3½ x ¼	20' - 0"	11'-0"	5'-0"	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

1. Long leg of the angle shall be placed in a vertical position.
2. Depth of reinforced lintels shall not be less than eight inches and all cells of hollow masonry lintels shall be grouted and solid. Reinforcing bars shall extend not less than eight inches into the support.
3. Steel members indicated are adequate typical examples; other steel members meeting structural design requirements may be used.

ROOF-CEILING CONSTRUCTION

3608.1 GENERAL

3608.1.1 Application: The provisions of 780 CMR 3608.1 shall control the design and construction of the roof-ceiling system for all buildings. The use of materials or methods of construction not specified in 780 CMR 3608.1 accomplishing the purposes intended with 780 CMR 36 and approved by the building official in accordance with 780 CMR 36 and approved by the building official in accordance with ***780 CMR 109*** shall be accepted as complying with 780 CMR 36.

3608.1.2 Requirements: Roof-ceiling construction shall be capable of ***supporting*** all loads imposed according to ***780 CMR 3603.1*** and shall transmit the resulting loads to supporting structural elements.

3608.1.3 Roof drainage: In areas where expansive or collapsible soils are known to exist ***or where required by city or town ordinance or by-law***, all dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least five feet (1524 mm) from foundation walls or to an approved drainage system.

780 CMR 3608.2 ROOF FRAMING

3608.2.1 Identification and grade: Load-bearing dimension lumber for rafters, trusses and ceiling joists shall conform to DOC PS 20 and to other applicable standards or grading rules, ***as listed in Appendix A***, and be identified by a grade mark or certificate of inspection issued by an approved agency. The grade mark or certificate shall provide adequate information to determine F_b, the allowable stress in bending, and E, the modulus of elasticity. Approved end jointed lumber may be used interchangeably with solid-sawn members of the same species and grade. Blocking shall be a minimum of utility grade lumber.

Exception: *Use of Native Lumber shall be allowed in accordance with 780 CMR 2303.0.*

3608.2.1.1 Fire-retardant-treated lumber: The allowable unit stresses for fire-retardant-treated lumber, including fastener values, shall be developed from an approved method of investigation which considers the effects of anticipated temperature and humidity to which the fire-retardant lumber will be subjected, the type of treatment and redrying process. The fire-retardant treated lumber shall be graded by an approved agency.

3608.2.2 Design and construction: Roof-ceilings of wood construction shall be designed and constructed in accordance with the provisions of 780 CMR 3608.2 or with the AFPA NDS-1991 "National Design Specification for Wood Construction," the CWC-1987 "Canadian Dimension Lumber Data Book," the WWPA- 1992 "Western Lumber Span Tables for Floor and Ceiling Joists and Roof Rafters," or the "Southern Pine Maximum Spans for Joists and Rafters," ***each as listed in Appendix A***. Roof-ceilings shall be constructed in accordance with Figures ***3606.4.10a***, ***3606.4.10b***, ***3606.4.10c*** and ***3608.2.4.1*** and nailed in accordance with Table ***3606.2.3a***.

3608.2.2.1 Cathedral ceilings: When ceiling joists and rafter ties are omitted and the rafters are used to create a cathedral ceiling, rafter ends shall be supported on bearing walls, headers or ridge beams. Rafters shall be attached to supporting members in accordance with Table ***3606.2.3a***. Ridge beams shall be capable of carrying the imposed roof loads and shall be supported by structural elements which transmit the loads to the foundation.

3608.2.3 Framing details: Rafters shall be nailed to ceiling joists to form a continuous tie between exterior walls where joists are parallel to the rafters. Where not parallel, rafters shall be tied with a rafter tie, located as near the plate as practical. Rafter ties shall be spaced not more than four feet (1219 mm) on center. Rafters shall be framed to ridge board or to each other with gusset plate as a tie. Ridge board shall be at least one-inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a valley or hip rafter not less than two-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point.

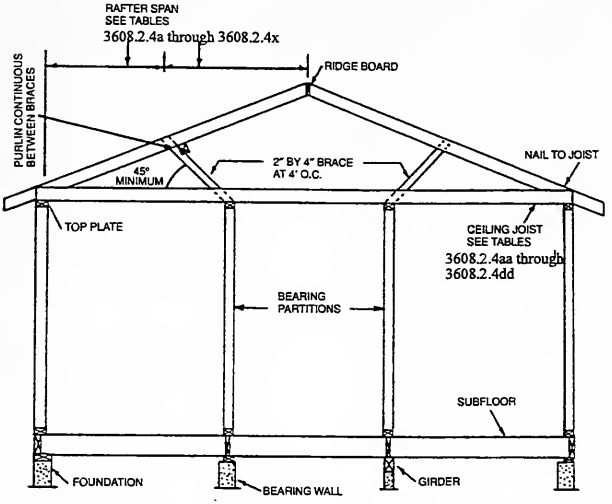
3608.2.3.1 Ceiling joists lapped: Ends of ceiling joists shall be lapped a minimum of three inches (76 mm) or butted over bearing partitions or beam and toenailed to the bearing member. When ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together and butted joists shall be tied together in a manner to resist such thrust.

3608.2.3.2 Collar ties: Pairs of rafters on opposing sides of a ridge board in roof pitches over three units vertical in 12 units horizontal shall be connected by collar ties. Collar ties shall be located at a maximum spacing of 48 inches on center, measured parallel to the ridge, or at every third pair of rafters, whichever is smaller. Collar ties shall be located in the upper third of the height of the roof, measured from the sill plate to the ridge, and shall be a minimum of one inch by six inch dimension lumber. Collar ties shall be connected to rafters in accordance with the requirements for rafter ties in Table 3606.2.3a.

3608.2.4 Allowable spans: The unsupported spans for ceiling joists shall not exceed the values set forth in Tables ***3608.2.4aa*** through ***3608.2.4dd*** The unsupported spans for rafters shall not exceed the values set forth in Tables ***3608.2.4a through 3608.2.4x.*** When the roof pitch is less than three units vertical in 12 units horizontal (25% slope), members supporting rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams. Selection of rafters shall be based on lumber properties, snow load zone and deflection due to live load based on ceiling finish (see table 3603.1.6

3608.2.4.1 Purlins: Purlins may be installed to reduce the span of rafters as shown in Figure ***3608.2.4.1.*** Purlins shall be sized no less than the required size of the rafters that they support. Purlins shall be continuous and shall be supported by two by four (51 by 102) struts installed to bearing walls at a slope not less than 45 degrees from the horizontal. The struts shall be spaced not more than four feet (1219 mm) on center, and the unbraced length of struts shall not exceed eight feet (2438 mm).

FIGURE 3608.2.4.1
BRACED RAFTER CONSTRUCTION



For SI: one inch = 25.4 mm, one foot = 304.8 mm.
NOTE: Where ceiling joists run perpendicular to the rafters, rafter ties shall be nailed to the rafters near the plate line and spaced not more than four feet on center.

3608.2.5 Bearing: The ends of each rafter or ceiling joist shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry.

3608.2.6 Cutting and notching: It shall be unlawful to notch, cut or pierce wood beams, joists or rafters in excess of the limitations herein specified, unless proven safe by structural analysis or suitably reinforced to transmit all calculated *loads*. Notches in the top or bottom of rafter shall not exceed $^{1}/_{16}$ of the depth of the rafter, ***shall not be longer than ⅓ the depth of the member*** and shall not be located in the middle third of the span. ***Notch depth at the ends of the member*** shall not exceed ¼ the rafter depth.

Exceptions:
1. A notch over the support is permitted to extend the full width of the support.
2. Notches on cantilevered portions of the member are permitted to extend the full length of the cantilever if the strength and deflection of the cantilever is calculated based on the reduced member section.
3. The tension side of rafters which are four inches or greater in nominal thickness, shall not be notched, except at ends of members.

3608.2.7 Holes: Holes drilled, bored ***or cut*** into rafters shall ***not be closer than*** two inches (51 mm) to the top or bottom of the rafters, ***or to any other hole located in the rafter. Where the rafter is notched, the hole shall not be closer than two***

NON-TEXT PAGE

inches to the notch. The diameter ***of the hole*** shall not exceed ⅓ the depth of the rafter.

3608.2.8 Lateral support: Rafters and ceiling joists having a depth-to-thickness ratio exceeding five to one based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation.

3608.2.8.1 Bridging: Rafters and ceiling joists having a depth-to-thickness ratio exceeding six to one based on nominal dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or a continuous one-inch-by-three-inch (25 mm by 76 mm) wood strip nailed across the rafters or ceiling joists at intervals not exceeding ten feet (3048 mm).

3608.2.9 Framing of openings: Openings in roof and ceiling framing shall be framed with headers between ceiling joists or rafters. When the header span does not exceed four feet (1219 mm), the header may be a single member the same size as the ceiling joist or rafter. When the header span exceeds four feet (1219 mm), the header and the joists or rafters that support the header shall be doubled, and approved hangers shall be used to connect the header to the joists or rafters.

3608.2.10 Trusses: Wood trusses shall be designed in accordance with approved engineering practice. Truss components may be joined by nails, glue, timber connectors or other approved fastening devices. The design of metal plate connected wood trusses shall comply with TPI QST, TPI PCT and TPI-1985 "Design Specification for Metal Plate Connected Wood Trusses", ***each as listed in Appendix A.*** Trusses shall be braced according to their appropriate engineered design. In the absence of specific bracing requirements, trusses shall be braced in accordance with TPI BWT, ***as listed in Appendix A.*** Truss members shall not be cut or altered unless so designed.

3608.2.11 Roof tie-down: Roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m^2) or greater, shall have rafter or truss ties provided in accordance with Table ***3608.2.12.*** The resulting uplift forces from the rafter or truss ties shall be transmitted to the foundation.

780 CMR 3608.3 ROOF SHEATHING

3608.3.1 Lumber sheathing: Allowable spans for lumber used as roof sheathing shall conform to Table ***3608.3.1.*** Spaced lumber sheathing for wood shingle and shake roofing shall conform to the requirements of ***780 CMR 3609.8 and 3609.9.***

3608.3.2 Plywood sheathing:

3608.3.2.1 Identification and grade: Plywood and wood structural panels shall conform to DOC PS 1 or DOC PS 2 ***as listed in Appendix A,*** and shall be identified by grade mark or certificate of inspection issued by an approved agency. Plywood and wood structural panels shall comply with the grades specified in Table ***3605.3.2.1.1a.***

3608.3.2.1.1 Type: All plywood, when designed to be exposed in outdoor applications, shall be of an exterior type. Plywood or wood structural panel roof sheathing exposed to the underside may be of interior type bonded with exterior glue, identified as Exposure 1.

3608.3.2.1.2 Fire-retardant-treated plywood: The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an approved method of investigation which considers the effects of anticipated temperature and humidity to which the fire-retardant plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an approved agency.

3608.3.2.1.3 Wood structural panels: Wood structural-use panels conforming to DOC PS 2, ***as listed in Appendix A,*** includes performance-rated plywood, oriented strandboard and composite panels. Oriented strandboard structural-use panels manufactured in Canada shall conform to CSA 0437 ***as listed in Appendix A.***

3608.3.2.2 Allowable spans: The maximum allowable spans for plywood and wood structural panel roof sheathing shall not exceed the values set forth in Table ***3605.3.2.1.1a.***

3608.3.2.3 Installation: Plywood and wood structural panel roof sheathing shall be installed with joints staggered or nonstaggered in accordance with Tables **3605.3.2.1.1**a and **3606.2.3**a, or APA E 30 ***as listed in Appendix A.***

TABLE 3608.2.12
WIND UPLIFT FORCES ON ROOF TRUSSES AND RAFTERS[1, 2, 3, 4]
(Pounds Per Tie-Down Connection)

WIND UPLIFT PRESSURE ON ROOF (psf)[5]	TOTAL BUILDING WIDTH ROOF INCLUDING OVERHANG (feet)				
	24	28	32	36	40
20	192	224	256	288	320
30	432	504	576	648	720
40	672	784	895	1,008	1,120
50	912	1,064	1,216	1,368	1,520
60	1,152	1,344	1,536	1,728	1,920
70	1,392	1,624	1,856	2,088	2,320
80	1,632	1,904	2,176	2,448	2,720
90	1,872	2,184	2,496	2,808	3,120

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, psf = 0.0479 kNm^2

1. A continuous load path capable of resisting the tributary forces shall be provided from tie-down connections to the foundation.
2. Wind uplift forces are based on 24-inch spacing of roof trusses or rafters. For spacing other than 24 inches, forces shall be adjusted accordingly.
3. Interpolation is permitted for intermediate values of wind uplift pressures and building widths.
4. The rated capacity of approved tie-down devices is permitted to include a ⅓ increase for wind effects.
5. Tie-down connections shall be provided at bearing walls for roof trusses or rafters to resist wind uplift forces.

3608.3.3 Particleboard sheathing:

3608.3.3.1 Identification and grade: Particleboard roof sheathing shall conform to Type 2-M-W as set forth in ANSI A208.1 ***as listed in Appendix A*** and shall be so identified by a grade mark or certificate of inspection issued by an approved agency.

3608.3.3.2 Allowable spans: The allowable loads and spans for particleboard roof sheathing shall not exceed the values set forth in Table **3608.3.3.2**.

3608.3.3.3 Installation: Particleboard roof sheathing shall be installed in accordance with Tables ***3606.2.3a*** and ***3608.3.3.2***. Where walls are subject to wind pressures of 30 pounds per square foot (1.44 kN/m^2) or greater, particleboard roof sheathing shall be attached to the gable end with 8d common nails spaced at no more than four inches ***on center*** (102 mm), or equivalent fasteners.

TABLE 3608.3.1
MINIMUM THICKNESS LUMBER ROOF SHEATHING

RAFTER OR BEAM SPACING (inches)	MINIMUM NET THICKNESS (inches)
24	5/8
48[1]	1½ T & G
60[2]	
72[3]	

For SI: 1 inch = 25.4 mm, 1 psi= 6.895 kPa.

1. Minimum 270 F_b, 340,000 *E*.
2. Minimum 420 F_b, 660,000 *E*.
3. Minimum 600 F_b, 1,150,000 *E*.

TABLE 3803.3.2
ALLOWABLE LOADS FOR PARTICLEBOARD ROOF SHEATHING[1, 2, 3]

GRADE	THICKNESS (inches)	MAXIMUM ON-CENTER SPACING	LIVE LOAD (pounds per square foot)	TOTAL LOAD (pounds per square foot)
2-M-W	3/8[4]	16	45	65
	7/16[4]	16	105	105
	7/16[4]	24	30	40
	½	16	110	150
	½	24	40	55

For SI: 1 inch = 25.4 mm, 1 psi = 6895 kPa.

1. Panels are continuous over two or more spans.
2. Uniform load deflection limitations: 1/180 of the span under live load plus dead load and 1/240 of the span under live load only.
3. The panels may be applied parallel or perpendicular to the span of the rafters or joists and shall be continuous over two or more spans. If the panels are applied perpendicular to roof supports, the end joints of the panels shall be offset so that four panel corners will not meet. Cutouts for items such as plumbing and electrical shall be oversized to avoid a forced fit. A ½-inch gap must be provided between the panel and concrete masonry walls. Leave a 1/16-inch gap between panels and nail no closer than ⅜ inch from panel edge.
4. Edges shall be tongue and groove or supported with blocking or edge clips.

780 CMR 3608.4 METAL

3608.4.1 General: Elements shall be straight and free of any defects which would significantly affect their structural performance.

TABLE 3608.2.4j
ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS
30 Lbs. per Sq. Ft. Live Load
For Use in Snow Load Zone 2

DESIGN CRITERIA: Strength—15 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 180.
RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.
HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SPACING AND SIZE		ALLOWABLE EXTREME FIBER STRESS IN BENDING, "*Fb*," (psi)											
(inches)	(inches)	200	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 4	12 .0	3-0 0.05	3-8 0.09	4-3 0.15	4-9 0.20	5-3 0.27	5-8 0.34	6-0 0.41	6-5 0.49	6-9 0.58	7-1 0.67	7-5 0.76	7-8 0.86
	16.0	2-7 0.04	3-2 0.08	3-8 0.13	4-1 0.18	4-6 0.23	4-11 0.29	5-3 0.36	5-6 0.43	5-10 0.50	6-1 0.58	6-5 0.66	6-8 0.74
	24.0	2-2 0.04	2-7 0.07	3-0 0.10	3-4 0.14	3-8 0.19	4-0 0.24	4-3 0.29	4-6 0.35	4-9 0.41	5-0 0.47	5-3 0.54	5-5 0.61
2x6	12.0	4-9 0.05	5-10 0.09	6-8 0.15	7-6 0.20	8-2 0.27	8-10 0.34	9-6 0.41	10-0 0.49	10-7 0.58	11-1 0.67	11-7 0.76	12-1 0.86
	16.0	4-1 0.04	5-0 0.08	5-10 0.13	6-6 0.18	7-1 0.23	7-8 0.29	8-2 0.36	8-8 0.43	9-2 0.50	9-7 0.58	10-0 0.66	10-5 0.74
	24.0	3-4 0.04	4-1 0.07	4-9 0.10	5-4 0.14	5-10 0.19	6-3 0.24	6-8 0.29	7-1 0.35	7-6 0.41	7-10 0.47	8-2 0.54	8-6 0.61
2 x 8	12.0	6-3 0.05	7-8 0.09	8-10 0.15	9-10 0.20	10-10 0.27	11-8 0.34	12-6 0.41	13-3 0.49	13-11 0.58	14-8 0.67	15-3 0.76	15-11 0.86
	16.0	5-5 0.04	6-7 0.08	7-8 0.13	8-7 0.18	9-4 0.23	10-1 0.29	10-10 0.36	11-6 0.43	12-1 0.50	12-8 0.58	13-3 0.66	13-9 0.74
	24.0	4-5 0.04	5-5 0.07	6-3 0.10	7-0 0.14	7-8 0.19	8-3 0.24	8-10 0.29	9-4 0.35	9-10 0.41	10-4 0.47	10-10 0.54	11-3 0.61
2x 10	12.0	8-0 0.05	9-9 0.09	11-3 0.15	12-7 0.20	13-9 0.27	14-11 0.34	15-11 0.41	16-11 0.49	17-10 0.58	18-8 0.67	19-6 0.76	20-4 0.86
	16.0	6-11 0.04	8-5 0.08	9-9 0.13	10-11 0.18	11-11 0.23	12-11 0.29	13-9 0.36	14-8 0.43	15-5 0.50	16-2 0.58	16-11 0.66	17-7 0.74
	24.0	5-8 0.04	6-11 0.07	8-0 0.10	8-11 0.14	9-9 0.19	10-6 0.24	11-3 0.29	11-11 0.35	12-7 0.41	13-2 0.47	13-9 0.54	14-4 0 61
(inches)	**(inches)**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**	**2000**	**2 1 00**	**2200**	**2400**	**2700**	**3000**
2 x4	12.0	8-0 0.96	8-3 1.06	8-6 1.17	8-9 1.28	9-0 1.39	9-3 1.51	9-6 1.63	9- 9 1.76	10-0 1.88	10-5 2.15	11-1 2.56	
	16.0	6- 11 0.83	7-2 0.92	7-5 1.01	7-7 1.11	7- 10 1.21	8-0 1.31	8-3 1.41	8-5 1.52	8-8 1.63	9-0 1.86	9-7 2.22	10- 1 2.60
	24.0	5-8 0.68	5-10 0.75	6-0 0.83	6-3 0.90	6-5 0.99	6-7 1.07	6-9 1.15	6-11 1.24	7-1 1.33	7-5 1.52	7-10 1.81	8-3 2.12
2 x 6	12.0	12-6 0.96	13-0 1.06	13-5 1.17	13-10 1.28	14-2 1.39	14-7 1.51	15-0 1.63	15-4 1.76	15-8 1.88	16-5 2.15	17-5 2.56	
	16.0	10-10 0.83	11-3 0.92	11-7 1.01	11-11 1.11	12-4 1.21	12-8 1.31	13-0 1.41	13-3 1.52	13-7 1.63	14-2 1.86	15-1 2.22	15-11 2.60
	24.0	8-10 0.68	9-2 0.75	9-6 0.83	9-9 0.90	10-0 0.99	10-4 1.07	10-7 1.15	10-10 1.24	11-1 1.33	11-7 1.52	12-4 1.81	13-0 2.12
2x8	12.0	16-6 0.96	17-1 1.06	17-8 1.17	18-2 1.28	18-9 1.39	19-3 1.51	19-9 1.63	20-3 1.76	20-8 1.88	21-7 2.15	22-11 2.56	
	16.0	14-4 0.83	14-10 0.92	15-3 1.01	15-9 1.11	16-3 1.21	16-8 1.31	17-1 1.41	17-6 1.52	17-11 1.63	18-9 1.86	19-10 2.22	20-11 2.60
	24.0	11-8 0.68	12-1 0.75	12-6 0.83	12-10 0.90	13-3 0.99	13-7 1.07	13-11 1.15	14-4 1.24	14-8 1.33	15-3 1.52	16-3 1.81	17-1 2.12
2x 10	12.0	21-1 0.96	21-10 1.06	22-6 1.17	23-3 1.28	23-11 1.39	24-6 1.51	25-2 1.63	25-10 1.76	26-5 1.88	27-7 2.15	29-3 2.56	
	16.0	18-3 0.83	18-11 0.92	19-6 1.01	20-1 1.11	20-8 1.21	21-3 1.31	21-10 1.41	22-4 1.52	22-10 1.63	23-11 1.86	25-4 2.22	26-8 2.60
	24.0	14-11 0.68	15-5 0.75	15-11 0.83	16-5 0.90	16-11 0.99	17-4 1.07	17-10 1.15	18-3 1.24	18-8 1.33	19-6 1.52	20-8 1.81	21-10 2.12

For Sl: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m2.
NOTE: The modulus of elasticity, "*E*," in 1,000,000 pounds per square inch is shown below each span.

TABLE 3608.2.4k
ALLOWABLE SPANS FOR LOW OR HIGH SLOPE RAFTERS
30 Lbs. per Sq. Ft. Live Load (Supporting Gypsum Ceiling)
For Use in Snow Load Zone 2

DESIGN CRITERIA: Strength—15 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines fiber stress. Deflection—For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 240.
RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.
HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (last column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE AND SPACING		ALLOWABLE EXTREME FIBER STRESS IN BENDING, *"Fb,"* (psi)										
(i nches)	(i nches)	300	400	500	600	700	800	900	1000	1100	1200	1300
2 x 6	12.0	5-10 0.13	6-8 0.19	7-6 0.27	8-2 0.36	8-10 0.45	9-6 0.55	10-0 0.66	10-7 0.77	11-1 0.89	11-7 1.01	12-1 1.14
	16.0	5-0 0.11	5-10 0.17	6-6 0.24	7-1 0.31	7-8 0.39	8-2 0.48	8-8 0.57	9-2 0.67	9-7 0.77	10-0 0.88	10-5 0.99
	24.0	4-1 0.09	4-9 0.14	5-4 0.19	5-10 0.25	6-3 0.32	6-8 0.39	7-1 0.46	7-6 0.54	7-10 0.63	8-2 0.72	8-6 0.81
2 x 8	12.0	7-8 0.13	8-10 0.19	9-10 0.27	10-10 0.36	11-8 0.45	12-6 0.55	13-3 0.66	13-11 0.77	14-8 0.89	15-3 1.01	15-11 1.14
	16.0	6-7 0.11	7-8 0.17	8-7 0.24	9-4 0.31	10-1 0.39	10-10 0.48	11-6 0.57	12-1 0.67	12-8 0.77	13-3 0.88	13-9 0.99
	24.0	5-5 0.09	6-3 0.14	7-0 0.19	7-8 0.25	8-3 0.32	8-10 0.39	9-4 0.46	9-10 0.54	10-4 0.63	10-10 0.72	11-3 0.81
2x 10	12.0	9 -9 0.13	11-3 0.19	12-7 0.27	13-9 0.36	14-11 0.45	15-11 0.55	16-11 0.66	17-10 0.77	18-8 0.89	19-6 1.01	20-4 1.14
	16.0	8-5 0.11	9-9 0.17	10-11 0.24	11-11 0.31	12-11 0.39	13-9 0.48	14-8 0.57	15-5 0.67	16-2 0.77	16-11 0.88	17-7 0.99
	24.0	6-11 0.09	8-0 0.14	8-11 0.19	9-9 0.25	10-6 0.32	11-3 0.39	11-11 0.46	12-7 0.54	13-2 0.63	13-9 0.72	14-4 0.81
2 x 12	12.0	11-10 0.13	13-8 0.19	15-4 0.27	16-9 0.36	18-1 0.45	19-4 0.55	20-6 0.66	21-8 0.77	22-8 0.89	23-9 1.01	24-8 1.14
	16.0	10-3 0.11	11-10 0.17	13-3 0.24	14-6 0.31	15-8 0.39	16-9 0.48	17-9 0.57	18-9 0.67	19-8 0.77	20-6 0.88	21-5 0.99
	24.0	8-5 0.09	9-8 0.14	10-10 0.19	11-10 0.25	12-10 0.32	13-8 0.39	14-6 0.46	15-4 0.54	16-1 0.63	16-9 0.72	17-5 0.81
(inches)	(inches)	1 400	1500	1600	1700	1800	1900	2000	2100	2200	2400	
2 x 6	12.0	12-6 1.28	13-0 1.41	13-5 1.56	13-10 1.71	14-2 1.86	14-7 2.02	15-0 2.18	15-4 2.34	15-8 2.51	16-5 2.86	
	16.0	10-10 1.10	11-3 1.22	11-7 1.35	11-11 1.48	12-4 1.61	12-8 1.75	13-0 1.89	13-3 2.03	13-7 2.18	14-2 2.48	
	24.0	8-10 0.90	9-2 1.00	9-6 1.10	9-9 1.21	10-0 1.31	10-4 1.43	10-7 1.54	10-10 1.66	11-1 1.78	11-7 2.02	12-4 2.41
2 x 8	12 0	16-6 1.28	17-1 1.41	17-8 1.56	18-2 1.71	18-9 1.86	19-3 2.02	19-9 2.18	20-3 2.34	20-8 2.51	21-7 2.86	
	16.0	14-4 1.10	14-10 1.22	15-3 1.35	15-9 1.48	16-3 1.61	16-8 1.75	17-1 1.89	17-6 2.03	17-11 2.18	18-9 2.48	
	24.0	11-8 0.90	12-1 1.00	12-6 1.10	12-10 1.21	13-3 1.31	13-7 1.43	13-11 1.54	14-4 1.66	14-8 1.78	15-3 2.02	16-3 2.41
2x 10	12 0	21-1 1.28	21-10 1.41	22-6 1.56	23-3 1.71	23-11 1.86	24-6 2.02	25-2 2.18	25-10 2.34	26-5 2.51	27-7 2.86	
	16.0	18-3 1.10	18-11 1.22	19-6 1.35	20-1 1.48	20-8 1.61	21-3 1.75	21-10 1.89	22-4 2.03	22-10 2.18	23-11 2.48	
	24.0	14-11 0.90	15-5 1.00	15-11 1.10	16-5 1.21	16-11 1.31	17-4 1.43	17-10 1.54	18-3 1.66	18-8 1.78	19-6 2.02	20-8 2.41
2 x 12	12 0	25-7 1.28	26-6 1.41	27-5 1.56	28-3 1.71	29-1 1.86	29-10 2.02	30-7 2.18	31-4 2.34	32-1 2.51	33-6 2.86	
	16.0	22-2 1.10	23-0 1.22	23-9 1.35	24-5 1.48	25-2 1.61	25-10 1.75	26-6 1.89	27-2 2.03	27-10 2.18	29-1 2.48	
	24.0	18-1 0.90	18-9 1.00	19-4 1.10	20-0 1.21	20-6 1.31	21-1 1.43	21-8 1.54	22-2 1.66	22-8 1.78	23-9 2.02	25-2 2.41

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kN/m2.
NOTE: The modulus of elasticity, "E," in 1,000,000 pounds per square inch is shown oelow each span.

ROOF COVERINGS

3609.1 GENERAL

3609.1.1 Application: The provisions of 780 CMR 3609.1 shall control the design and construction of roof coverings for all buildings. Roof coverings shall be listed for their intended use. Materials for which listing is not available shall be required to be approved by the ***State Board of Building Regulations and Standards in accordance with 780 CMR 109.3.4.***

3609.1.2 Requirements: The roof covering shall be capable of accommodating the loads indicated in ***780 CMR 3603.1*** and provide a barrier against the weather to protect supporting elements and the structure beneath.

3609.1.3 Roofing covering materials: Roofs shall be covered with materials as set forth in ***780 CMR 3609.3 through 3609.9.*** Classified roofing shall conform to UL 790, ***as listed in Appendix A,*** and shall be installed when the edge of the roof is less than three feet (914 mm) from a property line ***or as required by city or town ordinance or bylaw.*** The roofing materials set forth in ***780 CMR 3609.4 through 3609.6*** and concrete slabs may be accepted as Class A roofing.

780 CMR 3609.2 DECK PREPARATION

3609.2.1 Supporting construction: Roofing shall be applied only when the supporting roof construction is clean and dry.

3609.2.2 Single layer underlayment: When a single ply of underlayment is required, it shall be laid parallel to the eaves with a two-inch (51 mm) top lap and four-inch (102 mm) end lap nailed sufficiently to hold in place.

3609.2.3 Multiple layer underlayment: When two layers of underlayment are required, they shall be laid shingle fashion parallel to the eaves with 19-inch (483 mm) top lap and 12-inch (305 mm) end lap, with end laps located at least six feet (1829 mm) from end laps in the preceding course, and blind nailed sufficiently to hold in place.

780 CMR 3609.3 ASPHALT SHINGLES

3609.3.1 General: Asphalt shingles shall be applied only to solidly sheathed roofs Asphalt shingles shall be applied according to the manufacturer's printed instructions and 780 CMR 36.

3609.3.2 Slopes of four units vertical in 12 units horizontal (33% slope) or greater: Asphalt shingle roofs shall have an underlayment of not less than one ply of No. 15 felt, applied as required in ***780 CMR 3609.2*** and Table ***3609.3.4.***

3609.3.3 Slopes less than four units vertical in 12 units horizontal (33% slope) but not less than two units vertical in 12 units horizontal (17% slope): Nominally double-coverage asphalt shingles may be installed on slopes as low as two units vertical in 12 units horizontal (17% slope), provided the shingles are approved self-sealing shingles or are hand sealed and are installed with an underlayment consisting of two layers of No. 15 felt, applied as required in ***780 CMR 3609.2*** and Table ***3609.3.4.*** The two layers of felt shall be cemented together, in addition to the required nailing, from the eaves up the roof to overlie a point 24 inches (610 mm) inside the interior wall line of the building. Asphalt shingles shall not be used on roofs with slopes less than two units vertical in 12 units horizontal (17% slope).

3609.3.4 Fasteners: Asphalt shingles shall be fastened according to the manufacturer's printed instructions and Table ***3609.3.4.***

3609.3.5 Valley flashing: Roof valleys shall be flashed by one of the methods listed in ***780 CMR 3609.3.5.1 through 3609.3.5.3.*** Asphalt shingles shall be applied according to the manufacturer's printed instructions.

3609.3.5.1 Sheet metal: Open roof valleys may be provided of not less than No. 28 gage galvanized corrosion-resistant sheet metal and shall extend at least eight inches (203 mm) from the center line each way. Sections of flashing shall be jointed to provide an adequate water lock.

TABLE 3609.3.4
ASPHALT SHINGLE APPLICATION

ROOF OF SLOPE	NOT PERMITTED BELOW 2:12	
	2:12 to less than 4:12	4:12 and over
DECK REQUIREMENT	Asphalt shingles shall be fastened to solidly sheathed roofs. Sheathing shall conform to Tables 3605.3.2.1.1a and 3608.3.3.2	
UNDERLAYMENT Temperate climate	Asphalt strip shingles may be installed on slopes as low as two inches in twelve inches, provided the shingles are approved self-sealing or are hand sealed and are installed with an underlayment consisting of two layers of nonperforated Type 15 felt applied shingle fashion. Starting with an 18-inch-wide sheet and a 36-inch-wide sheet over the eaves, each subsequent sheet shall be lapped 19 inches horizontally.	One layer nonperforated Type 15 felt lapped two inches horizontally and four inches vertically to shed water.
Severe climate: In areas subject to wind-driven snow or roof ice buildup.	Same as for temperate climate, and additionally the two layers shall be solid cemented together with approved cementing material between the plies extending from the eave up the roof to a line 24 inches inside the exterior wall line of the building.	Same as for temperature climate, except that one layer No. 40 coated roofing or coated glass base sheet shall be applied from the eaves to a line 12 inches inside the exterior wall line with all laps cemented together.
ATTACHMENT Type of fasteners	Corrosion-resistant nails, minimum 12-gage ⅜-inch head, or approved corrosion-resistant staples, minimum 16-gage $^{15}/_{16}$-inch-crown width.	
	Fasteners shall be long enough to penetrate into the sheathing ¾ inch or through the thickness of the sheathing, whichever is less.	
No. of fasteners[1]	four per 36-40 inch strip two per nine-18-inch strip	
Exposure Field of roof	Per manufacturer's instructions included with packages of shingles.	
Hips and ridges	Hip and ridge weather exposures shall not exceed those permitted for the field of the roof	
Method	Per manufacturer's instructions included with packages of shingles.	
FLASHINGS Valleys Other flashings	Per 780 CMR 3609.3.5 Per 780 CMR 3609.3.6 and 3609.3.7	

For SI: 1 inch = 25.4 mm.
1. Figures shown are for normal application. For special conditions such as mansard application and where roofs are in special wind regions, shingles shall be attached per manufacturer's instructions.

3609.3.5.2 Roll roofing: Woven or closed valleys may be constructed by centering 36-inch-wide (914 mm) roll roofing material not less than Type 50 in the valley over the underlayment.

3609.3.5.3 Multiple layer flashing: Roof valley flashing may be of laced composition shingles, applied in an approved manner, with an underlay not less than 30-pound (14 kg) felt extending ten inches (254 mm) from the center line each way, or shall be of two layers of 90-pound (41 kg) mineral-surfaced cap sheet cemented together with the bottom layer not less than 12 inches (305 mm) wide laid face down and the top layer not less than 24 inches (610 mm) wide laid face up.

3609.3.6 Side wall flashing: Flashing against a vertical sidewall shall be by the step-flashing method.

Exception: Other methods shall be permitted when installed in accordance with the shingle manufacturer's printed instructions.

3609.3.7 Other flashing: Flashings against vertical front wall, as well as soil stack, vent pipe and chimney flashing, shall be applied according to asphalt shingle manufacturer's printed instructions.

3609.3.8 Hips and ridges: Hip and ridge shingles shall be fastened according to the manufacturer's printed instructions and Table ***3609.3.4.***

780 CMR 3609.4 SLATE SHINGLES

3609.4.1 General: Slate shingles shall be applied in an approved manner and securely fastened with corrosion-resistant nails or corrosion-resistant nails and wire.

3609.4.2 Slate shingles: Slate shingles shall conform to ASTM C406 as listed in Appendix A. Slate shingles shall not be installed on roof slopes below two units vertical in 12 units horizontal (2:12). Double-layer No. 15 felt underlayment shall be required on roof slopes below four units vertical in 12 units horizontal (4:12). Single-layer No. 15 felt underlayment shall be required on all other roof slopes. Slate shingles shall be secured to the roof with two fasteners per slate. The minimum slate headlap shall be three inches (76 mm).

3609.4.3 Valleys: Roof valley flashing shall be provided of not less than No. 28 gage galvanized corrosion-resistant sheet metal and shall extend at least 11 inches (279 mm) from the center line each

way and shall have a splash diverter rib not less than one inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than six inches (153 mm) and shall be provided with an adequate water lock.

780 CMR 3609.5 METAL

3609.5.1 General: Flat sheets or shingles shall be applied only to solid sheathed roofs. Metal roofing shall be applied in an approved manner ***consistent with the manufacturer's recommendations.***

3609.5.2 Materials: Metal roofing shall conform to AA ASM 35, or ASTM A 361 or B 209, ***as listed in Appendix A.***

3609.5.3 Metal shingles: Metal shingles shall not be installed on roof slopes below four units vertical in 12 units horizontal (4:12). Single-layer underlayment of No. 30 felt is required for all metal shingles other than flat metal shingles on all roof slopes.

780 CMR 3609.6 TILE, CLAY OR CONCRETE SHINGLES

3609.6.1 Attachment: All roof tile shall be securely fastened with corrosion-resistant nails or corrosion-resistant nails and wire, or other approved means.

3609.6.2 Interlocking clay or cement tile: Interlocking clay or cement tile shall be installed only over solid sheathing or spaced structural sheathing boards. Interlocking clay or cement tile shall not be installed on roof slopes below four units vertical in 12 units horizontal (4:12). Horizontal battens shall be required on roof slopes over seven units vertical in 12 units horizontal (7:12). Single-layer underlayment is required over solid sheathing on all roof slopes. Reinforced underlayment shall be required where spaced sheathing is installed. Regardless of roof slope, the first three tile courses and all tile within three feet (914 mm) of roof edges, changes in roof slope or changes in slope direction, shall be fastened to the roof. For the field of the roof, fastening is not required on roof slopes below five units vertical in 12 units horizontal (5:12); every tile course shall be fastened on roof slopes five units vertical in 12 units horizontal (5:12) to less than 12 units vertical in 12 units horizontal (12:12); and every tile shall be fastened on roof slopes 12 units vertical in 12 units horizontal (12:12) and over. Tile overlap shall be in accordance with approved manufacturer's installation instructions.

3609.6.3 Noninterlocking clay or cement tile: Noninterlocking clay or cement tile shall not be installed on roof slopes below 2½ units vertical in 12 units horizontal (2½:12). Double-layer underlayment is required on roof slopes below three units vertical in 12 units horizontal (3:12). Single-layer underlayment is required on all other roof slopes. Noninterlocking clay or cement tile shall be secured to the roof with two fasteners per tile. The minimum tile overlap shall be three inches (76 mm).

3609.6.4 Tile lugs: Tile with projection anchor lugs at the bottom of the tile shall be held in position by means of one-inch-by-two-inch wood (25 mm by 51 mm) stripping, treated to resist moisture deterioration, nailed to the roof sheathing over the underlayment or other approved means.

3609.6.5 Nailing and flashing: Nailing and valley flashing shall be the same as required for slate shingles.

780 CMR 3609.7 BUILT-UP ROOFING

3609.7.1 Decking: Built-Up roofing shall be applied only to solid surface roof decks.

3609.7.2 Materials: Built-Up roofing shall conform to UL 55A *as listed in Appendix A.*

3609.7.3 Underlayment: An underlayment of one layer sheathing paper is required under built-up roofing assemblies when the roof deck is constructed of sheathing boards Underlayment is to be applied as specified in *780 CMR 3609.2.*

3609.7.4 Base ply: On nailable decks, a base ply is to be fastened to the deck in accordance with the manufacturer's published specifications and Table 3609.3.4.

3609.7.4.1 Nonnailable decks: On nonnailable decks, cast-in-place concrete or precast concrete, a base ply required by manufacturer's specification shall be cemented or spot mopped to a primed deck as required by the type of deck material, using not less than 20 pounds (9.1 kg) per square of hot asphalt for solid mopping, or not less than ten pounds (4.5 kg) per square for spot mopping, or not less than 1½ gallons (5.7 L) per square of cold bituminous compound, or 25 pounds (11 kg) per square of coal-tar pitch, in accordance with the manufacturer's published specifications. If a base ply is not used, a minimum of three roofing plies applied shingle fashion shall be solidly cemented to the primed deck and cemented together, using no less cementing material than that specified for a solidly cemented base ply.

3609.7.4.2 Insulated decks: On insulated decks, a vapor retarder shall be installed between the deck and the insulation. Insulation shall be of a rigid type suitable for application of a roof covering. The insulation must be properly attached using mechanical fasteners Type II or Type III asphalt in accordance with ASTM D 312. *as listed in Appendix A.* and installed in

accordance with the manufacturer 's published ply specifications. The insulation may be taped if required. A base ply required by the manufacturer's specification shall be solidly cemented to the insulation, using no less cementing material than that specified for a solidly cemented base ply to a primed nonnailable deck. If a base ply is not used, a minimum of three roofing plies applied shingle fashion shall be solidly cemented to the insulation and cemented together, using no less cementing material than that specified for a solidly cemented base ply.

3609.7.5 Membrane over base ply: A minimum of two successive layers of roofing plies shall be solidly cemented shingle fashion to the base ply, using no less cementing material than that specified for a solidly cemented base ply.

3609.7.6 Surfacing: The built-up roofing assembly shall be surfaced by one of the methods described in ***780 CMR 3609.7.6.1 and 3609.7.6.2.***

3609.7.6.1 Mineral aggregate roofs: Mineral aggregate surfaced roofs shall be surfaced with not less than 60 pounds (27 kg) of hot asphalt or 75 pounds (34 kg) of coal-tar pitch in which is embedded not less than 400 pounds (181 kg) of gravel or 300 pounds (136 kg) of crushed slag per roofing square.

3609.7.6.2 Mineral-surfaced cap roofs: Mineral-surfaced cap sheets shall be cemented to the roofing plies using no less cementing material than specified for between the plies.

780 CMR 3609.8 WOOD SHINGLES

3609.8.1 Sheathing requirements: Wood shingles shall be applied to roofs with solid or spaced sheathing. Spaced sheathing boards shall not be less than one inch by four inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers a distance equal to the actual weather exposure of the shingles, not to exceed the dimensions set forth in Table ***3609.8 3.3.***

3609.8.2 Materials: Wood shingle roofing shall conform to CSSB "Grading and Packing Rules for Centigrade Red Cedar Shingles," ***as listed in Appendix A.***

3609.8.3 Installation: Wood shingles shall be laid with a side lap of not less than 1½ inches (38 mm). Joints in adjacent courses shall be offset a minimum of 1½ inches (38 mm) and no two joints in alternate courses shall be in direct alignment. Spacing between shingles shall not be less than ¼ inch (6.4 mm) or more than ⅜ inch (9.5 mm). Wood shingles shall be fastened to the sheathing in accordance with Table ***3609.8.3.***

3609.8.3.1 Roof slope: Shingles shall not be installed on a roof having a slope less than three units vertical in 12 units horizontal (25% slope) On roofs having slopes of three units vertical in 12 units horizontal (25% slope) to less than four units vertical in 12 units horizontal (33% slope), shingles shall be installed with reduced exposures or they shall be installed over an underlayment of not less than one ply of No. 15 felt, applied as required in ***780 CMR 3609.2.***

3609.8.3.2 Valley flashing: Roof valley flashing shall not be less than No. 28 gage corrosion-resistant sheet metal and shall extend ten inches (254 mm) from the center line each way for roofs having slopes less than 12 units vertical in 12 units horizontal (100% slope) and seven inches (178 mm) from the center line each way for slopes of 12 units vertical in 12 units horizontal (100%) slope) and greater. Sections of flashing shall have an end lap of not less than four inches (102 mm).

3609.8.3.3 Weather exposure: Weather exposures shall not exceed those set forth in Table ***3609.8.3.3.*** Hip and ridge weather exposures shall not exceed those permitted for the field of the roof. Wood shingle hip and ridge units shall conform to CSSB "Grading Rules for Shake Hip and Ridge based on the Standards of the Cedar Shake and Shingle Bureau," ***as listed in Appendix A.*** Nails used to fasten hip and ridge units shall be longer than those used in the field of the roof in order to penetrate the sheathing ¾-inch (19 mm) minimum.

3609.8.3.4 Label required: Each bundle of shingles shall be identified by a label of an approved grading or inspection bureau or agency.

780 CMR 3609.9 WOOD SHAKES

3609.9.1 Sheathing requirements: Wood shakes shall be applied to roofs with solid or spaced sheathing. Spaced sheathing boards shall not be less than one-inch-by-four-inch (25 mm by 102 mm) nominal dimensions for shakes installed at maximum 7½-inch (190 mm) exposures and shall be spaced on centers a distance equal to the actual weather exposure of the shakes, not to exceed the dimensions set forth in Table ***3609.8.3.3.*** For 24-inch (610 mm) shakes used in ten-inch (254 mm) exposure, the spaced sheathing shall be either one-inch-by-four-inch (25 mm by 102 mm) nominal dimension board spaced on centers a distance equal to the weather exposure with an additional one-inch-by-four-inch (25 mm by 102 mm) board placed between these boards, or one-inch-by-six-inch (25 mm by 153 mm) nominal dimension boards spaced on centers a distance equal to the weather exposure. The shakes shall be applied over an underlayment as required in Table ***3609.8.3.***

The requirements of 780 CMR 3610.2.14 shall not eliminate the requirement for noncombustible firestopping in accordance with 780 CMR 3610.2.15.

3610.2.15 Chimney firestopping: See 780 CMR 3606.2.7.

3610.2.16 Chimney crickets Chimney shall be provided with crickets when the dimension parallel to the ridgeline is greater than 30 inches (762 mm) and does not intersect the ridgeline. The intersection of the cricket and the chimney shall be flashed and counterflashed in the same manner as normal roof-chimney intersections. Crickets shall be constructed in conformity with Figure 3610.2.16 and Table 3610.2.16.

3610.4 Masonry fireplaces, general: Masonry fireplaces shall conform to the requirements of 780 CMR 3610.4.1 through 3610.4.7.

Note: Masonry fireplaces may be prescriptively constructed or may be of the "Rumford" type or may be of contemporary design; refer, additionally to the BOCA National Mechanical Code; Brick Institute of America, Technical Notes and NFPA 211 as listed in *Appendix A* - also see Figures 3610.4.1a, 1b, 1c, 1d,. 1e, 1f and 1g.

3610.4.1 Fireplace support: Fireplace foundations and supporting walls shall be anchored, supported and reinforced as required in 780 CMR 3610.4.1 through 3610.4.7, Table 3610.4.1, Figure 3610.4.1a and the applicable provisions of 780 CMR 3603 and 3604.

Figure 3610.2.16
CHIMNEY CRICKET

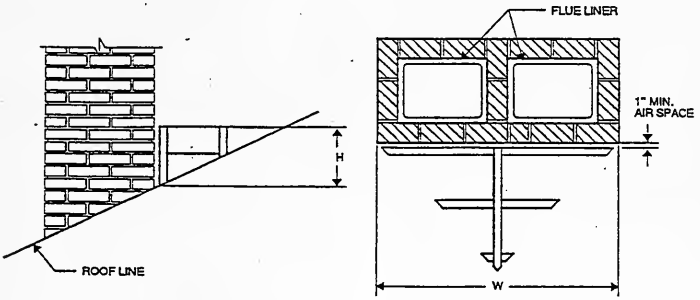


Table 3610.2.16
CRICKET DIMENSIONS

ROOF SLOPE	H
12 - 12	1/2 of W
8 - 12	1/3 of W
6 - 12	1/4 of W
4 - 12	1/6 of W
3 - 12	1/8 of W

3610.3 Factory-built chimneys, general: Factory-built chimneys shall be tested and listed to UL-103 or CAN/ULC-S629-M87 as found in **Appendix A** and shall be installed, operated and maintained in accordance with the conditions of their listing and the manufacturer's requirements. Factory-built chimneys that are listed as part of an assembly with factory-built fireplaces shall conform to 780 CMR 3610.5.1.

Exception: Masonry fireplaces other than those that are prescriptively constructed shall comply with the requirements of 780 CMR 3610.4.1 through 3610.4.7 but may be of a design other than shown in Figure 3610.4.1a - also see Figures 3610.4.1b, 1c, 1d,. 1e, 1f and 1g.

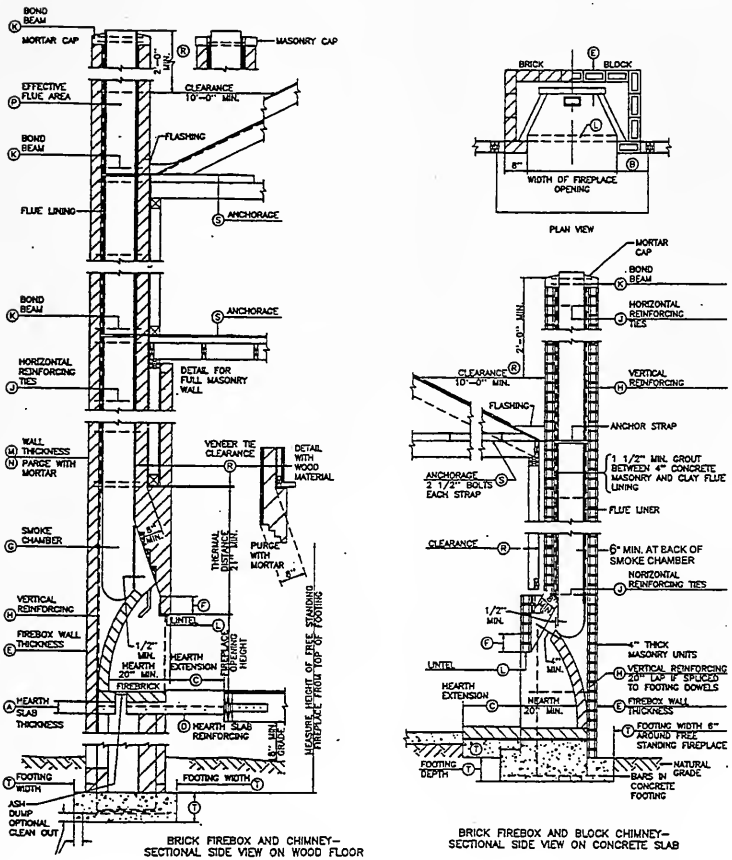
Foundations for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and extend at least six inches (153 mm) beyond the face of the fireplace or supporting wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

Table 3610.4.1
REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS

ITEM	LETTER[1]	REQUIREMENTS
Hearth slab thickness	A	4"
Hearth extension (each side of opening)	B	8" fireplace opening < 6 sq. ft. 12" fireplace opening ≥ 6 sq. ft.
Hearth extension (front of opening)	C	16" fireplace opening < 6 sq. ft. 20" fireplace opening ≥ 6 sq. ft
Hearth slab reinforcing	D	Reinforced as necessary to carry its own weight and all imposed loads
Thickness of wall of firebox	E	10" solid brick or 8" where a firebrick lining is used. Joints in firebrick 1/4" max.
Distance from top of opening to throat	F	8"
Smoke chamber edge of shelf Rear wall - thickness Front wall - thickness	G	 6" 8"
Chimney Vertical reinforcing	-	Seismic load reinforcement not required in Massachusetts
Horizontal reinforcing	-	Seismic load reinforcement not required in Massachusetts
Bond beams	K	No specified requirements
Fireplace lintel	L	Noncombustible material
Walls with flue lining	M	Refer to 780 CMR 3610.2.8
Walls with unlined flue	N	Unlined chimneys are not allowed to be constructed in Massachusetts
Distances between adjacent flues	-	Refer to 780 CMR 3610.2..9
Effective flue area (based on area of fireplace opening)	P	Refer to 780 CMR 3610.2.10 and 3610.2.11
Clearances Wood frame and combustible material Above roof	R	 Refer to 780 CMR 3610.2.14 and 3610.4.7 2' at 10' (780 CMR 3610.2.5)
Anchorage	-	Refer to 780 CMR 3610.4.1 and Figure 3610.4.1a
Footing Thickness Width	T	 12" min. 6" each side of fireplace wall

For SI: 1 inch = 304.8 mm.
1. The letters in this column refer to Figure 3610.4.1a

Figure 3610.4.1a
FIREPLACE AND CHIMNEY DETAILS



Figures 3610.4.1b through 3610.4.1g
TYPICAL FIREPLACE DETAILS

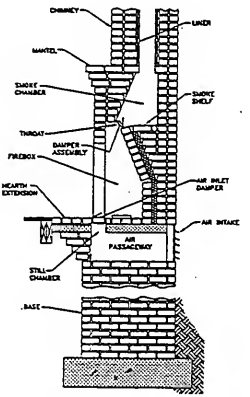


Figure 3610.4.1b
SINGLE-FACE FIREPLACE SECTION

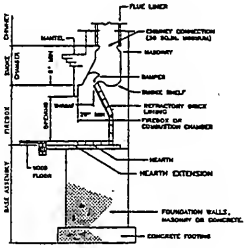


Figure 3610.4.1c
SECTION THROUGH FIREPLACE

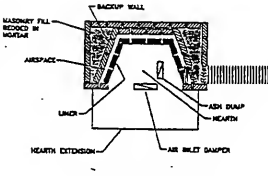


Figure 3610.4.1c
SINGLE-FACES FIREPLACE PLAN

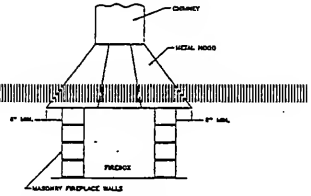


Figure 3610.4.1f
FRONT VIEW OF METAL HOOD OVERHANG

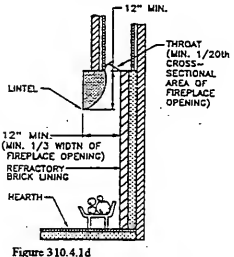


Figure 310.4.1d
RUMFORD REQUIREMENTS

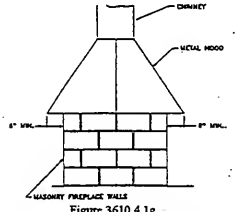


Figure 3610.4.1g
SIDE VIEW OF METAL HOOD OVERHANG

3610.4.2 Seismic reinforcing: Not applicable in Massachusetts.

3610.4.2.1 Seismic anchorage: Not applicable in Massachusetts.

3610.4.3 Fireplace walls: Masonry fireplaces shall be constructed of solid masonry units, stone or reinforced concrete in accordance with Figure 3610.4.1a. When a lining of firebrick at least two inches (51 mm) in thickness is provided, the total thickness of back and sides, including the lining, shall not be less than eight inches (203 mm). When no lining is provided, the thickness of back and sides shall not be less than ten inches (254 mm).

3610.4.3.1 Walls, steel fireplace units: Steel fireplace units shall be listed in accordance with UL 127 as found in ***Appendix A*** and shall be installed, operated and maintained according to their listing, the manufacturer's requirements and any applicable requirements of 780 CMR. Such fireplaces incorporating a fire box liner of not less than ¼ inch (6.4 mm) in thickness and an air chamber, may be installed with masonry to provide a total thickness at the back and sides of not less than eight inches (203 mm), of which not less than four inches (102 mm) shall be of solid masonry. Warm-air ducts employed with steel fireplace units of the circulating air type shall be constructed of metal or masonry.

3610.4.4 Lintel: Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be four inches (102 mm).

3610.4.5 Hearth extension material: Hearth extensions shall be of masonry or concrete at least four inches (102 mm) thick and supported by noncombustible materials and reinforced to carry its own weight and all imposed loads. The hearth extension shall be readily distinguishable from the surrounding floor. Combustible forms and centers used during the construction of the hearth extension shall be removed after the construction is complete.

Exception: When the bottom of the firebox opening is raised at least eight inches (203 mm) above the top of the hearth extension, a hearth extension of not less than ⅜ inch-thick (9.5I mm) brick, concrete, stone, tile or other approved noncombustible material may be used.

3610.4.6 Hearth extension: The hearth and the hearth extension shall extend a minimum of 36 inches (914 mm) from the back of the firebox to the end of the hearth extension. Hearth extensions shall extend at least 16 inches (406 mm) in front of, and at least eight inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is six square feet (0.557 m2) or larger, the hearth extension shall extend at least 20 inches (508 mm) in front of, and at least 12 inches (305 mm) beyond, each side of the fireplace opening.

3610.4.7 Fireplace clearance: Wood or combustible framing shall not be placed within two inches (51 mm) of the outside face of a masonry fireplace and not less than six inches (153 mm) from the inside surface of the nearest flue lining. Wood framing and other combustible material shall not be placed within two inches (51 mm) of the back surface of a masonry fireplace. See Figures 3610.4.7a and 7b.

Figure 3610.4.7a
CONSTRUCTION REQUIREMENTS FOR A TYPICAL MASONRY FIREPLACE IN A WOOD FRAME WALL

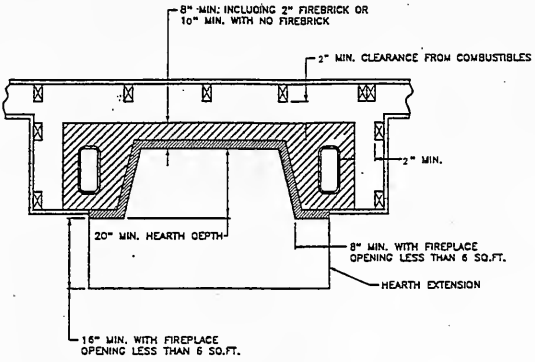
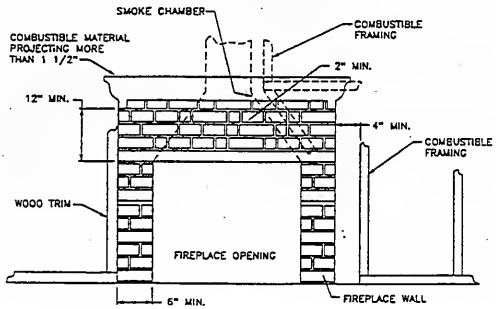


Figure 3610.4.7b
REQUIRED CLEARANCES FROM AMSONRY FIREPLACE TO COMBUSTIBLES



3610.5 Factory-built fireplaces, general: Factory-built fireplaces shall conform to the requirements of 780 CMR 3610.5.1 through 3610.5.4.

3610.5.1 Installation: Factory-built fireplaces that consist of a fire chamber assembly, one or more chimney sections, a roof assembly and other parts shall be tested and listed to UL-127 as found in ***Appendix A***. Such fireplaces may be installed when complying with all the following provisions:

1. The fire chamber assembly is installed to provide clear clearance to combustible materials not less than set forth in the listing.
2. The chimney sections are installed to provide clearance to combustible material not less than specified in the listing and if the fireplace chimney extends through floors and ceilings, factory-furnished firestops or firestop spacers shall be installed. Portions of chimneys which extend through rooms or closets are to be enclosed to avoid personal contact, contact of combustible material, and damage to the chimney.
3. Hearth extensions shall not be less than ⅜-inch-thick (9.5 mm) millboard, hollow metal, stone, tile or other approved noncombustible material. Such hearth extensions may be placed on combustible subflooring or finish flooring. The hearth extension shall be readily distinguished from the surrounding floor.

Note: Where *floor protection* underneath, to the sides, back or in front of factory-built fireplaces is required via testing/listing and/or manufacturer's requirments, refer to

floor protector requirements of 780 CMR 3610.6.7.1 and 3610.6,7,1,1.

4. Hearth extensions shall extend not less than 16 inches (406 mm) in front of and at least eight inches (203 mm) beyond both sides of the fireplace opening.

Exception: Where tested/listed extensions are identified, such hearth extension shall be allowed and required.

5. Factory-built fireplaces shall be installed in accordance with their listing and the manufacturer's installation instructions.

6. The supporting structure for a hearth extension shall be at the same level as the supporting structure for the fire place unit unless otherwise authorized by the listing.

3610.6 Solid fuel burning appliances

3610.6.1 Solid fuel-fired appliances, general: Solid fuel-fired appliances employed for comfort heating include, but are not limited to, room heaters and stoves, fireplace inserts, furnaces and boilers; additionally, the fuel for such appliances includes, but is not limited to: wood and wood pellets, coal and various other solid fuels such as nut shells and corn, etc. Solid fuel-burning appliances shall be tested and listed by *approved agencies* and installed, operated and maintained in accordance with such listing, the manufacturers' requirements and otherwise conform to the requirements of 780 CMR 3610.6.

Note 1: No solid fuel-burning appliance shall be installed in Massachusetts unless such appliance conforms to all applicable requirements of 780 CMR 3610.6, including the testing and listing of all clearances to combustibles and identification of required floor protection.

Note 2: In the absence of explicit requirements of 780 CMR 3610.6, the applicable requirements of NFPA 211 and/or the BOCA National Mechanical Code, as listed in *Appendix A*, shall apply.

3610.6.1.1 Listing standards, Room heaters, stoves and fireplace inserts: Room heaters, stoves and fireplace stoves (inserts), employed for comfort heating shall be listed and tested to UL 1482 and/or ANSI/UL 737 as found in *Appendix A* and as applicable; all such appliances shall bear labeling as required in 780 CMR 3610.6.2 or 3610.6.3 as applicable.

3610.6.1.2 Listing standards, all pellet fueled solid fuel-burning appliances: All pellet solid fuel-burning appliances sold for use in Massachusetts shall conform to 780 CMR 3610.6.1.1 and additionally comply with the certification program set forth by the State Board of Building Regulations and Standards (for pellet appliance certification information, contact the State Board of Building Regulations and Standards).

Note: Commencing January 1, 1998, all pellet solid fuel-burning appliances shall be tested and listed to ASTM E 1509 as found in Appendix A and shall bear such labeling as required in 780 CMR 3610.6.2

3610.6.2 Solid fuel-burning appliance labeling (not central heating appliances): Every solid fuel-burning appliance utilized for comfort heating shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by *an approved testing agency;* such label shall contain the following information:

1. Manufacturer's name and trademark;
2. Model and/or identification number of the appliance;
3. Type(s) of fuel(s) approved;
4. Testing laboratory's name or trademark and location;
5. Date tested;
6. Clearances to combustibles
   (a) Above top
   (b) From front
   (c) From back
   (d) From sides
7. Floor protection
8. National test standard(s)
9. Label serial number

3610.6.3 Solid fuel-burning central heating appliance labeling: Every solid fuel-burning boiler or warm air furnace shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by an approved testing agency; such label shall contain the following information:

1. Manufacturer's name and trademark;
2. Model and/or identification number of the appliance;
3. Type(s) of fuel(s) approved;
4. Testing laboratory's name or trademark and location;
5. Date tested;
6. Clearances to combustibles
   (a) Above top
   (b) From front
   (c) From back
   (d) From sides
7. Floor protection if applicable
8. National test standard(s)
9. Label serial number
10. Type of appliance (boiler or warm air furnace)
11. Every boiler, pressure vessel, or pressure relief device must be stamped in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. ASME stamping shall also be required for boilers, pressure vessels

and pressure relief devices produced outside the United State of America. Where required by the ASME Boiler and Pressure Vessel Code, ASME stamping may be affixed directly to the appliance in lieu of on the data plate.

3610.6.3 Hazardous locations: Solid fuel-burning appliances shall not be installed in hazardous locations (any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances).

Exception: solid fuel-fired appliances listed for such locations.

3610.6.4 Air for combustion and ventilation: Solid fuel-burning appliances shall be installed in a location and manner to assure satisfactory combustion of fuel, proper chimney draft and maintenance of safe operating temperatures. Combustion air may be obtained from interior spaces when the interior space containing the appliance has a volume, in cubic feet equal to one-twentieth (1/20) of the output Btu rating of all fuel-burning appliances in the space. When buildings are so tight as to preclude adequate infiltration, provisions shall be made to introduce outside air for combustion and ventilation.

3610.6..5 Chimney connection: All solid fuel-burning appliances shall be connected to chimneys in accordance with their listing, the manufacturer's requirements and the requirements of 780 CMR 36.

Exception: Solid fuel-burning appliances listed for exhaust vent termination other than through a chimney.

3610.6.5.1 Chimney connector clearance to combustibles: See 780 CMR Table 3610.6.5.1.

3610.6.5.2 Chimney flue size: For solid fuel-burning comfort heating appliances for one- and two family use, the cross-sectional area of the flue shall not be less than the cross-sectional area of the appliance flue collar. The cross-sectional area of the flue shall not be more than three times the cross-sectional area of the flue collar of the appliance.

Table 3610..6.5.1[1,2]
CHIMNEY AND/OR VENT CONNECTOR CLEARANCES TO COMBUSTIBLE MATERIALS/SOLID FUEL-BURNING APPLIANCES ONLY

Description of Appliance	Connector Type	Minimum Clearance (in)	Minimum Clearance (mm)
Residential-Type Appliances	Single-wall Metal Pipe Connector	18	457
Residential-Type Appliances	Type L Vent Piping Connector	9	229
Low-heat Appliances Boilers, Furnaces, Water Heaters	Single-wall Metal Pipe Connector	18	457
Medium-Heat Appliances	Single-wall Metal Pipe Connector	36	914
High-Heat Appliances	Masonry or Metal Connector	Note 3	Note 3

1. For greater detail and guidance, refer to NFPA 211, Section 6-5.
2. For Chimney Connectors tested and listed for other clearances to combustibles, such tested, listed clearances shall apply.
3. Clearances shall be based on engineering calculations and, good engineering practice - Refer to NFPA 211, Section 6-5

APPENDIX A

REFERENCED STANDARDS

Part I

The following is a listing of the standards referenced in 780 CMR, the effective date of the standard, the promulgating agency of the standard and the section(s) of 780 CMR that refer to the standard.

AA **Aluminum Association**
900 19th Street, N.W.
Suite 300
Washington, D.C. 20006

Standard reference number	Title	Referenced in 780 CMR Section number
ASM 35-80	Specification for Aluminum Sheet Metal Work in Building Construction	2002.1, 3609.5.2
SAS 30-94	Specification for Aluminum Structures	2002.1, 3608.4.3

AAMA **American Architectural Manufactures Association**
Suite 310
1540 Dundee Road
Palatine, IL 60067

Standard reference number	Title	Referenced in 780 CMR Section number
1402-86	Standard Specifications for Aluminum Siding, Soffit and Fascia	1405.3.4
101-88	Voluntary Specification for Aluminum Prime Windows and Glass Doors	3606.8.1, 3606.9.1

AASHTO **American Association of State Highway and Transportation Officials**
444 North Capitol Street, N.W.
Suite 225
Washington, D.C. 20001

Standard reference number	Title	Referenced in 780 CMR Section number
HB-15-92	Standard Specifications for Highway Bridges	1606.1.1

ACI **American Concrete Institute**
P.O. Box 19150
Detroit, Michigan 48219

Standard reference number	Title	Referenced in 780 CMR Section number
318-95	Building Code Requirements for Structural Concrete	1705.6.1, 1705.6.2, 1705.6.4 Table 1705.6.3, 1810.2, 1810.6, 1815.2.3, 1821.3.6, 1901.1, 1901.2, 1903.1, 1903.4, 1903.5.2, 1904.1, 1904.2, 1904.2.3 1906.1, 1906.2, 1906.4.2, 1906.5.1, 1906.6.1, 1906.7, 1907.1.3, 1907.1.4, 1908.1, 1908.2, 1908.2.1, 1908.3.1, 1908.3.4, 1908.5.2, 1908.8.2, 1910.1, 1910.3.1, 1910.5, 1910.6.2, 1910.6.5, 3604.4.1
336	Concrete Code	1815.4, 1815.7

Standard reference number	Title	Referenced in 780 CMR Section number
318.1-89	Building Code Requirements for Structural Plain Concrete-with 1992 Revisions.	1810.2, 1812.3.2, 1901.2, 1904.1, 1904.2, *3604.4.1*
506.2-90	Specification for Materials, Proportioning, and Application of Shortcrete	1911.9
ACI 530/ASCE 5/ TMS402-95	Building Code Requirements for Masonry Structures	707.3 1812.3.2, Table 1812.3.2, 2101.1.1, 2101.1.2, 2104.2, 2104.2.1, 2104.3, 2104.4, 2106.3.1, 3604.4.1, 3606.4.1
ACI 530.1/ ASCE6/TMS 602-95	Specifications for Masonry Structures	Table 1705.7, 2112.1.1

AFPA

American Forest and Paper Association
1111 19TH Street, NW, Suite 800
Washington, D.C. 20036

Standard reference number	Title	Referenced in 780 CMR Section number
NDS-91	(National Design) Specification for Wood Construction Design Values for Wood Construction	3608.2.2, 2312.1, 2312.4, 2313.3.1, 2313.3.2
TR-7	Basic Requirements for Permanent Wood Foundations Systems	3603.22.3.4

AHA

American Hardboard Association
520 N. Hicks Road
Palatine, Illinois 60067

Standard reference number	Title	Referenced in 780 CMR Section number
A135.4-95	Basic Hardboard	1405.3.1
A135.6-90	Hardboard Siding	1405.3.2, 2309.7, Table 3607.3.4
A194.1-85	Cellulosic Fiber Board	2309.1, Table 3606.2.3(a)

AISC

American Institute of Steel Construction, Inc.
Suite 3100
One East Wacker Drive
Chicago, Illinois 60601-2001

Standard reference number	Title	Referenced in 780 CMR Section number
ASD-89	Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design	Table 1705.5.2, 2203.1, 2203.5, 2208.1
LFRD-93	Load and Resistance Factor Design Specifications for Structural Steel Buildings	Table 1705.5.2, 2203.1, 2203.5, 2208.1
AISC-92	Seismic Provisions for Structural Steel Buildings	2203.2, 2203.2.1

AISI **American Iron and Steel Institute**
Suite 1300
1010 17th Street, N.W.
Washington, D.C. 20036-4700

Standard reference number	Title	Referenced in 780 CMR Section number
AISI-73	Criteria for Structural Applications of Steel Cables for Buildings	2207.2
CFSD-ASD-86	Specification for Design of Cold- Formed Steel Structural Members - with 1989 Addendum	2206.1, 2206.3 2206.3.1
CFSD-LRFD-91	Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members	2206.1, 2206.3, 2206.3.1

AITC **American Institute of Timber Construction**
Suite 407
1818 S. E. Mill Plain Blvd.
Vancouver, Washington 98684

Standard reference number	Title	Referenced in 780 CMR Section number
108-93	Standard for Heavy Timber Construction	2304.1
109-90	Standard for Preservative treatment of Structural Glued Laminated Timber	2313.1.1
112-93	Standard for Tongue and Groove Heavy Timber Roof Decking	2304.1
117-93	Standard Specifications for Structural Glued Laminated Timber of Softwood Species (Design)	2304.1
119-96	Standard Specifications for Hardwood Glued Laminated Timber	2304.1
A190.1-92	Structural Glued Laminated Timber	2304.1

ANSI **American National Standards Institute**
11 West 42nd Street
New York, New York 10036

Standard reference number	Title	Referenced in 780 CMR Section number
A108.1-92	Specifications for the installation of Ceramic Tile with Portland Cement Mortar	2105.10, 3607.2.4
A108.4-92	Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive	2105.10.7, 3607.2.4
A108.5-92	Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar	2105.10.1, 2105.10.3, 3607.2.4
A108.6-92	Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy	2105.10.4 3607.2.4
A108.7-92	Specifications for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar	2105.10.2,
A117.1		426.14
A108.8-92	Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout	2105.10.5
A108.9-92	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout	2105.10.6
A108.10-92	Installation of Grout in Tilework	2105.10.8
A108.11-90	Installation of Interior Cementitious Backer Units	3607.2.4
A118.1-92	Specifications for Dry-Set Portland Cement Mortar	2105.10.1, 3607.2.4
A118.2-92	Specifications for Conductive Dry-Set Portland Cement Mortar	2105.10.2
A118.3-92	Specifications for Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive	2105.10.4, 3607.2.4
A118.4-92	Specifications for Latex-Portland Cement Mortar	2105.10.3
A118.5-92	Specifications for Chemical Resistant Furan	2105.10.5
A118.6-92	Specifications for Ceramic Tile Grouts	2105.10.8
A118.8-92	Specifications for Modified Epoxy Emulsion Mortar/Grout	2105.10.6
A136.1-92	Specification for Organic Adhesives for Installation of Ceramic Tile, Types I and II	2105.10.7, 3607.2.4
A137.1-88	Specifications for Ceramic Tile	2105.4, 3607.2.4

Standard reference number	Title	Referenced in 780 CMR Section number
A208.1-93	Wood Particleboard	2308.1, 2308.2, 3605.3.3.1, 3606.11.1, 3608.3.3.1
Z97.1-84	Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings	2406.1, 3603.20.1, 3603.20.4.1.1
Z21.66-85	Electrically Operated Automatic Vent Damper Devices for Use with Gas-fired Appliances	3621.2.2.2
NWWDA I.S.2-87	Industry Standard for Wood Window Units	3606.8.1
NWWDA I.S.3-88	Industry Standard for Wood Sliding Doors	3606.9.1

APA **American Plywood Association**
P.O. Box 11700
Tacoma, WA 98411

Standard reference number	Title	Referenced in 780 CMR Section number
E30-90	Design and Construction Guide: Residential and Commercial	3608.3.2.3

ASCE **American Society of Civil Engineers**
345 East 47th Street
New York, NY 10017

Standard reference number	Title	Referenced in 780 CMR Section number
ASCE 3-84	Specifications for the Design and Construction of Composite Slabs	2206.1.1
ASCE 5/ACI 530/TMS 402-95	Building Code Requirements for Masonry Structures	707.3, 1705.7, Table 1705.7, 1812.3.2 Table 1812.3.2, 2101.1.1, 2104.2, 2104.3, 2104.4, 2106.3.1
ASCE 6/ACI 530.1/TMS 602-95	Specifications for Masonry Structures	2112.1.1
ASCE 7-95	Minimum Design Loads for Buildings and Other Structures	1604.2, 1605.1, 1611.12, 1611.12.2
ASCE 8-SSD-LRFD/ASD-90	Specifications for Design of Cold-Formed Stainless Steel Structural Members	2206.1, 2206.3, 2206.3.1

ASHRAE **American Society of Heating,**
Refrigerating and Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, Georgia 30329-2305

Standard reference number	Title	Referenced in 780 CMR Section number
90.1-1989	Energy Code for Commercial and High Rise Residential Buildings	1314.5.2

ASME

American Society of Mechanical Engineers
345 East 47th Street
New York, New York 10017

Standard reference number	Title	Referenced in 780 CMR Section number
A13.1-81(85)	Scheme for Identification of Piping Systems	416.15.3
B31.3-93	Chemical Plant and Petroleum Refinery Piping	416.15

ASTM

American Society for Testing Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

Standard reference number	Title	Referenced in 780 CMR Section number
A6-95c	Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use	Table 1705.5.2
A36-94	Specification for Structural Steel	1818.1, 2105.9.5, 3606.4.14
A82-95	Specification for Steel Wire, Plain, for Concrete Reinforcement	2105.9.2, 2105.9.5, 3606.4.14
A153-95	Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware	2105.9.6, Table 3606.4.14.1
A167-94a	Specification for Stainless and Heat-Resisting Chromium-Nickel steel Plate, Sheet, and Strip	2105.9.2, 2105.9.5, 2105.9.6, 3604..14, Table 3606.4.14.1
A185-94	Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement	2105.9.4, 2105.9.5
	(Note: ASTM A256 - 82 has been discontinued and not replaced by ASTM)	
A252-93	Specification for Welded and Seamless Steel Pipe Piles	1818.1, 1819.1
A283-93a	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	1818.1, 1819.1
A361-94	Specification for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process for Roofing and Siding	1507.3.7, 3609.5.2
A366-91	Specification for Steel, Sheet, Carbon, Cold-Rolled Commercial Quality	2105.9.5
A416-94a	Specification for Steel Strand, Uncoated Seven Wire for Prestressed Concrete	1821.3.2
A496-95	Specification for Steel Wire, Deformed, for Concrete Reinforcement	2105.9.3
A 497-95	Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement	2105.9.4
A510-82	Specification for Wire Rods and Course Round Wire, Carbon Steel	3606.4.14
A 525-91b	Specification for General Requirements for Steel Sheet, Zinc - Coated (Galvanized) by the Hot - Dip Process	2105.9.6, Table 3606.4.14.1, 3619.1.1.1.3
A 568-95	Specification for Steel Sheet, Carbon and High - Strength, Low - Alloy, Hot - Rolled and Cold - Rolled, General Requirements for	Table 1705.5.2
A 572 -94c	Specification for High - Strength Low Alloy Columbium - Vanadium Steels of Structural Quality	1818.1
A 588 -94	Specification for High - Strength Low Alloy Structural Steel with 50 ksi (345 Mpa) Minimum Yield Point to 4 in. (100 mm) Thick	1818.1
A 615 -95c	Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement	2105.9.1
A 616 -95b	Specification for Rail - Steel Deformed and Plain Bars for Concrete Reinforcement	2105.9.1
A 617 -95b	Specification for Axle - Steel Deformed and Plain Bars for Concrete Reinforcement	2105.9.1
A 641 -92	Specification for Zinc-Coated (Galvanized) Carbon Steel Wire	2105.9.6, Table 3606.4.14.1
A 706 -95b	Specification for Low - Alloy Steel Deformed Bars for Concrete Reinforcement.	1705.6.1, 1906.5.2, 2105.9.1
A 755 -95	Specification for Steel Sheet, Metallic - Coated by the Hot - Dip Process and Prepainted by the Coil - Coating Process for Exterior Exposed Building Products	1507.3.7
B101-92	Specification for Lead - Coated Copper Sheets	1507.3.7

Standard reference number	Title	Referenced in 780 CMR Section number
B 209-89	Specification for Aluminum and Aluminum-Alloy Sheet and Plate	3609.5.2
B 227-80	Specifiation for Hard-Drawn Copper-Clad Steel Wire	3606.4.14
C 5 -79	Specification for Quicklime for Structural Purposes (Re-approved 1992)	Table 2505.2, 3607.2.2
C 28-92	Specifications for Gypsum Plasters	Table 2505.2, 3607.2.2
C 31-95	Practice for Making and Curing Concrete Test Specimens in the Field	1908.3.2, 1908.3.3
C 33-93	Specifications for Concrete Aggregates	1906.3, Table 1907.1.1
C 34-93	Specifications for Structural Clay Load-Bearing Wall Tile	2105.2,
C 35-95	Specifications for Inorganic Aggregates for Use in Gypsum Plaster	Table 2505.2, 3607.2.2
C 36-92	Specifications for Gypsum Wallboard	Table 2503.2, 3607.2.3.1
C 37-92	Specifications for Gypsum Lath	Table 2505.2, 3607.2.2
C 39-94	Test Method for Compressive Strength of Cylindrical Concrete Specimens	1908.3.2
C 55-95	Specification for Concrete Building Brick	2105.1
C 56-93	Specification for Structural Clay Non-Load-Bearing Tile	2105.2
C 59-91	Specifications for Gypsum Casting and Molding Plaster	Table 2505.2, 3607.2.2
C 61-95	Specifications for Gypsum Keene's Cement	Table 2505.2, 3607.2.2
C 62-95a	Specifications for Building Brick (Solid Masonry Units made from from Clay or Shale)	2105.2, 3602.2
C 67-94	Test Methods of Sampling and Testing Brick and Structural Clay Tile	2112.5
C 73-95	Specifications for Calcium Silicate Face Brick (Sand Lime Brick)	2105.1
C 79-95	Specifications for Gypsum Sheathing Board	Table 2503.2, Table 3606.2.3(a)
C 90-85	Hollow Load-Bearing Concrete Masonry Units	3602.2
C 94-95	Specifications for Ready-Mix Concrete	1908.5.1
C 126-95	Specifications for Ceramic Glazed Structural Clay Facing Tile, Facing Brick and Solid Masonry Units	2105.2
C129-85	Nonload-Bearing Concrete Masonry Units	3602.2
C145-85	Solid Load-Bearing Concrete Masonry Unit	3602.2
C150-95	Specification for Portland Cement	1906.2, 1907.1.2.1, 1907.1.2.2.3, 1908.2.1, 1908.2.2, Table 2505.2, 3604.2.2
C 172-90	Practice for Sampling Freshly Mixed Concrete	1908.3.2
C 206-84	Specification for Finishing Hydrated Lime	Table 2505.2
C 208-95	Specification for Cellulosic Fiber Insulating Board	2309.1, Table 3606.2.3(a)
C 212-93	Specification for Structural Clay Facing Tile	2105.2
C 216-95a	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).	2105.2
C 222-91	Specifications for Asbestos-Cement Roofing Shingles	1507.2.1
C 231-91b	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.	1907.1.1
C 260-95	Specification for Air-Entraining Admixtures for Concrete	1906.6.2
C 270-95	Specification for Mortar for Unit	2105.7, 3606.7.1.1
C 330-89	Specification for Lightweight Aggregates for Structural Concrete	1906.3
C 406-89	Specification for Roofing Slate	1507.2.7, 3609.4.2
C 474-94	Test Methods for Joint Treatment Materials for Gypsum Board Construction	Table 2503.2
C 475-94	Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.	Table 2503.2, 3607.2.3.1
C476-95	Specification for Grout for Masonry	2105.11, 3606.7.1.1
C494-92	Specification for Chemical Admixtures for Concrete	1906.6.2
C503-89	Specification for Marble Dimension Stone (Exterior)	2105.3
C514-94	Specification for Nails for the Application of Gypsum Wallboard	Table 2503.2, 3607.2.3.1
C532-88	Specification for Structural Insulating Formboard (Cellulosic Fiber)	2309.1
C 557-93	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.	3607.2.3.1
C 568-89	Specification for Limestone Dimension Stone	2105.3
C 578-87	Specification for Preformed Cellular Polytyrene Thermal Insulation	3604.3.3
C 587-91	Specification for Gypsum Veneer Plaster	Table 2505.2, 3607.2.2
C 588-95	Specification for Gypsum Base for Veneer Plasters	Table 2505.2, 3607.2.2
C 595-95a	Specification for Blended Hydraulic Cements	1907.1.2.1, 1907.1.2.2.1, 1907.1.2.2.2, 1908.2.2, 3604.2.2

Standard reference number	Title	Referenced in 780 CMR Section number
C 615-92	Specification for Granite Dimension Stone	2105.3
C 616-95	Specification Quartz- Based Dimension Stone	2105.3
C 618-95	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete	1906.6.3, 1907.1.2.1, 1907.2.2.1
C 629-89	Specification for Slate Dimension Stone	2105.3
C 630-95	Specification for Water - Resistant Gypsum Backing Board	Table 2503.2, 2503.4 3607.2.4.1
C 631-95a	Specification for Bonding Compounds for Interior Plastering	Table 2505.2, 3607.2.2
C 645-95a	Specification for Non-Load (Axis) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board	Table 2503.2, Table 2505.2, 3607.2.3.3
C 652-95c	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)	2105.2
C 685-95	Specification for Concrete Made by Volumetric Batching and Continuous Mixing	1908.5.1
C 744-95a	Specification for Prefaced Concrete and Calcium Silicate Masonry Units	2105.1
C 754-95a	Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board	Table 2504.1
C 836-89a	Specification for High- Solids Content, Cold Liquid- Applied Elastometric Waterproofing Membrane for Use With Separate Wearing Course	1507.3.6
C 841-90	Specification for Installation of Interior Lathing and Furring	Table 2504.1
C 842-85	Specification for Application of Interior Gypsum Plaster	Table 2504.1
C 843-94	Specification for Application of Gypsum Veneer Plaster	Table 2504.1, 3607.2.2
C844-85	Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster	Table 2504.1, 3607.2.2
C847-93	Specification for Metal Lath (Re-approved 1992)	Table 2505.2, 3607.2.2
C887-95	Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar	1813.3.2.2, 2105.8, 3604.6.1
C897-95a	Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters	Table 2505.2, 3607.2.2
C926-95	Specification for Application of Portland Cement Based-Plaster	2506.3
C932-85	Specification for Surface-Applied Bonding Agents for Exterior Plastering	Table 2505.2
C933-85	Specification for Welded Wire Lath (Re-approved 1990)	Table 2505.2, 3607.2.2
C946-91	Practice for Construction of Dry-stacked, Surface-Bonded Walls	2105.8, 2106.4
C954-93	Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness	Table 2503.2, Table 2505.2, 3607.2.3.5
C955-95b	Specification for Load Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum and Metal Plaster Bases	Table 2505.2, 3607.2.3.3
C957-93	Specification for High- Solids Content, Cold Liquid- Applied Elastometric Waterproofing Membrane with Integral Wearing Surface	1507.3.6
C960-91	Specifications for Predecorated Gypsum Board	3607.2.3.1
C989-95	Specification for Ground Granulated Blast - Furnace Slag for Use in Concrete and Mortars	1906.6.4, 1907.1.2.1, 1907.1.2.2.2,
C1002-93	Specification for Drill Screws for the Application of Gypsum Board or Metal Plaster Bases	Table 2503.2, Table 2505.2, 3607.2.3.1, 3607.2.3.5
C1007-83	Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs Accessories and Related Accessories	Table 2504.1
C1029-90	Specification for Spray - Applied Rigid Cellular Polyurethane Thermal Insulation	1507.3.5
C1032-86	Specification for Woven Wire Plaster Base (Re-approved 1990)	3607.2.2
C1047-85	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base (Re-approved 1990)	3607.2.2, 3607.2.3.1
C1063- 95a	Specification for Installation of Lathing and Furring for Portland Cement - Based Plaster	2506.3, 3607.2.2

Standard reference number	Title	Referenced in 780 CMR Section number
C1088-94	Specification for Thin Veneer Brick Units Made from Clay or Shale	2105.2
D1586		
D25-91	Specification for Round Timber Piles	1822.1
D56-93	Test Method for Flash Point by Tag Closed Tester	307.2
D86	Test Method for Distillation of Petroleum Products	307.2
D93-94	Test Methods for Flash Point by Pensky-Martens Closed Tester	307.2
D224-89	Specification for Smooth- Surfaced Asphalt Roll Roofing (Organic Felt)	1507.2.2
D225-95	Specification for Asphalt Shingles (Organic Felt) Surfaced With Mineral Granules	1507.2.3
D226-95	Specification for Asphalt- Saturated Organic Felt Used in Roofing and Waterproofing	Table 1507.3.1
D227-95	Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing	Table 1507.3.1
D249-89	Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules	1507.2.2
D312-95	Specification for Asphalt Used in Roofing	Table 1507.3.1, 3609.7.4.2
D323-94	Test Method for Vapor Pressure of Petroleum Products (Reid Method)	307.2
D368	Tension Load Test	
D371-89	Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; Wide- Selvage	1507.2.2
D450-91	Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing	Table 1507.3.1
	(Note 568-77 has been discontinued and not replaced by ASTM)	
D635-91	Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position	2601.2, 2604.1
D1143-81	Test Method for Piles under Static Axial Compressive Load	1817.4.2, 1817.4.3
D1227-87	Specification for Emulsified Asphalt Used as a Protective Coating for Roofing	1507.3.6
D1248-84 (1989)	Specification for Polystyrene Plastics Molding and Extrusion Materials	3619.1.1.2
D1557	Test methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop	1804.3.2, 1805.3
D 1586-84	Method for Penetration Test and Split Barrel Sampling of Soils	Table 1804.3, App. D
D1761-88	Test Methods for Mechanical Fasteners in Wood	2312.1, 2312.2, 2312.3
D1784-90	Specification for Rigid Poly (Vinyl Chloride) (PFC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds	3619.1.1.2
D1863- 86	Specification for Mineral Aggregate Used on Built-Up Roofs	Table 1507.3.1
D 1929-93	Test Method for Ignition Properties of Plastics	2601.2, 2604.2
D2178-89	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	Table 1507.3.1
D2412-87	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	3619.1.1.2
D2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)	Appendix D
D2488	Practice for description and Identification of Soils (Visual-Manual Procedure)	Appendix D
D2626-95	Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing	Table 1507.3.1
	(Note: D2277-87 has been discontinued and not replaced by ASTM)	
D2843-93	Test Method for Density of Smoke from the Burning or Decomposition of Plastics	2601.2, 2604.1
D2898-94	Methods for Accelerated Weathering of Fire-Retardant Tested Wood for Fire Testing	1506.2, 2310.3
D2938		Table 1804.3, App. D
D3161-81	Test Method for Wind Resistance of Asphalt Shingles	1505.2.3
D3201-94	Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-based Products	2310.3
D3462-93a	Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules	1507.2.3
D3468-90	Specification for Liquid- Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing	1507.3.6
D3672-86	Specification for Venting Asphalt - Saturated and Coated Inorganic Felt Base Sheet Used in Roofing	Table 1507.3.1
D3679-88	Rigid Poly (Vinyl Chloride) (PVC) Siding	Table 3607.3.4
D3689-90	Test Method Individual Piles under Static Axial Tensile Load	1817.7.2
D3746-85	Test Method for Impact Resistance of Bituminous Roofing Systems	1505.3.2

Standard reference number	Title	Referenced in 780 CMR Section number
D3909-95a	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules	1507.2.2, Table 1507.3.1
D3966-90	Test Method for Piles Under Lateral Loads	1817.6.2
D4099-89	Specification for Poly (Vinyl Chloride) (PVC) Prime Wndows	3606.8.1
D4272-90a	Test Method for Total Energy Impact of Plastic Films by Dart Drop	1505.3.2
D4434-87	Specification for Poly (Vinyl Chloride) Sheet Roofing	1507.3.3
D4601-95	Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing	Table 1507.3.1
D4637-87	Specification for Vulcanized Rubber Sheet Used in Single-Ply Roof Membrane.	1507.3.2
D5055-95a	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists	2313.5
E72-95	Methods of Conducting Strength Tests of Panels for Building Construction	2305.7
E84-95b	Test Method for Surface Burning Characteristics of Building Materials	412.3.6.3, 428.11, 704.4.1.2, 722.2, 722.3, 803.2, 803.3.2, 2310.2, 2601.2, 2603.3, 2603.6.3, 2603.7.4, 2604.1, 2805.2.2, 3105.3, 3603.17.1.1, 3603.17.2.6, 3603.17.3, 3603.18.3, 3603.19.1, 3603.19.2, 3612.2
E90-90	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions	1214.2, 3603.4.3.1
E96-90	Standard Test for Water Vapor Transmission of Materials	
E108-95	Test Methods for Fire Tests of Roof Coverings	1506.1, 1506.2, 2608.2, 2608.3
E119-95a	Test Methods for Fire Tests of Building Construction and Materials	412.3.6.2, 704.1.1, 705.2.4 705.4, 707.7.2, 707.7.3, 707.8.1.2, 709.6.1, 709.6.2, 709.6.4, 709.7.1.2, 713.4.2, 2105.2, 2603.4, 3603.4.1
E136-95	Test Method for Behavior of Materials in Vertical Tube Furnace at 750°C	704.4.1.1, 3612.2
E152-81a	Methods of Fire Tests of Door Assemblies	716.1, 716.1.1, 3603.17.3
E163-84	Methods of Fire Tests of Window Assemblies	718.1, 719.1
E283-91	Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified PressureDifferences Across the Specimen	3606.8.2, 3606.9.2
E492-90	Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine	1214.3, 3603.4.3.3
E648-95	Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source	805.2
E814-94b	Test Method for Fire Tests of Through-Penetration Fire Stops	707.7.2, 707.7.3, 709.6.1, 709.6.2, 713.4.1
E838-81	Practice for Performing Accelerated Outdoor Weathering Using Concentrated Natural Sunlight	1505.3.1
E970-89	Test Method for Critical Rdiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Sources	3603.19.4
E1509-	Specification for Room Heaters, Pellet Fuel-Burning Type	
G23-95	Practice for Operating Light- Exposure Apparatus (Carbon- Arc Type) With and Without Water for Exposure of Nonmetallic Materials	1505.3.1
G26-95	Practice for Operating Light- Exposure Apparatus (Xenon- Arc Type) With and Without Water for Exposure of Nonmetallic Materials	1505.3.1
G53-95	Practice for Operating Light- and Water- Exposure Apparatus (Fluorescent UV - Condensation Type) for Exposure of Nonmetallic Materials	1505.3.1

AWPA **American Wood Preservers Association**
P.O. Box 286
Woodstock, Maryland 21163-0286

Standard reference number	Title	Referenced in 780 CMR Section number
C1-95	All Timber Products -Preservative Treatment by Pressure Processes	1506.3, 2311.3, 3603.22.3.1
C2-95	Lumber, Timber, Bridge Ties and Mine Ties -Preservative Treatment by Pressure Processes	1808.1, 1808.2, 2311.3, 2311.4, 2311.5, 2311.7, 3603.22.3.1, 3603.22.4
C3-95	Piles - Preservative Treatment by Pressure Processes	1808.1, 1822.2, 3603.22.3.1
C4-95	Poles - Preservative Treatment by Pressure Processes	3603.22.3.1
C9-95	Plywood- Preservative Treatment by Pressure Processes	2311.3, 2311.4, 2311.5, 2311.7, 3603.22.3.1, 3603.22.4
C15-90	Wood for Commercial-Residential Constrruction Preservative Treatment by Pressure Process	3603.22.3.1
C18-90	Standard for Pressure-treated Material in Marine Construction	3603.22.3.1
C20-93	Structural Lumber - Fire- Retardant Treatment Pressure Processes	2310.2, 3603.22.3.1
C22-93	Lumber and Plywood for Permanent Wood Foundations - Preservative Treatment by Pressure Processes	1808.3, 3603.22.3.1, 3604.2.1.2, 3605.4.3
C23-84	Round Poles and Posts Used in Building Construction, Preservative Treatment by Pressure Process	3603.22.3.1
C24-86	Sawn Timber Piles Used for Residential Commerce Building	3603.22.3.1
C27-93	Plywood- Fire-Retardant Treatment by Pressure Process	2310.2, 3603.22.3.1
C28-90	Standard for Preservative Treatment of Structural Glues-Laminated Members and Laminations Before Cluing of Southern Pine, Pacific Coast Douglas Fir, Hem-fir and Western Hemlock by Pressure Process.	
M4-95	Standard for the Care of Preservative- Treated Wood Products	1822.2
P1/P13-95	Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water) Use	2311.3, 3603.22.3.1
P2-95	Standard for Creosote Solutions	2311.3, 3603.22.3.1
P3-89	Standard for Creosote - Petroleum Oill Solution	3603.22.3.1
P5-95	Standards for Waterborne Preservatives	2311.3, 3603.22.3.1, 3604.2.1.2
P8-95	Standards for Oil- Borne Preservatives	2311.3, 3603.22.3.1
P9-92	Standards for Solvents and Formulations for Organic Preservative Systems.	2311.3, 3603.22.3.1

AWS **American Welding Society**
550 N.W. Lejeune Road
P.O. Box 351040
Miami, Florida 33135

Standard reference number	Title	Referenced in 780 CMR Section number
D1.1-92	Structural Welding Code- Steel	1705.5.3.2.1
D1.4-92	Structural Welding Code- Reinforced Steel	1906.5.2

BOCA

Building Officials and Code Administrators International
4051 West Flossmoor Road
Country Club Hills, Illinois 60477-5795

Standard reference number	Title	Referenced in 780 CMR Section number
BNFOC-93	BOCA National Fire Prevention Code **Note:** 527 CMR is the Fire Prevention code for Massachusetts	
BNMC-93	BOCA National Mechanical Code	201.3, 307.8, 408.4.1, 408.5, 411.3, 416.9, 417.1, 417.3, 418.3.1.4, 418.3.2, 418.3.2.3, 418.3.3, 418.3.4, 419.2, 419.2.1, 602.4.2, 602.4.3, 717.2, 722.2, 913.1, 1203.1, 1208.3, 1209.1, 1210.3, 2114.2, 2114.9, 2305.12, 2801.2, 2802.1, 2802.3, 2804.1, 2805.2.3, 2805.2.4, 2808.3, 2811.1, 3107.6, 3309.2, 3603.6.7.1
BNPC-93	BOCA National Plumbing Code **Note:** 248 CMR is the Plumbing Code for Massachusetts	

CGSB

Canadian General Standards Board
Technical Information Unit
PC1, Phase III, Place Du Portage
Hull, Ottawa, Canada K1A 1G6

Standard reference number	Title	Referenced in 780 CMR Section number
37-GP-52M-84	Roofing and Waterproofing Membrane, Sheet Applied, Elastometric	1505.3.2, 1507.3.2
37-GP-54M-79	Roofing and Waterproofing Membrane, Sheet Applied, Flexible, Polyvinyl Chloride	1507.3.3
37GP-56M-80	Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing - with Dec. 1985 revision	1507.3.4

CPSC

Consumer Product Safety Commission
Office of the Secretary
Washington, D.C. 20207

Standard reference number	Title	Referenced in 780 CMR Section number
16CFR Part 1201-77	Safety Standard for Architectural Glazing	2405.1, 2406.1, 2407.2, 3603.20.4.1, 3603.20.4.1.1
16CFR Part 1209-86	Interim Safety Standard for Cellulose Insulation	722.4
16CFR Part 1404-86	Cellulose Insulation	722.4
16CFR Part 1500-84	Hazardous Substances and Articles; Administration and Enforcement Regulations	307.2
16CFR, Part 1630 (DOC FF-1)-70	Standard for the Surface Flammability of Carpets and Rugs	805.3, 805.5

CSA

Canadian Standards Association
178 Rex Dale Boulevard
Rex Dale, Ontario, Canada M9W1R3

Standard reference number	Title	Referenced in 780 CMR Section number
CSA 0437-M92	OSB and Waferboard	3605.3.2.1.2, 3608.3.2.1.3

CSSB **Cedar Shake and Shingle Bureau**
515 116TH Avenue, NE, Suite 275
Bellevue, WA 98004

Standard reference number	Title	Referenced in 780 CMR Section number
CSSB-84	Grading and Packing Rules for Certigrade Red Cedar Shingles (Revised February 1, 1984)	3609.8.2
CSSB-85	Grading and Packing Rules for Cert-Split Red Cedar Shakes (Revised October 1, 1985)	3609.9.2
CSSB-90	Grading Rules for Shake Hip and Ridge based on the Standards of the Cedar Shake and Shingle Bureau	3609.8.3.3, 3609.9.3.4
CSSB-90	Grading Rules for Certi-Sawn Taper-Sawn Cedar Shakes (Revised May 30, 1990)	3609.9.2
CSSB-90	Wood Shakes (Preservative Treated) based on Grading and Packing Rules for Treated Southern Pine Taper-Sawn Shakes of the Cedar Shake and Shingle Bureau	3609.9.3
CSSB-93	Grading Rules for Wood Shakes and Shingles	3607.2.6, 3607.3.5
	Exterior and Interior Walls - Design and Application Manual for, 1989	
	New Roof Coverings - Red Cedar Shingle and Shake Design and Application Manual for, 1989	
	Red Cedar Shingles - Grading Rules for Certi-Grade, 1984	
	Wood Shakes -	
	Grading Rules for Certi-Sawn Taper Sawn Red Cedar Shakes, 1981	
	Grading Rules for Certi-Split Red Cedar Shakes, 1985	
	Wood Shingles -	
	Grading Rules for Certi-Grade Shingles, 1984	

CWC **Canadian Wood Council**
1730 St. Laurent Boulevard - Suite 350
Ottawa, Ontario, Canada K1G 5L1

Standard reference number	Title	Referenced in 780 CMR Section number
CWC-87	Canadian Dimension Lumber Data Book	3608.2.2

DOC **United States Department of Commerce**
National Institute of Standards and Technology
Gaithersburg, MD 20899

Standard reference number	Title	Referenced in 780 CMR Section number
PS 1-95	Construction and Industrial Plywood	2306.4.6, 2307.1, 3606.10.1, 3608.3.2.1, Table 3604.4.3.3
PS 2-95	Performance Standard for Wood- Based Structural- Use Panels	2307.1, 3604.4.3.3, 3605.3.2.1, 3605.3.2.1.2, 3606.10.1 3608.3.2.1
PS 20-94	American Softwood Lumber Standard -with 1991 Amendments	2302.1, 3604.4.3.1, 3605.2.1, 3606.2.1, 3608.2.1
FF-1(CPSC 16 CFR, Part 1630) -70	Standard for the Surface Flammability of Carpet and Rugs	805:3, 805.5

DOTn **U.S. Department of Transportation**
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402-9325

Standard reference number	Title	Referenced in 780 CMR Section number
49 CFR, Part 100-178 & 179-199 -88	Specification for Transportation of Explosive and Other Dangerous Articles, Shipping Containers	307.2

EIA

Electronics Industries Association
2001 Pennsylvania Avenue, NW
Washington, D.C. 20006

Standard reference number	Title	Referenced in 780 CMR Section number
222-E - 91	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures	3108.4

FM

Factory Mutual Engineering Corporation
Standards Laboratories Department
1151 Boston Providence Turnpike
Norwood, Massachusetts 02062

Standard reference number	Title	Referenced in 780 CMR Section number
4450-90	Approval Standard for Class I Insulated Steel Deck Roofs -with Supplement (July 1992)	1505.2.2, 2603.4.1.5
4470-86	Approval Standard for Class 1 Roof Coverings -with Supplement 3 (August 1992)	1505.2.2, 1505.3.2
4880-94	Test Procedure for Building Corner Fire Test	2603.8, 3603.17.3

GA

Gypsum Association
103 Orrington Avenue, Suite 1210
Evanston, IL 60201

Standard reference number	Title	Referenced in 780 CMR Section number
GA 253-93	Recommended Specification for the Application of Gypsum Seathing	Table 3606.2.3(a)

HPMA

Hardwood Plywood Manufactures Association
1825 Michael Faraday Drive, P.O. Box 2789
Reston, Virginia 22090-2789

Standard reference number	Title	Referenced in 780 CMR Section number
HP-83	Hardwood and Decorative Plywood	2307.1, 3607.2.5
HP-SG-86	Structural Design Guide for Hardwood Plywood Wall Panels	2307.1, 3605.3.2.1, 3606.10.1

MASSACHUSETTS, COMMONWEALTH OF
CODE OF MASSACHUSETTS REGULATIONS (CMR)

Specific numbers have been established by the Massachusetts Office of the Secretary of State to identify for reference purposes all rules and regulations promulgated by agencies of the Commonwealth of Massachusetts. These numbers are designated as "Code of Massachusetts Regulations" (CMR's). Although they may not be cited in the text of 780 CMR, the CMR's listed below are pertinent to building construction and design or maintenance.

Board of State Examiners of Plumbers and Gas Fitters
100 Cambridge Street
Boston, MA 02202

CMR number	Title	780 CMR Section number
248 CMR 2.00	Massachusetts State Plumbing Code	201.3, 408.4, 418.3.4, 421.7, 602.4.3, 1212.7, 1813.5.3
248 CMR 4.00 - 7.00	Massachusetts Fuel Gas Code	

Department of Mental Health
25 Staniford Street
Boston, MA 02114

104 CMR 17.13		429.1, 429.1.6

Department of Mental Retardation
160 North Washington Street
Boston, MA 02114

115 CMR 7.00 - 8.00		423.1.1, 427.1.1.1

Outdoor AdvertisingBoard
100 Cambridge Street, Floor 20
Boston, MA 02002

711 CMR 3.00	Control and Restriction of Billboards, Signs and Other Advertising Devices	

Department og Emvironmental Protection
One Winter Street
Boston, MA 02208

310 CMR		401.2

Department of Public Health
150 Tremont
Boston, MA 02111

105 CMR 130.000	Hospital Licensure	
105 CMR 140.000	Licensure of Clinics Designer's Guide (Bureau of Planning and Construction) Dispensaries and Clinics, December 21, 1966-	
105 CMR 151.000	General Standards of Construction for Long Term Care Facilities in Massachusetts	
105 CMR	Intensive Care Unit Amendment, October 1, 1972	
105 CMR 400.000	State Sanitary Code Chapter I: General Administrative Procedures	
105 CMR 410.000	Minimum Standards of Fitness for Human Habitation (State Sanitary Code: Chapter II):	
105 CMR 420.000	Housing and Sanitation Standards for Farm Labor Camps (State Sanitary Code: Chapter III)	
105 CMR 430.000	Minimum Sanitation and Safety Standards for Recreational Camps for Children (State Sanitary Code: Chapter IV)	
105 CMR 435.000	Minimum Standards for Swimming Pools (State Sanitary Code: Chapter V)	421.7
105 CMR 440.000	Minimum Standards for Developed Family Type Campgrounds (State Sanitary Code: Chapter VI)	
105 CMR 590:000	State Sanitary Code Chapter X - Minimum Sanitation Standards for Food Establishments	

Division of Industrial Safety
100 Cambridge Street, 11th Floor
Boston, MA 02202

454 CMR 2.00	Toilets in Industrial Establishments *Industrial Bulletin No. 4*	
454 CMR 10.00	Construction Industry Rules and Regulations *Industrial Bulletin No. 12*	
454 CMR 11.00	Structural Painting Safety Code *Industrial Bulletin No. 13*	
454 CMR 12.00	Requirements for the Care of Employees Injured or Taken Ill in Industrial Establishments *Industrial Bulletin No. 14*	
454 CMR 16.00	Lighting Code for Factories, Workshops, Manufacturing, Mechanical and Mercantile Establishments *Industrial Bulletin No. 18*	
454 CMR 19.00	Window Cleaning *Industrial Bulletin No. 21*	

Architectural Access Board
Department of Public Safety
One Ashburton Place, 13 th Floor
Boston, MA 02108

Standard reference number	Title	Referenced in 780 CMR Section number
521 CMR 1.00 - 47.00	Architectural Access Board Regulations	401.2, 421.5.5, 424.4.10

Board of Boiler Rules
Department of Public Safety
One Ashburton Place, Roon 1301
Boston, MA 02108

522 CMR 2.00	Construction of Power Boilers	
522 CMR 3.00	Power Boilers, Power Reactor Vessels and Piping and Unfired Pressure Vessels as Used in Atomic Energy Installations	401.2
522 CMR 4.00	Steam and Hot Water Boilers and Heat Storage Sources	401.2
522 CMR 5.00	Heating Boilers	401.2
522 CMR 6.00	Low Pressure Heating Boilers	401.2
522 CMR 7.00	Air Tanks	401.2
522 CMR 8.00	Air Tanks	401.2
522 CMR 9.00	Refrigeration and Air Conditioning Systems	401.2
522 CMR 10.00	Material Specifications	401.2
522 CMR 11.00	Welding Specifications	401.2
522 CMR 12.00	Fiberglass-reinforced Plastic Pressure Vessels	401.2

Board of Elevator Regulations
One Ashburton Place, Roon 1301
Boston, MA 02108

524 CMR 2.00 - 11.00	Elevator and Escalator Regulations	403.8
524 CMR 15.00-34.00	Elevator, Dumbwaiter, Escalator, and Moving Walk Regulations	403.8

Board of Fire Prevention and Regulation
1010 Commoowealth Avenue
Boston, MA 02215

527 CMR :		
527 CMR 3.00	Dry Cleaning and Dry Dyeing and the Keeping, Storage and Use of Cleaning and Dyeing Fluids	401.2
527 CMR 4.00	Oil Burning Equipment	401.2
527 CMR 5.00	Operation and Maintenance of Buildings or Other Structures Used as Garages, Service Stations and the Related Storage, Keeping and Use of Gasoline or Other Motor Fuel	401.2, 408.6
527 CMR 6.00	Liquefied Petroleum Gas Containers and Systems	401.2, 418.3.3
527 CMR 7.00	Manufacture and Handling of Plastics	401.2
527 CMR 9.00	Tanks and Containers	401.2, 3103.1
527 CMR 10.00	Prevention of Fire in Buildings and in or on Ships	401.2, 426.15
527 CMR 12.00	1993 National Electrical Code (Amendments)	401.2, 403.9.1, 405.8, 405.9, 410.4.5, 414.5, 416.11, 416.14.6, 416.15.2, 417.5.4, 421.7, 426.14. 3102.6.3, 3102.13.1, 3107.7
527 CMR 14.00	Flammable and Combustible Liquids, Flammible Solids or Flammable Gases	401.2, 417.1, 417.2.1, 417.3, 417.5, 417.5.1, 417.5.2, 417.5.3, 417.6, 417.6.1, 417.6.3, 418.3.2, 418.1, 418.2, 418.2.1, 418.3, 418.3.1, 418.4, 418.5, 705.2.1
527 CMR 21.00	Decorations, Curtains, Draperies, Blinds and Other Window Treatments	401.2
527 CMR 49.03		426.5, 426.6. 429.1, 429.1.6

NCMA **National Concrete Masonry Association**
2302 Horse Pen Road, P.O. Box 781
Herndon, VA 22070

Standard reference number	Title	Referenced in 780 CMR Section number
NCMA TR68-A-75	Design and Construction of Plain and Reinforced Concrete Masonry Basement and Foundation Walls	3604.4.1

NFPA **National Fire Protection Association**
Batterymarch Park
Quincy, Massachusetts 02269

Standard reference number	Title	Referenced in 780 CMR Section number
10-94	Portable Fire Extinguishers	920.2
11-94	Low Expansion Foam And Combined Agent Systems	911.1, 911.5
11A-94	Medium and High Expansion Foam Systems	911.1, 911.5
12-93	Carbon Dioxide Extinguishing Systems	909.1, 909.5
12A-92	Halon 1301 Fire Extinguishing Systems	912.1, 912.5
12B-90	Halon 1211 Fire Extinguishing Systems	912.1, 912.5
13-96	Installation of Sprinkler Systems	412.7, 416.4, 426.3, 426.6, 706.2, 906.2.1, 906.9.1, 907.2.1, 917.7.3
13D-94	Installation of Sprinkler Systems in One- and Two- Family Dwellings and Mobile Homes	423.6, 427.3.5, 906.2.3
13 R-96	Installation of Sprinkler Systems in Residential Occupancies Up to Four Stories in Height	426.7, 906.2.2, 923.1
14-95	Standpipe and Hose Systems	914.1, 914.3, 914.4, 914.5, 914.6
15-96	Water Spray Fixed Systems for Fire Protection	908.1, 908.4
16-95	Deluge Foam- Water Sprinkler and Spray Systems	911.1, 911.5
17-94	Dry Chemical Extinguishing System	910.1, 910.5
17A-94	Wet Chemical Extinguishing Systems	913.1, 913.5
20-96	Installation of Centrifugal Fire Pumps	924.1, 924.2, 924.3
22-96	Standard for Water Tanks for Private Fire Protection	
24-95	Installation of Private Fire Service Mains	417.6.3, 906.9.1, 914.6.1
25-95	Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems	901.4
30-96	Flammable and Combustible Liquids Code	307.8, 416.14, 418.3.2, 419.2.3, 426.3, 426.5, 426.11
30A-96	Automotive and Marine Service Station Code	408.6, 417.6.6
30B-94	Manufacture and Storage of Aerosol Products	426.3, 426.12
31-92	Oil Burning Equipment	3612.1
32-96	Dry Cleaning Plants	418.3.4
33-95	Spray Application Using Flammable and Combustible Materials	307.8, 419.1
34-95	Dipping and Coating Processes Using Flammable or Combustible Liquids	307.8, 419.1
40-94	Cellulose Nitrate Motion Picture Film	411.1
50-96	Bulk Oxygen Systems at Consumer Sites	2810.1
51-92	Oxygen-Fuel Gas Systems for Welding, Cutting and Allied Processes	2810.1
54-92	National Fuel Gas Code	3612.1.1
61-95	Prevention of Fire and Dust Explosions in Agricultural Food Products Facilities	418.3.1
65-93	Processing and Finishing of Aluminum	418.3.1
69-92	Explosion Prevention Systems	417.5.1.2
70-96	National Electrical Code (527 CMR 12.00: Massachusetts Amendments)	416.11, 416.14.6, 416.15.2, 602.4.4, 1405.4.3, 3102.6.3, 3102.13.1, 3107.7 *See also 527 CMR 12.00*
72-96	National Fire Alarm Code	403.6, 417.5.3, 426.14, 427.3.7, 427.3.8, 428.12.1, 428.16, 906.5, 917.1, 917.7.1.1, 917.6, 917.7, 917.7.3, 917.8.1, 917.9, 917.10, 918.1, 918.2.1, 918.8, 919.1, 919.6, 921.4, 923.1, 923.2, 923.2.1, 923.2.2, 923.2.3
80-95	Fire Doors and Windows	716.2, 716.5, 1017.4.4
80A-96	Protection of Buildings from Exterior Fire Exposures	

Standard reference number	Title	Referenced in 780 CMR Section number
82-94	Incinerators, Waste and Linen Handling Systems and Equipment	2807.1
90A-96	Installation of Air Conditioning and Ventilation Systems	
90B-96	Installation of Warm Air Heating and Air Conditioning Systems	
92A-96	Smoke Control Systems	
92B-95	Smoke Management System in Malls, Atria and Alrge Areas	
96-96	Ventilation Control and Fire Protection of Commercial Cooking Operations	
99-96	Health Care Facilities	2809.1, 2809.2
104-94	Life Safety Code	
102-95	Assembly Seating, Tents and Membrane Structures	3104.4
120-94	Coal Preparation Plants	418.3.1
130-95	Standard for Fixed Guideway Systems	
211	Chimney, Fireplace and Vents	3610.4
231-95	General Storage	426.3, 426.6
231C-95	Rack Storage of Materials	507.1, 426.3, Table 922.2
231D-94	Storage of Rubber Tires	426.3, 426.6
241-96	Safeguarding Construction, Alteration and Demolition Operations	903.1.5, 915.1, 914.7.2
259-87	Standard Test Method for Potential Heat of Building Materials	3603.17.2.5
409-95	Aircraft Hangers	426.3, 426.5, 426.6
416-93	Construction and Protection of Airport Terminal Buildings	
418-95	Roof-top Heliport Construction and Protection	1511.3
430-95	Storage of Liquid and Solid Oxidizers	426.3, 426.5, 426.6
495-96	Explosive Material Code	417.5.1 *See also 527 CMR*
502-96	Access Highways, Tunnels, Bridges, Air Right Structures	
651-93	Manufacture of Aluminum or Magnesium Powder	418.3.1
654-94	Prevention of Fire, and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries	418.3.1
655-93	Prevention of Sulfur Fires and Explosions	418.3.1
664-93	Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	418.3.1
701-96	Standard Methods of Fire Tests for Flame Resistant Textiles and Films	807.2, 807.2.2, 3102.6.4.2, 3103.3.2, 3104.5, 3105.3
704-96	Identification of the Fire Hazards of Materials	416.2, 416.15.1
750-96	Installation of Water Mist Fire Protection Systems	
8503-96	Pulverized Fuel Systems	418.3.1

NFoPA (AFPA)

American Forest and Paper Association*
1250 Connecticut Avenue, N.W./ Suite 200
Washington, D.C. 20036

Standard reference number	Title	Referenced in 780 CMR Section number
NDS-91	National Design Specification for Wood Construction -with 1991 Supplement; Design Values for Wood Construction	1801.1, 2303.1, 2304.1, 2305.14.1, 2305.15, 2306.4, 2306.4.5.1, 2306.4.5.2, 2306.4.6, 2306.4.6.1.1, 2306.4.6.2.1, 2306.4.7.1.1, 2306.4.7.2.1, 2312.1, 2312.4, 2313.3.1, 2313.3.2
TR7-87	Basic Requirements for Permanent Wood Foundation System	1808.3, 1813.3, 2311.3.3

**The National Forest Products Association (NFoPA) has changed their name to the American Forest and Paper Association (AFPA). The referenced standard in this code may be identified with the designation AFPA.*

RCSC

Research Council On Structural Connections
c/o American Institute of Steel Construction, Inc.
Suite 3100
One East Wacker Drive
Chicago, IL 60601-2001

Standard reference number	Title	Referenced in 780 CMR Section number
RCSC-85	Specifications for Structural Joints Using A325 or A490 Bolts	1705.5.3.2.1
RCSC-88	Specification for Load and Resistance Design	

RMA

Rubber Manufacturers Association
1200 K Street, N.W.
Washington, D.C. 20005

Standard reference number	Title	Referenced in 780 CMR Section number
RP-1- 90	Minimum Requirements for Non- Reinforced Black EPDM Rubber Sheets	1507.3.2
RP-2-90	Minimum Requirements for Fabric- Reinforced Black EPDM Rubber Sheets	1507.3.2
RP-3-85	Minimum Requirements for Fabric- Reinforced Black Polychlorprene Rubber Sheets	1507.3.2

SJI

Steel Joist Institute
1205 48th Avenue North
Suite A
Myrtle Beach, South Carolina 29577

Standard reference number	Title	Referenced in 780 CMR Section number
SJI-94	Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders	2205.1

SMACNA

Sheet Metal and Air Conditioning Contractors
National Association, Inc.
4201 Lafayette Center Drive
Chantilly, VA 22021

Standard reference number	Title	Referenced in 780 CMR Section number
SMACNA-88	Installation Standards for Residential Heating and Air Conditioning Systems	3619.1.3.1

TFS

Texas Forest Service
Forest Products Laboratory
P.O. Box 310
Lufkin, Texas 75902-0310

Standard reference number	Title	Referenced in 780 CMR Section number
TFS-90	Grading Rules for Preservative Treated Southern Yellow Pine Tapersawn Shakes	1507.2.9

TMS

The Masonry Council
Suite B
2619 Spruce Street
Boulder, CO 80302-3808

Standard reference number	Title	Referenced in 780 CMR Section number
TMS 402/ACI 530/ ASCE 5-95	Building Code Requirements for Masonry Structures	707.3, Table 1705.7, 1812.3.2, Table 1812.3.2, 2101.1.1, 2104.1, 2104.2, 2104.3, 2104.4.1, 2104.4.2, 2106.3.1
TMS 602/ACI 530.1/ASCE 6-95	Specifications for Masonry Structures	Table 1705.7, 2104.2, 2112.1.1

TPI

Truss Plate Institute Inc.
Suite 200
583 D'Onofrio Drive
Madison, Wisconsin 53719

Standard reference number	Title	Referenced in 780 CMR Section number
PCT-80	Design Specification for Metal Plate Connected Parallel Chord Wood Trusses	2305.14.1, 2313.3.2, 3605.2.10, 3608.2.11
TPI 1-95	National Design Standard for Metal Plate Connected Wood Truss Construction	2305.15 , 2313.3.1, 3605.2.10, 3608.2.11
TPI BWT-76	Bracing Wood Trusses: Commentary and Recommendations	3605.2.10, 3608.2.11
TPI QST-89	Quality Standard for Metal Plate Connected Wood Trusses	3605.2.10, 3608.2.11

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, Illinois 60062

Standard reference number	Title	Referenced in 780 CMR Section number
10A-93	Standard for Safety Tin- Clad Fire -with Revisions through May 1985	716.2
14B-93	Standard for Safety Sliding Hardware for Standard, Horizontally Mounted Tin-Clad Fire Doors -with Revisions through October 1984	716.2
14C-93	Standard for Safety Swinging Hardware for Standard Tin-Clad Fire Doors Mounted Singly and in Pairs -with Revisions through October 1984	716.2
55A-83	Material for Built-up Roof Coverings (Revised 1989)	3609.7.2
103-94	Standard for Safety Chimneys, Factory Built, Residential Type and Building Heating Appliance -with Revisions through February 1989	720.6.4, 3612.2
127-88	Standard for Safety Factory-Built Fireplaces -with Revisions through June, 1992.	720.6.4
181-90	Factory-Made Air Ducts and Air Connectors (Revised November, 1990)	3619.1.2
181A-90	Closure System for Use with Rigid Air Ducts and Connectors	3619.1.2
217-93	Standard for Safety Single and Multiple Station Smoke Detectors -with Revisions through February 1989	409.5.1
268-89	Standard for Safety Smoke Detectors for Fire Protective Signaling Systems -with Revisions through May 1989	409.5.1
441-86	Gas Vents	3612.2
555-95	*Fire Dampers*	717.1
559-85	Heat Pumps (Revised December, 1987)	3614.2.1
580-94	Standard for Safety Tests for Uplift Resistance of Roof Assemblies -with Revisions through December 1989	1505.2.2
641-86	Low-Temperature Venting Systems, Type L	3612.2
790-83	Tests for Fire Resistance of Roof Covering Material (Revised, 1989)	3609.1.3
910-95	Standard for Safety Test for Flame Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air	2805.2.5
997-81	Standard for Safety Wind Resistance of Prepared Roof Covering Materials -with Revisions through July, 1981	1505.2.3
1040-71	Outline of Investigation for Insulated Wall Construction	3603.17.3
1096-86	Electric Central Air Heating Equipment (Revised January, 1988)	3614.1.12
1256-85	Standard for Safety Fire Test of Roof Deck Constructions	2603.4.1.5
1715-94	Fire Test of Interior Finish Material -with Revisions through March 1991	2603.8, 3603.17.3
1777-88	Chimney Liners (Revised November, 1989)	3610.2.14

Standard reference number	Title	Referenced in 780 CMR Section number
1040-89	Outline of Proposed Investigation for Insulated Wall Construction	2603.8
1820-94	Standard for Safety Fire Test Pneumatic Tubing for Flame and Smoke Characteristics - with Revisions through April 1991	2805.2.6
1887-95	Fire Tests of Plastic Sprinkler Pipe for Flame and Smoke Characteristics	2805.2.1

USC

United States Code
c/o Superintendent of Documents
U.S. Governmeot Printiog Office
Washiogtoo, D.C. 20402-9325

Standard reference number	Title	Referenced in 780 CMR Section number
Title 18; Chapter 40-70	Importation, Manufacture, Distribution and Storage of Explosive Materials	307.2

WWPA

Western Lumber

Standard reference number	Title	Referenced in 780 CMR Section number
WWPA-92	Western Lumber Span Tables for Floor and Ceiling Joists and Roof Rafters	3608.2.2

of rain and snow, sized by the criteria in ***780 CMR 1210.***

J7.5.1.1 With a ceiling vapor barrier installed: Attics with a ceiling vapor barrier must be ventilated with screened openings of at least one square foot of free vent area for each 300 square feet of ceiling area.

J7.5.1.2 Without a ceiling vapor barrier installed: Attics without a ceiling vapor barrier installed shall be ventilated with screened openings of at least one square foot of free vent area for each 150 square feet of ceiling area.

J7.5.1.3 Eave vents: When eave vents are installed, adequate baffling shall be provided to deflect the incoming air above the surface of the insulation. Baffles shall be installed prior to insulation, and shall be installed over the exterior wall at an angle to provide a two inch minimum clearance under the roof deck for upward flow of ventilation air to the fixed vents in the upper portion of the attic.

J7.5.1.4 Ridge or gable vent: When eave vents are installed, the ridge or gable vent must be at least three feet above the level of the eave vents.

J7.5.2 Underfloor space ventilation:

J7.5.2.1 With a ground vapor barrier: Underfloor spaces with an approved vapor barrier installed on the ground surface shall be ventilated with screened openings of one square foot of vent area for each 1,500 square feet of crawl space. Vents shall be positioned to provide cross ventilation. ***See 780 CMR 1210.***

J8.0 COMPONENT DESIGN

J8.1 Scope: All low rise residential buildings that are heated or mechanically cooled shall be constructed so as to provide the required thermal performance of the various components listed in 780 CMR J8.0, J9.0 and 780 CMR 1310 through 1312, and to provide the lighting switching requirements of 780 CMR 1313.2.2.1.

J8.2 Thermal Performance: Information on thermal properties, performance of building envelope sections and components, and heat transfer shall be obtained from laboratory or field test measurements, or when information is not available from these sources, then such information may be obtained from the ASHRAE Handbook, 1993 of Fundamentals as listed in ***Appendix A.***

When laboratory or field test measurements are used, they shall be conducted in accordance with ASTM standards:

1. C-177-85/R1993, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate,
2. C-518-91, Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter,
3. C-236-89/R1993, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box, or
4. C-976-90, Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box,

each as listed in ***Appendix A.***

To determine thermal conductance through window assemblies the following ASTM, American Architectural Manufacturers Association (AAMA), or National Fenestration Rating Council (NFRC) standards shall be used.

1. AAMA 1503.1-1988, Test Method of Thermal Transmittance of Windows, Doors and Glazed Wall Sections,
2. ASTM C-236-89/R1993, Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of Guarded Hot Box,
3. ASTM C-976-90, Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box, or
4. NFRC 100-91 Procedure for Determining Fenestration Product Thermal Properties, each as listed in ***Appendix A.***

When using any of the four test procedures above, a 15 mile per hour wind shall be applied perpendicular to the glazing and applied in other directions as required by the subject standard..

J8.3 Gross wall area: For the purposes of Appendix J, the gross area of exterior walls consists of all opaque wall areas, including foundation walls, areas between floor spandrels, peripheral edges of floors, window areas including sash, and door areas, where such surfaces enclose a heated or mechanically cooled space including interstitial areas between two such spaces, but excluding vents, grills and pipes.

J8.4 Roof assembly: For the purpose of Appendix J, a roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thereby creating a building transmission heat loss or gain, where such assembly encloses a heated or mechanically cooled space.

J8.4.1 Gross roof area: The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights, exposed to the heated or mechanically cooled space.

J8.4.2 Ceiling plenums: Where air ceiling plenums are employed, the roof/ceiling assembly shall:

1. for thermal transmittance purposes not include the ceiling proper nor the plenum space as part of the assembly; and
2. for gross area purposes be based upon the interior face of the upper plenum surface.

J8.5 Swimming pools: All pool enclosures shall be designed in accordance with the 1993 edition of the

ASHRAE Applications Handbook, as listed in *Appendix A*.

Such pool enclosures shall have a maximum overall (roof/gables/sidewalls) U value of 0.25.

J9.0 EXTERIOR ENVELOPE REQUIREMENTS FOR LOW RISE RESIDENTIAL BUILDINGS

J9.1 Criteria for low rise residential buildings: The following requirements shall apply to all buildings and structures or portions thereof in use groups R-1, R-2, R-3, and R-4 (hotels, multi-family, and one- and two-family) that are heated or mechanically cooled and not more than three stories high.

1. All buildings in these use groups shall conform to the thermal transmittance values in Table J9.1 or shall be designed to satisfy the requirements of 780 CMR J9.3 or shall be designed to satisfy the requirements of 780 CMR 1315.
2. An overall Uo value of 0.167 for structures heated by oil, gas or heat pumps, or an overall Uo of 0.105 for structures heated by electric resistance may be used for the combination of walls, doors and windows containing heated space in lieu of the separate U values listed for walls, doors and windows. The overall Uo of 0.167 or 0.105 shall be used when the windows exceed 15% of the gross exterior wall area.
3. For purposes of 780 CMR J9.0 only, framing members shall not be included in the calculations of R and U values.

TABLE J9.1
MAXIMUM U VALUES AND MINIMUM R VALUES OF WALLS, ROOF/CEILING, AND FLOORS FOR RESIDENTIAL BUILDINGS OF J9.1

ELEMENT	DESCRIPTION	U VALUE	TOTAL R VALUE	NOTES
Walls	All wall construction containing heated or mechanically cooled space	0.08	12.5	1
	Electric resistance heating	0.05	20.0	1
Foundation Walls Including Band Joist	Containing heated or mechanically cooled space	0.08	12.5	-
	Containing unheated space	0.08	12.5	4
Roof/Ceiling Assembly	All roof construction containing heated or mechanically cooled space	0.033	30.0	-
Windows	All construction enclosing heated or mechanically cooled space	0.65	1.54	2
	Electric resistance heating	0.40	2.50	6. 7
Doors	All construction enclosing heated or mechanically cooled space	0.40	2.50	-
Floors	Floor sections over areas exposed to outside air or unheated space	0.05	20.0	3
	Slab on grade beneath conditioned space	-	10.0	5

Note 1: These values may be used when the doors and windows do not exceed 15% of the gross exterior wall area. When doors and windows exceed 15% of the gross wall area, see 780 CMR J9.1, item 2.

Note 2: Double glazed primary windows or single glaze primary windows with storm windows will satisfy the required U value of 0.65.

Note 3: Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of 0.08.

Note 4: The U value requirement of zero point zero eight for foundation walls may be omitted when floors over unheated spaces are provided with a U value of 0.05.

Note 5: R value for perimeter insulation (see 780 CMR J6.4.6).

Note 6: When doors and windows do not exceed 15% of the gross exterior wall area, this value may be used. When doors and windows do not exceed 10% of the gross exterior wall area, windows having a U value of 0.65 (R value of 1.54) may be used. When windows and doors exceed 15% of the gross exterior wall area, see 780 CMR J9.1, item 2.

Note 7: Double glazed primary windows with storm windows or most triple glazed primary windows or double glazed low emissivity primary windows will satisfy the required U value of 0.40.

APPENDIX K

FLOOR PROTECTOR THERMAL CONDUCTIVITY CALCULATIONS

(Reference 780 CMR 3610.7.1 and 3610.6.7.1.1)

OVERVIEW

Floor protection requirements for heat producing appliances are typically included as part of the tested/listed installation criteria for such appliances.

Such floor protection, listed as a thermal conductivity factor is often developed utilizing NFPA SUBJECT 1618, "OUTLINE OF INVESTIGATION FOR WALL PROTECTORS, FLOOR PROTECTORS, AND HEARTH EXTENSIONS". (Note that an NFPA SUBJECT is not treated nor maintained in the same manner as an NFPA STANDARD).

When floor protection is developed utilizing NFPA SUBJECT 1618, or developed via "good Engineering Practice", such methodology will typically establish floor protection based on 3/8 inch millboard.

As the thermal conductivity of such millboard can vary from manufacturer to manufacturer, it will be necessary to obtain the thermal conductivity value from a specific manufacturer for a specific millboard product.

Typical thermal conductivity values can range from:

$k = 0.21$ (Btu) (inch) / (foot^2) (hour) (°F)

to

$k = 0.84$ (Btu) (inch) / (foot^2) (hour) (°F)

Thus the necessity for product specific thermal conductivity.

Note that the lower the algebraic value of "k", the lower the thermal conductivity and the less heat per given time that is transferred across the *floor protector*.

Note that in the following discussions it is necessary to maintain consistent dimensions - i.e.; in dealing with the thickness of materials, do not mix feet with inches, but rather keep all dimensions in inches.

COMPLIANCE

If the manufacturer of the appliance specifies an acceptable material and thickness for floor protection it is necessary, utilizing that specific material with specific thermal conductivity, k, to meet or exceed the thickness specified in order to assure compliance with the listed floor protection requirements of the appliance.

ESTABLISHING EQUIVALENCY

If it is determined that another material of different thermal conductivity is desired to be utilized for floor protection (i.e., perhaps for aesthetic reasons or in order to minimize the thickness of the floor protector) and noting that the thermal conductivity, k, is linear as a function of thickness (for a given single material) then:

$$k_1/t_1 = k_2/t_2,$$

where:

k = thermal conductivity in

(Btu) (inch) / (foot^2) (hour) (°F) and

t = thickness in inches

and therefore knowing any three of the variables of k and t allows one to solve for the remaining variable; i.e., :

Knowing k_1, t_1 and t_2, one can solve for k_2:

$k_2 = (k_1)(t_2)/(t_1)$

Knowing k_1, t_1 and k_2, one can solve for t_2:

$t_2 = (k_2)(t_1)/(k_1)$

COMPOSITE FLOOR PROTECTOR ASSEMBLIES

When an assembly consists of more than one material, the assembly is defined as a composite "material".

When a floor protector is constructed of more than one material; i.e., some form of backer board with decorative tile over, it is helpful to first establish the thermal resistance, r, of each material as thermal resistances may be directly added together and then convert the resulting total R to an equivalent thermal conductivity.

r = (foot^2) (hour) (°F)/(Btu) (inch) and;

$R = (r)(t)$

where r is for a particular material in the composite and t is the thickness of that particular material.

Thus for the two-material example of backer board plus decorative tile,

$$R_{total} = R_{backer\ Board} + R_{decorative\ tile}$$

and;

$$R_{backer\ board} = (r_{backer\ board})(t_{backer\ board})$$

and;

$$R_{tile} = (r_{tile})(t_{tile})$$

RELATIONSHIP BETWEEN k AND R

By definition:

$R = (1/k)(t)$ for each distinct material

NON-TEXT PAGE

APPENDIX L

SCHEDULE OF FEES

L 1.0 Fee Schedule: In accordance with the authority conferred by M.G.L. c 143, § 94, the State Board of Building Regulations and Standards hereby establishes the following fees as specified in Table L-1.

Exceptions:

1. Fees for projects which are under the jurisdiction of a city or town shall be as duly established by said city or town in accordance with 780 CMR 114.0.
2. Fees for construction related licenses issued by a city or town shall be in accordance with fee schedules established by said city or town.
3. Fees for administrative appeals hearings in cities of towns having duly established building code appeals boards in accordance with 780 CMR 122 shall be as established by said city or town.

Table L-1

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Concrete Testing Laboratory			**780 CMR R1**
Initial license	One year	50.00	780 CMR R1.1.8
Renewal	One year	50.00	780 CMR R1.1.10
Concrete Test Technician - Class A			780 CMR R2
Initial license	One year	50.00	780 CMR R2.1.9
Renewal	One year	50.00	780 CMR R2.1.11
Examination	Per exam	Note 1	780 CMR R2.1.7
Manufactured Buildings			780 CMR R3
Manufacturer - initial certification (per system)	One year	1200.00	780 CMR R3.18.1
Manufacturer -renewal of certification	One year	650.00	780 CMR R3.18.3
Labels per unit	Per label	50.00	780 CMR R3.18.4
Replacement label	Per label	2.00	780 CMR R3.18.4
Labels per component	Per label	2.00	780 CMR R3.18.4
Inspection Agency - initial certification	One year	500.00	780 CMR R3.18.2
Inspection Agency - certification renewal	One year	500.00	780 CMR R3.18.3
Registration of Producers of Native Lumber			780 CMR R4
Initial registration fee	Two years	25.00	780 CMR R4.1.4
Registration renewal	Two years	25.00	780 CMR R4.1.5
Construction Supervisor License (CSL)			780 CMR R5
Unrestricted license (any building enclosing up to 35,000 cubic feet of space)			
Initial license	Three years	150.00	780 CMR R5.2.5
Renewal	Two years	100.00	780 CMR R5.2.5
Examination fee	Per exam	Note 1	780 CMR R5.2.5
Restricted License (one and two family dwellings)			
Initial license	Three years	150.00	780 CMR R5.2.5
Renewal	Two years	100.00	780 CMR R5.2.5
Examination fee	Per exam	Note 1	780 CMR R5.2.5
Restricted License - Masonry only			
Initial license	Three years	150.00	780 CMR R5.2.5
Renewal	Two years	100.00	780 CMR R5.2.5
Examination fee	Per exam	25.00	780 CMR R5.2.5

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Home Improvement Contractor Registration			M.G.L. c 142A & 780 CMR R6
Initial Certification (applicants holding CSL License)	Two years	No fee	
Initial Application (all other applicants)	Two years	100.00	
Renewal (applicants holding CSL License)	Two years	No fee	
Renewal (all other applicants)	Two years	100.00	
Guaranty Fund Payment (upon initial registration - all applicants)			
0-3 employees	Note 2	100.00	
4-10 employees	Note 2	200.00	
11-30 employees	Note 2	300.00	
over 30 employees	Note 2	500.00	
Certification of Building Commissioners, Inspectors of Buildings and Local Inspectors.			M.G.L. c 143 § 3 & 780 CMR R7
Certification fee		no fee	
Examination registration		Note 1	
Continuing education programs provided directly by the Board of Building Regulations and Standards		Reserved	
State Building Code Appeal Board			M.G.L. c 143 § 100
Administrative Hearing	Per hearing	150.00	780 CMR 122.3.1
Structural Peer Review Advisory Board			780 CMR 125
Mediation Hearing		No fee	780 CMR 125.3
Building Permits and Construction Inspection for State Projects (except Massachusetts Bay Transportation Authority Projects) subject to 780 CMR and under the jurisdiction of the Department of Public Safety, Division of Inspections.			M.G.L. c 143 §§ 93 & 94 M.G.L. c 143 § 3A
Plans examination, construction inspection, issuance of building permit and certificate of and occupancy Note: This fee structure shall be deemed to include, but not be limited to, electrical, plumbing mechanical and fire protection work. Fees shall not be permitted to be levied by local jurisdictions.	Per building or structure.	0.001 times the contract amount (Note 3)	M.G.L. c 143 §§ 93 & 94
Massachusetts Bay Transportation Authority Projects			M.G.L. c 161A § 18
Massachusetts Bay Transportation Authority Projects subject to 780 CMR.		No fee	M.G.L. c 161A § 18
Periodic Inspections of Existing Buildings under the jurisdiction of the Division of Inspections, Department of Public Safety			780 CMR 106.5 & M.G.L. c 111
Hospitals and Clinics (certificate of inspection)			
First 100 beds	Two years	50.00	M.G.L. c 111§ 51
Each additional 25 beds	Two years	10.00	
Infirmaries; Convalescent Homes; Nursing Homes; Charitable Homes for the Aged; Rest Homes; Intermediate Care Facilities for the Mentally Retarded. (certificate of inspection)	Two years	50.00	M.G.L. c 111 § 71

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Periodic Inspections of all other existing buildings.			M.G.L. c 143 § 94
Periodic inspections of specified use groups as specified by 780 CMR 106.5 and Table 106	As specified by 780CMR Table 106	As specified by 780CMR Table 106	780 CMR 106.5 and Table 106

Notes:

1. Examination fees established by examining institution.
2. M.G.L. c 142 A § 11 provides that additional payments into the guaranty fund may be required if the fund administrator determines that the amount of the fund is insufficient to maintain it at a level commensurate with claims made against said fund.
3. Contract amount, for the basis calculation of permit fees, shall include the entire scope of work of the project and shall include all incidental constructions. Contract amount, for the basis of calculation of permit fees, shall not be deemed to include design fees or any other professional fees associated with construction observation or supervision or construction management.

NON-TEXT PAGE

CONCRETE TESTING LABORATORIES LICENSING

780 CMR R1.1 ADMINISTRATION

R1.1.1 Title As authorized by M.G.L. c. 143, §§ 93 through 100, and in accordance with 780 CMR 123.0, establishing the Construction Materials Safety Board,780 CMR R1 is adopted for Licensing of Concrete Testing Laboratories.

R1.1.2 Definitions Unless otherwise expressly stated in 780 CMR, the following terms shall, for the purpose of 780 CMR R1, have the meaning indicated in 780 CMR R1.2:

Accredited Laboratory: A laboratory which has been licensed in accordance with 780 CMR R1 by the BBRS.

BBRS: State Board of Building Regulations and Standards

Board: Construction Materials Safety Board (CMSB).

Branch Laboratories: A branch of a Testing Laboratory physically removed from the location of the headquarters or main testing facility of the Testing laboratory.

Laboratories: Testing laboratory, branch laboratory, and project laboratory.

Person: Individual, partnership, corporation, trust, joint venture, etc.

Pre-Qualifying Agency: Construction Materials Safety Board (CMSB).

Project Laboratory: A temporary on-site facility providing concrete testing services for a specific project under the direction of a testing or branch laboratory licensed by the Commonwealth of Massachusetts.

Testing Agency: National Institute of Standards and Technology (NIST), Cement and Concrete Reference Laboratory (CCRL), the Army Corps of Engineers, or other agency designated by the BBRS.

Testing Laboratory: A proprietorship, corporation, partnership or agency which conforms to the requirements of ASTM E 329-72 as modified in 780 CMR R1.

R1.1.3 Licensing All laboratories defined by 780 CMR R1.1.2 as Testing Laboratories, Branch Laboratories and Project Laboratories which are engaged in the testing of concrete and concrete materials for use in buildings and structures subject to control according to the provisions of 780 CMR 116 will be licensed by the BBRS in accordance with 780 CMR R1.

R1.1.4 Application for Licensing Each laboratory desiring to obtain such license shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that the laboratory equipment meets the requirements of 780 CMR R1.2 and its management personnel are qualified in accordance with 780 CMR R1.4 and .5. Such application shall also include payment of the licensing fee set forth in 780 CMR R1.1.8.

R1.1.5 Pre-qualifying Agency The BBRS hereby designates the Construction Materials Safety Board as its Pre-Qualifying Agency, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Pre-Qualifying Agency. The Pre-Qualifying Agency shall examine, or cause to be examined, the evaluation performed by the Testing Agency and the personnel on each Concrete Testing Laboratory application and make its recommendation to the BBRS regarding such license.

R1.1.6 Testing Agency The BBRS hereby designates the Cement and Concrete Reference Laboratory of the National Institute of Standards and the Army Corps of Engineers as the agencies to examine and evaluate all laboratories desiring to be licensed in the practice of concrete testing, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Testing Agency.

R1.1.7 Notification of Testing and Testing Results The Testing Agency shall notify the applicant of the date for evaluation and shall provide the audited laboratory with a report of audit findings.

Note: Unless specific permission has been granted by the BBRS, accredited laboratories must have the capability to test both concrete and concrete aggregate.

R1.1.7.1 Audit findings response: The audited laboratory shall request that the testing agency forward a copy of the audit report to the BBRS.

The audited laboratory shall prepare formal responses to each and all audit findings and issue such response report to the BBRS for review. (Also see 780 CMR R1.3

R1.1.8 Licensing Fee The fee for licensing shall be $150.00 per annum or in accordance with the fee schedule established by the BBRS from time to time.

R1.1.9 Number and Classification Each laboratory so licensed by the BBRS shall be issued a number and classification.

R1.1.10 Renewals Commencing January 1, 1978, all licenses issued shall expire on December 31 of the year issued. Within 60 days before the expiration date of any such license, the Administrator of the BBRS shall forward to each laboratory so licensed an application form for renewal. Said renewals shall be returned to the BBRS by December 31. The said Administrator, upon receipt of the completed form and fee, shall renew the license for a period of one year or notify such applicant of the BBRS's refusal with reasons thereof.

R1.1.11 Penalties Any such person and/or laboratory who fails to comply with the requirements of 780 CMR R1 or who files a false report shall be subject to the penalties and actions as prescribed in 780 CMR 118.

780 CMR R1.2 LABORATORY LICENSING REQUIREMENTS

R1.2.1 ASTM Testing Requirements Except as modified in 780 CMR R1, all testing laboratories including branch laboratories shall conform to Sections 5 and 6 of the ASTM E 329-72 standard requirements for testing of concrete and its constituent materials.

Exception: The following sections of ASTM E 329-72 shall not apply:
Sections 2.2; 2.3; 2.7; 3.2.7; 3.3; 3.4 C360 of 6.2; 7; 8; 9 and 10.

R1.2.2 ASTM Equipment and Personnel Requirements: All laboratories subject to 780 CMR R1 shall be approved and licensed in accordance with the ASTM E 329-72 standard for the performance of those functions recommended in standard ASTM E 329-72, for equipment and personnel, as modified in 780 CMR R1.

780 CMR R1.3 PRE-QUALIFICATION REQUIREMENTS FOR LABORATORIES

R1.3.1 Evaluation:

a. Testing and branch laboratories subject to 780 CMR R1 shall be examined and evaluated, upon notification from the BBRS, by a testing agency designated by the BBRS. The interval between such examination and evaluation shall not exceed three years.

b. Project laboratory equipment which is used in the testing of concrete materials for use in buildings and structures subject to the provisions of 780 CMR shall conform to the requirements of ASTM E 329 as modified by 780 CMR R1.2.

c. Reports of evaluations by the testing agency shall be filed with the BBRS within ten days of receipt of the report by the laboratory, unless a waiver is granted by the laboratory to have the report sent directly to the BBRS by the testing agency.

d. Laboratory deficiencies cited in the report of the testing agency shall be corrected within 30 days of the date of issue of the report and shall be so certified by an affidavit submitted by the laboratory on a form supplied by the BBRS.

R1.3.2 Review of Deficiencies: Laboratories which fail to meet the requirements of 780 CMR R1.3.1 items c. and d. shall be subject to review and revocation of their license by the BBRS.

R1.3.3 Testing Machines: Compression testing machines used for testing materials subject to 780 CMR R1 shall be calibrated and verified, with equipment traceable to the National Institute of Standards and Technology (NIST), at least annually or as required by the BBRS, and the results submitted to the BBRS.

780 CMR R1.4 PERSONNEL

The management and supervision of each laboratory subject to 780 CMR R1 shall be in accordance with the following requirements:

R1.4.1 Required: Each accredited licensed Concrete Testing Laboratory must have an individual approved by the BBRS in each of three distinctly different categories: Director of Testing Services, Supervisory Laboratory Technician and Supervisory Field Technician. An individual may fill more than one position at the particular laboratory if he meets all the qualifications for each position, but he may not fill positions concurrently at a separate (branch or project) laboratory. The project laboratory must have a full-time resident supervisory laboratory technician qualified in accordance with 780 CMR R1.

R1.4.2 Filing of Qualifications: Each individual being certified for a position must submit his or her credentials and qualifications under penalty of perjury with signature notarized. Individuals applying for certification in more than one category must file separate applications for each position as described in 780 CMR R1.5. Application for certification shall be filed within 30 days of employment for such duties. It is the responsibility of the Director of Testing Services to notify the BBRS within seven days of any vacancy of any position. Any vacant position shall be filled within 30 days.

780 CMR R1.5 QUALIFICATIONS

R1.5.1 Qualifications for Director of Testing Services: The testing services of each laboratory (main, branch or project) shall be under the direction of a Director of Testing Services who shall be a full-time resident employee of that laboratory and shall be qualified in accordance with any one of the following three sets of requirements:

a. He or she shall be a Professional Engineer, registered in the Commonwealth of Massachusetts with a least five years of experience in responsible charge of work related to Structural Engineering, Construction Engineering or Construction Materials Testing. He shall be subject to demonstrate his ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or,

b. He or she shall have a Bachelor's Degree in Engineering from an accredited institution and an additional total of three years experience performing tests on concrete and concrete materials which shall include two years as a laboratory technician or supervisor. He or she shall be subject to demonstrate his ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or

c. He or she shall have at least eight years experience including five years experience as a laboratory technician or supervisor and shall be subject to demonstrate his ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72.

R1.5.2 Qualifications for Supervisory Laboratory Technician: A Supervisory Laboratory Technician shall have at least five years' experience performing tests on construction materials including concrete and concrete aggregates. He or she shall be subject to demonstrate his ability to perform correctly tests of concrete and aggregates as stated in ASTM E 329-72. "Class A" accreditation by the Pre-Qualifying Agency shall be required as qualification for concrete only. (See 780 CMR R2 Concrete Testing Personnel Licensing Rules and Regulations.)

R1.5.3 Qualifications for Supervisory Field Technician: A Supervisory Field Technician shall have at least five years experience performing tests on construction materials including concrete. He or she shall be subject to demonstrate either by oral or written examination, or both, his ability to perform correctly the tests of concrete as stated in ASTM E 329-72. "Class A" accreditation by the Pre-Qualifying Agency shall be required as qualification for concrete only. (See 780 CMR R2 Concrete Testing Personnel Licensing Rules and Regulations.)

780 CMR R1.6 PROJECT AFFIDAVIT

In accordance with 780 CMR 110.12, those structures subject to control as required in 780 CMR 116, affidavits must be submitted with the building permit application that the individuals and testing laboratories responsible for carrying out the duties of 780 CMR 116 have been licensed and registered by the BBRS.

R1.6.1 Affidavit: In accordance with 780 CMR R1.6, an affidavit shall be furnished to the building department by the licensed laboratory and shall be provided by the licensed laboratory for each building project.

R1.6.2 Notice of Termination: The building official shall receive written notification of the termination of laboratory functions certifying that the owner has also been so notified. Such termination shall be effective no earlier than three working days from the notification received by the building official.

R1.6.3 Successor Laboratory: If concrete testing is to be continued for the said project by a successor laboratory, such notice shall be given to the building official and a new project affidavit shall be filed with the building official.

780 CMR R1.7 REVOCATION AND SUSPENSION PROCEDURES

R1.7.1 Revocation and Suspension: The BBRS on its own initiative or upon the recommendation of the Construction Materials Safety Board may suspend or revoke the license of any Testing Laboratory or Project Laboratory found to be in noncompliance with 780 CMR R1, 780 CMR, or the Standards of good practice. Notice of suspension or revocation of such license shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with 780 CMR 118.6.

R1.7.2 Notice and Conference: Prior to suspension, revocation, or refusal to renew the license of an accredited laboratory, written notice of such intent shall be served by the Construction Materials Safety Board of BBRS in accordance with 780 CMR 118.6. Within ten calendar days of receipt of such notice, the affected accredited laboratory may request a conference before a three member panel designated by the Chairman of the Construction Materials Safety Board; said panel will hear facts and make their recommendations to the Construction Materials Safety Board, who in turn shall report such findings to the BBRS for BBRS consideration and action.

R1.7.3 Effect of suspension or revocation: Upon suspension or revocation of the license, the accredited laboratory shall immediately cease engaging in the testing of concrete and concrete materials for use in buildings and structures which are subject to the provision of 780 CMR 116 and no action brought before the Board of Appeals as specified in

780 CMR R1.8.1 or in any court of competent jurisdiction shall stay the said suspension or revocation unless said Board of Appeals or court shall issue an order for a stay of the BBRS's suspension or revocation.

780 CMR R1.8 APPEALS

R1.8.1 Building Code Appeals Board: Any laboratory or individual aggrieved by the suspension or revocation of their license or by an interpretation, order, requirement, direction or failure to act under 780 CMR R1 may appeal to the State Building Code Appeals Board as provided in 780 CMR 122; however, entry of an appeal from the BBRS's order of revocation or suspension shall not stay such revocation or suspension unless so ordered by the State Building Code Appeals Board in a preliminary hearing conducted expressly for the purpose of a stay in accordance with that part of 780 CMR 122.3.2 dealing with procedure required for a hearing on such stay.

CONCRETE TESTING PERSONNEL LICENSING

780 CMR R2.1 ADMINISTRATION

R2.1.1 Title: As authorized by M.G.L. c. 143, §§ 93 through 100, and in accordance with 780 CMR 123.0 establishing the Construction Materials Safety Board, 780 CMR R2 is adopted for Concrete Testing Personnel.

R2.1.2 Definitions: Unless otherwise expressly stated in 780 CMR, the following terms, for the purpose of 780 CMR R2, shall have the meaning indicated in 780 CMR R2.1.2.

BBRS: State Board of Building Regulations and Standards

Board: Construction Materials Safety Board (CMSB)

Concrete Testing Personnel: A person issued a Class "A" license by the BBRS authorizing such person to test/inspect concrete.

Field Concrete Technician: A person issued a Class "A" license by the BBRS to test concrete in the field.

Pre-Qualifying Agency: Construction Materials Safety Board (CMSB)

Testing Agency: Massachusetts Construction Industry Board (MCIB)

R2.1.3 Licensing: All Concrete Personnel engaged in the testing/inspection of concrete for use in buildings and structures subject to control according to the provisions of 780 CMR 116.0 shall be licensed by the BBRS in accordance with 780 CMR R2.

R2.1.4 Application for Licensing: Each person desiring to obtain such license shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that he is qualified to be licensed in accordance with 780 CMR R2.

R2.1.5 Pre-qualifying Agency: The BBRS hereby designates the Construction Materials Safety Board as its Pre-Qualifying Agency, provided however, that the BBRS may revoke such designation at any time and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Pre-Qualifying Agency. The Pre-Qualification Agency shall examine, or cause to be examined, the examination results and evaluation performed by the Testing Agency on each Concrete Testing Personnel Application and make its recommendation to the BBRS regarding such license.

R2.1.6 Testing Agency: The BBRS hereby designates the Massachusetts Construction Industry Board (MCIB) as the agency to examine and evaluate all persons desiring to be licensed in the practice of concrete testing, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its Testing Agency. The Testing Agency shall submit all examination results and evaluation on each Concrete Testing Application and make its recommendations to the Pre-Qualification Agency regarding such license.

R2.1.7 Examination: Accompanied by the application, there shall be paid to the Testing Agency an initial examination fee to cover the cost of such testing. The Testing Agency may also assess fees for partial or complete retesting. The Testing Agency is authorized to require the applicant to provide all required test equipment.

R2.1.8 Notification of Examination and Examination Results: The Testing Agency shall notify the applicant of the time and place for the examination. The BBRS shall be informed by the Testing Agency/Pre-Qualifying Agency of the examination results, evaluation and recommendations. Within 14 days therefrom, the BBRS shall notify the applicant of its decision. If the applicant fails fully or partially, he may request of the Testing Agency a retesting. If the applicant is notified by the BBRS that he has met all the requirements herein established, he shall submit to the said BBRS, the license fee in accordance with 780 CMR 2.1.9, and his 1¼" x 1¼", full face, black and white or color photograph.

R2.1.9 Licensing Fee: The fee for licensing shall be $50 in accordance with the fee schedule established by the BBRS. Concrete Testing Personnel employed for that purpose by a municipality or county or the federal government, or the Commonwealth or any department, commission, agency or authority of, or created by, the Commonwealth, shall be exempt from this fee.

R2.1.10 Number and Classification: Each person so licensed by the BBRS shall be issued a number and classification.

R2.1.11 Renewals: Licenses shall be valid for two years and the license renewal fee shall be $50 dollars. Within 30 days before the expiration date of any such license, the Administrator of the BBRS shall forward to each person so licensed an application form for renewal. The said Administrator, upon receipt of the completed form and fee, shall renew the license for a period of two years or notify such applicant of the BBRS's refusal with the reasons thereof. An applicant shall submit a renewal application with fees within one year of the expiration date of the license. Failure to submit a renewal application within this time period shall be cause for examination or re-examination. Upon successful completion of a Class A Technician's examination said applicant is eligible to be licensed upon submittal of an application and fee. Said application and fee shall be submitted within one year of the date of the examination. Failure to acquire a license within this time period shall be cause for examination or re-examination.

780 CMR R2.2 PRE-QUALIFICATION REQUIREMENTS FOR PERSONS DESIROUS OF BEING LICENSED FOR CONCRETE TESTING

R2.2.1 Evaluation: Field Concrete Technicians, subject to 780 CMR R2, shall be examined and evaluated by the Massachusetts Construction Industry Board to determine the applicant's knowledge and ability to perform the following ASTM Standard Test Procedures:

a. ASTM C172: Sampling Fresh Concrete
b. ASTM C143: Test for Slump
c. ASTM C31: Making and Curing Test Specimens in the Field
d. ASTM C231: Test for Air Content - Pressure Method
e. ASTM C173: Test for Air Content - Volumetric Method
f. ASTM C138: Test for Weight per Cubic Foot (Density)
g. ASTM C192: Storage and Transportation of Test Cylinders

The applicant's performance of these tests is to be observed and evaluated by two qualified jurors designated by the Testing Agency (MCIB), using detailed data sheets. The said jurors' evaluations are appraised by the Certification Committee of the Testing Agency and reappraised by the Board of Trustees of the said Testing Agency. Three categories of performance are to be used in the final evaluation process as follows:

1. PASS: The applicant has satisfactorily completed the examination.
2. PARTIAL: The applicant has failed one of the five performance tests and must take a partial re-test.
3. FAIL: The applicant has failed two or more of the five performance tests and must take a complete re-test.

780 CMR R2.3 REVOCATION AND SUSPENSION PROCEDURES

R2.3.1 Revocation and Suspension: The BBRS on its own initiative or upon the recommendation of the Construction Materials Safety Board or the Massachusetts Construction Industry Board, may suspend or revoke the licenses of any one so engaged in the practice of Concrete Testing found to be in noncompliance with 780 CMR R2, 780 CMR or the standards of good practice. Notice of suspension or revocation of such license shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with 780 CMR 118.6.

R2.3.2 Notice of Conference: Prior to suspension, revocation or refusal to renew such license, written notice of such intent shall be served by the Pre-Qualifying Agency or BBRS in accordance with 780 CMR 118.6. Within ten calendar days of receipt of such notice, the affected licensee may request a hearing before a three member panel designated by the chairman of the said agency, who will hear facts and make recommendations to the Pre-Qualifying Agency.

R2.3.3 Effect of Suspension or Revocation of License: Upon suspension or revocation of the license, the licensee shall immediately cease engaging in the testing of concrete and concrete materials for use in buildings and structures which are subject to the provision of 780 CMR and no action brought before the State Building Code Appeals Board as specified in 780 CMR R2.4.1 or in any court of competent jurisdiction shall stay the said suspension or revocation unless said Appeals Board or court shall issue an order for a stay of the BBRS's suspension or revocation.

780 CMR R2.4 APPEALS

R2.4.1 Massachusetts State Building Code Appeals Board Any one engaged in the practice of Concrete Testing aggrieved by the suspension or revocation of their license or by an interpretation, order, requirement, direction or failure to act under 780 CMR R2 may appeal to the State Building Code Appeals Board as provided in 780 CMR 122.0; however, entry of an appeal from the BBRS's order of revocation or suspension shall not stay such revocation or suspension unless so ordered by the said Appeals Board in a preliminary hearing conducted expressly for the purpose of a stay in accordance with that part of 780 CMR 122.3.2 dealing with the procedure required for a hearing on such stay.

the manufacturer or by the inspection agency. A copy of such records covering attachment of each label shall be sent to the BBRS on the tenth of each month and the BBRS shall forward all such records to the State Enforcement Agencies.

R3.3.4 Attachment of Labels: The inspection agency shall attach in numerical sequence labels to manufactured buildings or manufactured building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with a approved compliance assurance program, if custody of the labels has been entrusted to them in accordance with 780 CMR R3.3.3.4.

R3.3.5 Suspension and Revocation: The BBRS may suspend or revoke, or cause to be suspended or revoked, the certification of any manufactured building or manufactured building component which the State Enforcement Agencies or an inspection agency finds not to comply with the applicable codes or 780 CMR R3, or which has been manufactured pursuant to a building system or a compliance assurance program for which approval has been suspended or revoked, or which has not been manufactured in accordance with the approved compliance assurance program. The State Enforcement Agencies or an inspection agency shall remove or cause to be removed, labels from any such manufactured building, manufactured building component or manufactured home until it is brought into compliance with the applicable codes and 780 CMR R3. Notice of suspension or revocation of certification shall be in writing with the reasons for suspension or revocation clearly set forth therein.

a. Upon suspension or revocation of the approval of any building system or compliance assurance program, no further labels shall be attached to any manufactured buildings or manufactured building components manufactured pursuant to the building system or compliance assurance program with respect to which the approval was suspended or revoked. Upon termination of such suspension or revocation, labels may again be attached to the manufactured building or manufactured building components manufactured after the date approval was reinstated. Should any building or building component have been manufactured during the period of suspension or revocation, it shall not be labeled unless the State Enforcement Agencies or inspection agency have inspected such building or building component and is satisfied that all requirements for certification have been met. If the State Enforcement Agency acts under 780 CMR R3.3.5, it must notify the inspection agency.

b. The manufacturer shall return all labels allocated for a manufactured building or manufactured building component to the BBRS no later than 30 days from the effective date of any suspension or revocation of the State Enforcement Agencies or inspection agency, of the building system or compliance assurance program pursuant to which the manufactured building or manufactured building component is being manufactured. The manufacturer shall also return to the BBRS all labels which it determines for any reason are no longer needed.

R3.6 Variations of Certified Units: Manufactured buildings, manufactured building components or manufactured homes certified and labeled pursuant to the applicable codes and 780 CMR R3 shall not be varied in any way prior to the issuance of a certificate of occupancy without resubmission to the BBRS for its approval of the variation and of the unit which includes the variation. The State Enforcement Agencies or an inspection agency shall inspect the manufactured building, manufactured building component or manufactured home wherever it is located and such inspection may include such tests or destructive or nondestructive disassembly as the State Enforcement Agencies or an inspection agency deems necessary to assure compliance with the applicable Codes and 780 CMR R3. Local Enforcement Agencies may be designated by the BBRS or State Enforcement Agencies as inspection agencies for such purposes.

780 CMR R3.4 INSPECTION BY THE STATE ENFORCEMENT AGENCIES OR THEIR AGENTS

The State Enforcement Agencies shall make, or cause to be made, such inspections of the entire processing of manufacturing, certifying, handling, storing and transporting of manufactured buildings or manufactured building components produced pursuant to approved building systems as they deem necessary.

R3.4.1 Inspection of Facilities: As part of the process of evaluating building systems and compliance assurance programs, the State Enforcement Agencies shall inspect, or cause to be inspected, the manufacturing facilities in which the buildings or building components are to be manufactured.

R3.4.2 Inspection According to Compliance Assurance Programs: The State Enforcement Agencies or an inspection agency shall make such

inspections as may be required by an approved compliance assurance program, or as may be deemed necessary by the State Enforcement Agencies.

R3.4.3 Inspection of Damaged Components: Prior to the issuance of a certificate of occupancy, the State Enforcement Agencies or an inspection agency shall inspect, or cause to be inspected, certified manufactured buildings or manufactured building components which it determines to have been sufficiently damaged after certification to warrant such inspection and to take such action with regard to such buildings or building components as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions. The local enforcement agencies may be designated by the BBRS or the State Enforcement Agencies as the inspection agency.

R3.4.3.1 Repairing Damaged Components: The State Enforcement Agencies or an inspection agency shall require manufactured buildings or manufactured building components which are so damaged as to no longer comply with the applicable Codes and 780 CMR R3, to be repaired and made to comply within a reasonable time; or if they are so damaged that they cannot be brought into compliance, the State Enforcement Agencies or inspection agency shall order that the labels be removed from such buildings, building components or manufactured homes. A report under this section shall be filed with the inspection agency, BBRS and State Enforcement Agency.

R3.4.3.2 Irreparably Damaged Compooents: Irreparably damaged buildings or building components shall be disposed of by the manufacturer.

R3.4.4 Monitoring Inspection Agency: The State Enforcement Agencies or their designated agents shall examine each approved inspection agency, at any reasonable time, and without prior announcement, in order to monitor the reliability of each agency and of its monitoring of each compliance assurance program,. Each such examination shall investigate the adequacy of all procedures used by the agency in monitoring compliance assurance programs including inspection, tests, production methods, process controls, operator performance, materials, receipts, storage and handling, workmanship standards, records and all other activities which implement the compliance assurance program in the manufacturing facility, during transport, on-site, and at critical subcontractors' facilities. The results of such examinations shall be filed with the office of the BBRS. Copies of such reports shall be sent to the inspection agency and the State Enforcement Agencies. Inspection agencies shall be specifically notified by the BBRS of any deficiencies and of the manner and time by which such deficiencies must be eliminated. If deemed necessary by the State Enforcement Agencies an inspection agency's approval may be suspended or revoked by the BBRS as provided herein.

R3.4.4.1 Prior to Approval: Such examinations may also be conducted before approving an inspection agency.

R3..5 Inspection by Disassembly: No inspection entailing disassembly, damage to or destruction of certified manufactured buildings, manufactured building components or manufactured homes shall be conducted except to implement 780 CMR R3.

780 CMR R3.5 LOCAL ENFORCEMENT AGENCY PROCEDURES AND INSPECTIONS

R3.5.1 Issuance of building permits: Upon application and in conformity with the provisions of 780 CMR, the building official shall issue building permits for installation of certified manufactured buildings, manufactured building components or manufactured housing.

R3.5.1.1 Licensed Construction Supervisors and Certified Installers: A construction supervisor, duly licensed in accordance with 780 CMR R5, shall, in accordance with 780 CMR 108.3.5, act as the agent for the owner for the purpose of applying for and obtaining any and all building permits required for the field erection of all one or two family manufactured dwellings subject to the provisions of 780 CMR 35 and applicable 780 CMR R3.

As part of the building permit application process, the licensed construction supervisor shall submit to the building official, in writing, the name of the installer, who shall be duly certified by the manufacturer to install said manufacturer's product, and is identified as a *certified installer of manufactured buildings* (certified installer) by said manufacturer. The certified installer shall be responsible for the safe and proper placement and connection of the manufactured home units in accordance with 780 CMR 35, 780 CMR R3 and specialized codes as listed in ***Appendix A***.

The licensed construction supervisor shall be responsible for the construction of the foundation system, and all pertinent site work, in accordance with 780 CMR 35 and 780 CMR R3 listed in ***Appendix A***. The licensed construction supervisor shall provide at least 48 hours notice to the building official before the placement and connection of such units shall begin An application to local enforcement agencies for an appropriate permit shall, when requested, in addition to any other requirements contain:

R3.5.1.2 Permit Application - Statement of Content: A statement that the work to be

satisfactorily enforced, it may upon the recommendation of the State Enforcement Agencies, as provided in 780 CMR 3.2.1, extend reciprocity to that jurisdiction by:

a. Giving notice to any requesting manufacturer;
b. Giving notice to the Administrative Agency of the other jurisdiction;
c. Giving notice to the State Enforcement Agencies and all local enforcement agencies in this state.

R3.14.3 Rejections: If the standards of the other state or other agency do not meet the objectives of the appropriate codes or are inadequately enforced, or both, reciprocity shall not be extended. In that event, the BBRS shall notify any requesting manufacturer and the Administrative Agency of the other state or other agency of the refusal and the reasons therefore.

780 CMR R3.15 PROCEDURES FOR RECIPROCITY CERTIFYING MANUFACTURED BUILDINGS OR BUILDING COMPONENTS

A manufacturer from a jurisdiction to which reciprocity has been extended shall submit to the BBRS evidence that his building system and compliance assurance program have been approved by such state or other agency. The BBRS shall verify the approval and shall notify the State Enforcement Agencies, local enforcement agencies and the manufacturer in writing of such verification and that properly labeled buildings or building components of his manufacture will be accepted.

780 CMR R3.16 SUSPENSION AND REVOCATION

The BBRS shall suspend or revoke, or cause to be suspended or revoked, the acceptance or certification or both of such reciprocally certified manufactured buildings or manufactured building components if the State Enforcement Agencies determine that the standards for the manufacture and inspection of which manufactured buildings or manufactured building components of such other state or other agency do not meet the objectives of the appropriate codes and 780 CMR R3.0, or that such standards are not being enforced to the satisfaction of the State Enforcement Agencies. If such other state or other agency or its agents should suspend or revoke its approval and certification, the acceptance of certification or both granted under 780 CMR 3.16 shall be revoked or suspended accordingly. Notice to the State Enforcement Agencies, local enforcement agencies, manufacturer and to the Administrative Agency of such other state or agency of such suspension or revocation shall be in writing with the reasons for such suspension or revocations set forth therein. Appeals from such suspension or revocations shall receive timely review.

PART V APPEALS

780 CMR R3.17 HEARINGS

All hearings shall comply with the applicable sections of the applicable codes and the Rules and Regulations thereof established for the purpose of appeal.

PART VI SCHEDULE OF FEES

780 CMR R3.18 ESTABLISHMENT

The following is the SCHEDULE OF FEES established by the BBRS for certifying manufactured buildings or manufactured building components. Fees shall be made payable to the "Commonwealth of Massachusetts Board of Building Regulations and Standards" and shall accompany all applications for certification.

R3.18.1 Compliance Assurance Programs and Building Systems: An initial fee of $1,200.00 shall be charged each manufacturer for its certified compliance assurance program for each plant desiring certification. The maximum fee charged under 780 CMR R3.18 shall be $1,200.00 for each manufacturing plant.

R3.18.2 Third Party Inspection Agencies: An initial fee of $500.00 shall be charged to each third party inspection agency.

R3.18.3 Annual Renewal Fees:

a. One year from the date of certification of the manufacturer and every year thereafter certification is in effect, there shall be paid an annual renewal fee of $650.00 for each such certification.

b. One year from the date of certification of the Third Party Inspection Agency, and every year thereafter certification is in effect, there shall be paid an annual renewal fee of $500.00.

R3.18.4 Labels

a. A fee of $50.00 per unit of a manufactured building shall be charged for each label issued by the BBRS.

Note: A "unit" as used in 780 CMR R3.18 shall mean any building or proportion thereof which is towed or shipped separately to be somehow tied together at the site.

b. A fee of $1.00 per building component shall be charged for each label issued by the BBRS for building components.

Note: Manufacturers of building components shall be permitted to use any labels as approved by the BBRS. If such labels are supplied by any source other than the BBRS, there shall be no charge for such labels.

c. Mutilated labels may be replaced at the option of the BBRS at a cost of $2.00 each.

d. Upon satisfactory proof to the BBRS of lost or stolen labels, not the result of negligence, labels may be replaced at a cost of $2.00 each.

e. Labels shall be purchased from the BBRS by the inspection agency or manufacturer.

REGISTRATION AND ENFORCEMENT OF HOME IMPROVEMENT CONTRACTOR PROGRAM

FORWARD

780 CMR R6 covers the registration of home improvement contractors and subcontractors and enforcement of the requirements of M.G.L. c. 142A as they pertain to home improvement contractors and subcontractors. Other regulations applicable to the Home Improvement Contractor program include:

201 CMR 14.00 Operation of the home improvement arbitration program authorized by M.G.L. c. 142A, promulgated by the secretary of the Office of Consumer Affairs and Business Regulations.

201 CMR 15.00 Operation of the home improvement guaranty fund, promulgated by the secretary of the Office of Consumer Affairs and Business Regulations.

780 CMR R6.1 General Provisions
- R6.1.1 Title
- R6.1.2 Definitions
- R6.1.3 Scope
- R6.1.4 Administration and Enforcement
  - R6.1.4.1 Director responsibility
  - R6.1.4.2 Advisory board
- R6.1.5 Persons Who Must Register
  - R6.1.5.1 Filing of application
  - R6.1.5.2 Designated individual
  - R6.1.5.3 Liability
- R6.1.6 Persons Exempt From Registration

780 CMR R6.2 Registration Procedure
- R6.2.1 Applicant Actions
  - R6.2.1.1 Application
  - R6.2.1.2 Supporting documentation
  - R6.2.1.3 Mailing address
  - R6.2.1.4 Certified check/money order
  - R6.2.1.5 Lost/destroyed certificate
  - R6.2.1.6 Licensee liability
- R6.2.2 Director's Action on Application
  - R6.2.2.1 Issuance of certificate
  - R6.2.2.2 Grounds for refusal to register
  - R6.2.2.3 Application refused
  - R6.2.2.4 Record retention
- R6.2.3 Duration of Registration
- R6.2.4 Fees to be Paid Upon Registration or Renewal
  - R6.2.4.1 Registration and renewal fee
  - R6.2.4.2 Contribution to guaranty fund - initial registration
- R6.2.5 Responsibilities of Each Registrant
  - R6.2.5.1 Changes in status
  - R6.2.5.2 Display of certificate number
  - R6.2.5.3 Return of certificate

780 CMR R6.3 Enforcement Procedure
- R6.3.1 Notification of Violation
- R6.3.2 Consideration of Factors
- R6.3.3 Letter of Reprimand
- R6.3.4 Suspension, Revocation, Administrative Penalties
  - R6.3.4.1 Hearing procedure
- R6.3.5 Injunction, Restitution
- R6.3.6 Fines and Criminal Penalties

780 CMR R6.4 Enforcement Actions
- R6.4.1 Administrative Penalties
  - R6.4.1.1 Allowable actions
  - R6.4.1.2 Pendency of claims
- R6.4.2 Fines and Criminal Penalties
  - R6.4.2.1 Sought by attorney general or district attorney
  - R6.4.2.2 Operating without certificate
  - R6.4.2.3 Other violations
- R6.4.3 Injunction, Restitution
  - R6.4.3.1 Order from superior court
  - R6.4.3.2 Director bond not required
- R6.4.4 Permit Requirements, Prohibited Acts and Penalties
  - R6.4.4.1 Permit requirements
  - R6.4.4.2 Prohibited acts
  - R6.4.4.3 Penalties
  - R6.4.4.4 Deceptive act

780 CMR R6.5 Contracts
- R6.5.1 Contract in Writing
- R6.5.2 Contents of Contract
  - R6.5.2.1 Documents and information
  - R6.5.2.2 Permit notice
  - R6.5.2.3 Acceleration of payment
  - R6.5.2.4 Copy to owner
  - R6.5.2.5 Alternative dispute resolution
- R6.5.3 Dispute Resolution
  - R6.5.3.1 Court action
  - R6.5.3.2 Owner right to arbitration
  - R6.5.3.3 Contractor right to arbitration
- R6.5.4 Validity of contract

780 CMR R6.6 Supplementary Identification Cards
- R6.6.1 Definitions
- R.6.6.2 Certificates of registrants
  - R.6.6.2.2 Non-Individual Registrants
- R6.6.3 Fees
- R6.6.4 Expiration

780 CMR R6.1 GENERAL PROVISIONS

R6.1.1 Title: 780 CMR R6 is authorized and promulgated by the administrator of the State Board of Building Regulations and Standards under the authority of M.G.L. c. 142A.

R6.1.2 Definitions:

Application: The form provided by the director which, along with other documentation and fee(s) that may be required, must be duly filed to become a registered home improvement contractor or subcontractor.

Advertisement: Any commercial message in any newspaper, magazine, leaflet, flyer, catalog, display space in the telephone book, on radio, television, public address system, or made in person, by letter or other printed material, or any interior or exterior sign or display, including on a vehicle, which is delivered or made available to an owner by a registrant in any manner whatsoever.

Applicant: Any person who files an application to become registered as a home improvement contractor or subcontractor.

BBRS: The State Board of Building Regulations and Standards

Certificate: The document provided to the registrant which lists the certificate number and other information required by the director.

Certificate number: See registration number.

Clear and Conspicuous: The material representation being disclosed is of ten point type and is so presented as to be readily noticed and understood by a reasonable person. Language in the body of a contract is "conspicuous" if it is in larger or contrasting type or color, or underscored.

Contract: Unless specifically noted otherwise in the text, a written agreement between a home improvement contractor and an owner contained in one or more documents for the performance of certain residential contracting work, including all labor, material, goods and services set forth under said agreement for a total amount exceeding $1,000.00.

Contractor: Any person who, through himself or others, undertakes, offers to undertake, purports to have the capacity to undertake, or submits a bid for construction work. (See "home improvement contractor")

Director: The administrator of the State Board of Building Regulations and Standards, an agency within the executive office of public safety, established by M.G.L. c. 6A, § 19.

Employee: For the purposes of 780 CMR R6 in determining the number of employees of an applicant for registration, any individual engaged in construction related activities who, in the weekly pay period prior to the date of registration worked 20 or more hours for the registrant and for whom, the registrant withheld or was required to withhold federal or state income taxes and who, during the same pay period, was not otherwise paid or had such taxes withheld by any other registrant. Included would be all construction workers, supervisors, sales personnel, designers, estimators, active partners and officers of corporations.

Fund: The residential contractor's guaranty fund. See "guaranty fund".

Fund administrator: the administrator of the residential contractor's guaranty fund, appointed by the secretary of the Office of Consumer Affairs and Business Regulation.

Guaranty fund: The residential contractor's guaranty fund. A fund out of which an owner, as defined herein, aggrieved by a registrant(s) may be paid part or all of their damages under rules and regulations promulgated by the secretary of the Office of Consumer Affairs and Business Regulation.

Home improvement contractor: Any person who owns or operates a contracting business who, through himself or others, undertakes, purports to have the capacity to undertake, offers to undertake, or submits a bid for residential contracting work to an owner, as such work is defined in 780 CMR R6 and M.G.L. c. 142A, and such work for each project is in a total amount in excess of $1,000, and is registered or required to be registered in accordance with M.G.L. c. 142A and 780 CMR R6.

Homeowner: See "owner".

Local consumer group: A local or regional agency which deals with the resolution of consumer problems and who is determined eligible by the attorney general under standards set by the attorney general in accordance with M.G.L. c. 12, § 11G.

Mortgage broker: Any person, who, for compensation or gain, or in the expectation of compensation or gain, directly or indirectly

negotiates, places, assists in placement, finds or offers to negotiate, place, assist in placement of mortgage loans on residential property for others, or as otherwise defined in M.G.L. c. 255E.

Mortgage lender: Any person engaged in the business of making mortgage loans, or issuing commitments to fund mortgage loans, or accepting applications or fees associated with the making of mortgage loans which are secured by a mortgage on residential property, or as otherwise defined in M.G.L. c. 255E.

Mortgage loan: A loan to any person made primarily for personal, family, or household purposes, secured wholly or partially by a mortgage on a residential property, or as otherwise defined by M.G.L c. 255E.

Owner: Any homeowner of a building which is an existing building at the time of a contract that is owner occupied, containing at least one but not more than four dwelling units, or a tenant authorized by the homeowner thereof, who orders, contracts for, or purchases the services of a contractor or subcontractor. An owner occupying a condominium unit in a building containing no more than four dwelling units qualifies as an owner under this definition, provided the owner owns a total of not more than four condominium units. A condominium association does not qualify as an owner.

Owner-occupied: The residential building of at least one but not more than four dwelling units and occupied by the owner as a primary residence.

Permit: For the purposes of 780 CMR R6, any construction-related permit, excluding any permits required by the owner which are not considered construction-related, such as zoning, environmental, historical commission, and the like.

Person: Any individual, partnership, corporation, society, trust, association, or any other legal entity.

Registrant: Any duly registered home improvement contractor or subcontractor.

Registration number: The number assigned to the applicant after he has been approved for registration by the director and the Board of Building Regulations and Standards.

Residential contracting: The reconstruction, alteration, renovation, repair, modernization, conversion, improvement, removal or demolition or the construction of an addition to any pre-existing owner-occupied building containing at least one but not more than four dwelling units, which building or portion thereof is used or designed to be used as a residence or dwelling unit, or to structures which are adjacent and accessory to such residence or building, including but not necessarily limited to: garages, sheds, cabanas, poolhouses, gazebos.

Salesperson: any person, other than a supplier of materials or a laborer, who solicits, offers, negotiates, executes, or otherwise endeavors to procure by any means whatsoever, directly or indirectly, a contract for residential contracting services from an owner on behalf of a home improvement contractor or subcontractor.

Secretary: The secretary of the Office of Consumer Affairs and Business Regulations.

Subcontract: A contract, written or verbal, in any amount, between a home improvement contractor and a subcontractor or between two subcontractors for the performance of any part of the home improvement contractor's or subcontractor's contract.

Subcontractor: Any person, other than a supplier of only materials, who enters into a contract, written or verbal, with a home improvement contractor for the performance of any part of a home improvement contractor's contract with an owner for residential contracting, or who enters into a contract with any other subcontractor for the performance of any part of the subcontractor's contract.

R6.1.3 Scope:

R6.1.3.1 M.G.L. c. 142A and 780 CMR R6 require the registration of persons who engage in residential contracting work as defined in 780 CMR R6 and M.G.L. c. 142A after July 1, 1992, and define the requirements of M.G.L. c. 142A and enforcement of these requirements, as they pertain to home improvement contractors and subcontractors.

R6.1.3.2 Except for those persons who are specifically exempt from the provisions of 780 CMR R6 and M.G.L. c. 142A, all contractors and subcontractors who engage in residential contracting as defined in 780 CMR R6 and M.G.L. c. 142A shall be subject to and shall comply with 780 CMR R6 and M.G.L. c. 142A.

R6.1.4 Administration and Enforcement:

R6.1.4.1 Director responsibility: The director shall promulgate and enforce the provisions of 780 CMR R6 and M.G.L. c. 142A as to all home

improvement contractors and subcontractors who are registered or required to register.

R6.1.4.2 Advisory board: The director may appoint an advisory board which may review proposed suspensions, revocations, and administrative penalties against any registrants, and shall make recommendations to the director relative thereto. The advisory board shall include six members, any four of whom will constitute a quorum; the fund administrator, a representative of the attorney general, a representative of a consumer group appointed by the secretary, a representative of the Massachusetts Homebuilders Association who is a registered home improvement contractor or subcontractor, a Representative of the National Association of the Remodeling Industry, and a BBRS staff member.

R6.1.5 Persons Who Must Register:

R6.1.5.1 General: All home improvement contractors and subcontractors, as defined in 780 CMR R6, except those exempt in 780 CMR R6.1.6, shall register with the director by filing an application prescribed by the director.

R6.1.5.2 Designated individual: In the case of registration by a corporation or partnership, an individual shall be designated to be responsible for the corporation's or partnership's residential contracting work.

R6.1.5.3 Liability: The corporation or partnership and its designee shall be jointly and severally liable for the payment of the registration fee, the payment to the guaranty fund, and for violations of any provisions of 780 CMR R6, including actions by the registrant's employees, subcontractors or salespersons.

R6.1.6 Persons Exempt From Registration or Renewal: Any person exempt from registration under 780 CMR R6.1.6, and does not voluntarily register, is not subject to any of the provisions of 780 CMR R6 or M.G.L. c. 142A. Persons exempt from registration are:

1. the Commonwealth or its political subdivisions;
2. any school, public or private, offering as part of a vocational education program courses and training in any aspects of home construction or home improvements;
3. electricians, plumbers, architects or any other persons who are required by law to attain standards of competency or experience as a prerequisite to licensure for and engaging in such trade or profession and who are acting exclusively within the scope of the profession for which they are currently licensed pursuant to such law, *construction supervisors excepted.*
4. persons dealing in the sale of goods or materials who neither arrange to perform nor perform directly or indirectly any work or labor in connection with the installation of or application of the goods or materials;
5. any owner personally doing residential contracting work on his/her own home;
6. any individual who performs construction related labor or services for a home improvement contractor or subcontractor, for wages or salary and who does not act in the capacity of a home improvement contractor or subcontractor;
7. any contractor or subcontractor who works on one residential contracting undertaking or project by one or more contracts where the aggregate contract price to the owner is less than $1,000; provided, however, that the contract is not in an amount of less than $1,000 for the purpose of evading 780 CMR R6 or M.G.L. c. 142A.
8. any person who engages in the business of a home improvement contractor or subcontractor on other than a full-time basis, and who has earned in gross revenues from residential contracting work, less than $5,000 in the previous 12-month period;
9. any person acting as a home improvement contractor or subcontractor who was enrolled as a full-time student in a secondary school or college with degree granting authority from the government of the state in which the school is located, for the immediately preceding academic semester and is also enrolled as a full-time student for the next academic semester, in the same or a similar degree granting secondary school or college provided that at least ⅔ of the number of employees of the contractor or subcontractor are similarly enrolled in secondary schools or colleges and that the home improvement contractor or subcontractor does not reasonably expect to earn or does not in fact earn, in gross revenues, more than $5,000 from residential contracting work;
10. persons who install any or all of the following:
    - central heating,
    - air-conditioning systems,
    - energy-conservation devices, or
    - provides conservation services conducted by or on behalf of a public utility under a program approved by the department of public utilities;
11. any contractor or subcontractor who works exclusively in any of the following home improvement areas:
    - landscaping;
    - interior painting or wall covering;
    - finished floor covering, including, but not limited to, carpeting, vinyl, tile, non-structural hardwood;
    - fencing or freestanding masonry walls;
    - above-ground swimming pools;

R6.5.2.2 Permit notice: Any contract entered into between a home improvement contractor and an owner shall contain a clause informing the owner of the following:

1. any and all necessary construction-related permits;
2. that it shall be the obligation of the home improvement contractor to obtain such permits as the owner's agent;
3. that owners who secure their own construction-related permits or deal with unregistered contractors will be excluded from the guaranty fund provisions of M.G.L. c. 142A;

R6.5.2.3 Acceleration of payment: No contract shall contain an acceleration clause under which any part or all of the balance not yet due may be declared due and payable because the holder deems himself to be insecure. However, where the contractor deems himself to be insecure he/she may require as a prerequisite to continuing said work that the balance of funds due under the contract, which are in the possession of the owner, shall be placed in a joint escrow account requiring the signatures of the home improvement contractor and owner for withdrawal.

R6.5.2.4 Copy to owner: At the time of signing, the owner shall be furnished with a copy of the contract signed by both the home improvement contractor and the owner. No work shall begin prior to the signing of the contract and transmittal to the owner of a copy of such contract.

R6.5.2.5 Arbitration: Any contract entered into between a home improvement contractor and owner may provide that the home improvement contractor may initiate alternative dispute resolution through any private arbitration services approved by the secretary, as provided in M.G.L. c. 142A; provided, that said alternative dispute resolution provision is clearly and conspicuously disclosed in the contract, in language designated by the secretary, and that each party separately signs and dates the provision, thereby assenting to the procedure. The following language and format is acceptable:

THE CONTRACTOR AND THE HOMEOWNER HEREBY MUTUALLY AGREE IN ADVANCE THAT IN THE EVENT THE CONTRACTOR HAS A DISPUTE CONCERNING THIS CONTRACT, THE CONTRACTOR MAY SUBMIT SUCH DISPUTE TO A PRIVATE ARBITRATION SERVICE WHICH HAS BEEN APPROVED BY THE SECRETARY OF THE EXECUTIVE OFFICE OF CONSUMER AFFAIRS AND BUSINESS REGULATIONS AND THE CONSUMER SHALL BE REQUIRED TO SUBMIT TO SUCH ARBITRATION AS PROVIDED IN M.G.L. c.142A.

_____
Contractor

_____
Owner

NOTICE: THE SIGNATURES OF THE PARTIES ABOVE APPLY ONLY TO THE AGREEMENT OF THE PARTIES TO ALTERNATIVE DISPUTE SETTLEMENT INITIATED BY THE CONTRACTOR. THE OWNER MAY INITIATE ALTERNATIVE DISPUTE RESOLUTION EVEN WHERE THIS SECTION IS NOT SEPARATELY SIGNED BY THE PARTIES.

R6.5.3 Dispute Resolution

R6.5.3.1 Court action: Any party may bring an action to enforce any provisions of 780 CMR R6 and M.G.L. c. 142A, in superior court, the district court, or the small claims division of the district court.

R6.5.3.2 Owner right to arbitration: In the alternative, an owner may request that a dispute resulting from and relating to residential contracting be decided under the terms of a private arbitration service approved by the secretary.

R6.5.3.3 Contractor right to arbitration: The home improvement contractor may initiate dispute resolution through private arbitration services approved by the secretary, provided: that the contract between the owner and the home improvement contractor contains such a clause as provided in 780 CMR R6.5.2.5.

R6.5.4 Validity of contract: Contracts which fail to comply with the requirements of 780 CMR R6 and M.G.L. c. 142A shall not be invalid solely because of noncompliance.

780 CMR R6.6 SUPPLEMENTARY IDENTIFICATION CARDS

R6.6.1 Definitions

Certificate of registration: The document issued by the Director showing the registrant's certificate number and other data as required by the director.

Identification card: The document issued to the responsible individual or to one or more individuals in the employ of the applicant/registrant.

R6.6.2 Certificates of registrants: For applicants registering as individuals, the certificate of

registration and identification card will be issued in the name of the registrant. Only one identification card will be issued to individual registrants.

R6.6.2.2 Non-Individual Registrants:

R6.6.2.2.1 If the Applicant is a corporation, partnership, proprietorship with a fictitious name, or other non-individual entity, the certificate of registration and the initial identification card will bear the name of the registrant entity and the individual responsible for the home improvement residential contracting activities of the registrant.

R6.6.2.2.2 Supplementary identification cards may be issued, upon request of the registrant, to named officers, partners, of key individuals in the employ of the registrant under the certificate of registration number of the applicant entity, upon submission of the appropriate request form and fee. The applicant is responsible for the prompt return of individual identification cards if there is a change in status of individuals holding such supplementary cards.

R6.6.3 Fees: For each additional identification card request in accordance with 780 CMR R6.2.2.1, an additional fee per card in an amount of $10.00 must accompany the request for additional cards.

R6.6.4 Expiration: Supplementary cards will expire on the same date as the expiration date of the registrant entity, and must be renewed along with the renewal of the registrant entity's registration by submission of the required application and fee of $10.00 per card requested.

191

THE COMMONWEALTH OF MASSACHUSETTS
Office of the Secretary of the Commonwealth

Notice of Correction
Regulation Filing *To be completed by filing agency*

CHAPTER NUMBER: 780 CMR R3

CHAPTER TITLE: Manufactured Buildings, Manufactured Building Components and Mobile Homes

AGENCY: State Board of Building Regulations and Standards

ORIGINAL PUBLICATION REFERENCE: Register Number 826 Date 9/19/97

SUMMARY OF CORRECTION

Corrects footer at bottom of page which incorrectly identified the page as an "EMEKGENCY" page.

AGENCY CONTACT: Wm Ryan PHONE: (617) 727-2831
ADDRESS: Regulations Division, One Ashburton Pl. , Boston, MA 02108

Publication *To be completed by the Regulations Division*

MASSACHUSETTS REGISTER NUMBER: 829 DATE: 10/31/97

EFFECTIVE DATE: 8/28/97

CODE OF MASSACHUSETTS REGULATIONS

Remove these pages: CMR: Vol.	*Insert these pages:*
775, 776	775, 776

A TRUE COPY ATTEST
WILLIAM FRANCIS GALVIN
SECRETARY OF THE COMMONWEALTH
DATE 10/9/97 CLERK

97

Bldg Code

performed under such permit is to include the installation of a certified manufactured building, manufactured building component or manufactured home in accordance with the provisions of the applicable codes, the statement to be signed by the applicant or his agent, with the appropriate address.

R3.5.1.3 Permit Application - Building System: A true copy of the approved building system with respect to which the manufactured building or manufactured building component was manufactured or is to be manufactured, where one has not previously been furnished to that local enforcement agency.

R3. 5.1.4 Permit Application - Building System Approval: A copy of the Building System Report, as approved by the BBRS, where it has not previously been furnished to the Local Enforcement Agency.

R3. 5.2 Inspection of Site Preparation and Service Connections: Appropriate local enforcement agencies shall inspect site preparation work including foundations, not within the scope of the approval and certification, and the structural, mechanical, plumbing and electrical connections among units, for compliance with applicable law, rules and regulations.

R3.5.3 Compliance with Instructions: Appropriate local enforcement agencies shall inspect all manufactured buildings, manufactured building components or manufactured homes upon, or promptly after, installation at the building site to determine whether all instructions in the Building System Approval Report or conditions listed on the manufacturer's data plate have been followed.

This may include tests for tightness of plumbing and mechanical systems, and for malfunctions in the electrical system and a visual inspection for obvious nonconformity with the approved building system.

R3.5.3.1 Disassembly Prohibited: Unauthorized destructive disassembly of certified buildings and building components and mobile homes shall not be performed in order to conduct such tests or inspections, except as provided in 780 CMR R3.3.4.3, nor shall there be imposed standards or test criteria different from those adopted by the State Enforcement Agencies or specified in the Building System Approval Report, or the "HUD's" Manufactured Home Construction and Safety Standards.

R3.5.3.2 Opening Panels: Nondestructive disassembly may be performed only to the extent of opening access panels and cover plates.

R3.5.4 Noncomplying New Units: Local enforcement agencies shall report to the BBRS in accordance with 780 CMR R3.5.6 any noncomplying manufactured buildings and building components.

R3.5.5 Certificates of Occupancy: Appropriate local inspectors shall issue certificates of occupancy for certified manufactured buildings and manufactured homes containing certified building components which otherwise comply with all the applicable codes, after they have been installed and inspected pursuant to the applicable codes and 780 CMR R3, provided that any manufactured building or manufactured building component found not to comply with the Building System Approval Report or any manufactured home found not to comply with "Hud's" Manufactured Home Construction and Safety Standards shall be brought into compliance before such certificate of occupancy shall be issued.

R3.5.6 Reporting of Violations to Department of Public Safety: When any local enforcement agency is making an inspection and finds violations or suspected violations, it shall report the details of the violations in writing to the BBRS. Where violations are hazardous to occupants, a certificate of occupancy shall not be issued and the building shall not be occupied before such hazards are corrected. If the violations are not hazardous, a temporary certificate of occupancy may be issued.

780 CMR R3.6 FEES

R3.6.1 Deposit for Application to the BBRS: A deposit shall be required upon application to the BBRS to perform any of the functions in 780 CMR R3.

R3.6.2 Establishment of Fees: Fees charged by the BBRS for functions performed shall be in accordance with the fee schedule established by the State Administrative Agencies as specified in 780 CMR R3.18.

780 CMR R3.7 NOTIFICATION OF CHANGES IN NAME, ADDRESS, OWNERSHIP OR LOCATION

R3.7.1 Notification by Manufacturers: Manufacturers shall notify the BBRS in writing within ten days of any of the following occurrences:

a. The corporate name is changed;
b. The main address of the company is changed;
c. There is a change in 25% or more of the ownership interest of the company within a 12 month period;
d. The location of any manufacturing facility is changed;
e. A new manufacturing facility is established; or
f. There are changes in principal officers of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

R3.7.2 Notification by Inspection Agencies: Inspection agencies shall notify the BBRS in writing within ten days of any of the following occurrences:

a. The company name is changed;
b. The main address of the company is changed;
c. There is a change in 25% or more of the ownership interest or control of the company within a 12 month period;
d. The location of any testing facility is changed;
e. A new testing facility is established; or
f. There are changes in principal officers and key supervisory and responsible personnel of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

780 CMR R3.8 PROPRIETARY INFORMATION

All information relating to building systems and compliance assurance programs which the manufacturer or other party considers proprietary shall be so designated by him at the time of its submission, and shall be so held by the State Enforcement Agencies and State Administrative Agencies, except as the State Administrative Agencies determine in each case, that disclosure is necessary to carry out the purposes of the applicable codes and 780 CMR R3.

PART II REQUIREMENTS FOR SUBMISSION OF BUILDING SYSTEMS AND COMPLIANCE ASSURANCE PROGRAMS

780 CMR R3.9 BUILDING SYSTEMS

Building systems shall meet the requirements set forth below to be evaluated for compliance with the standards, specifications and requirements adopted by the State Administrative Agencies.

R3.9.1 General Requirements:

R3.9.1.1 Plans, Specifications and Documentation: Building systems, including all plans, specifications and other documentation, shall be submitted in quadruplicate to the BBRS who shall act as the depository and disburser of all such items. The BBRS shall forward to the appropriate State Enforcement Agencies plans, specifications and documentation for their recommendations.

R3.9.1.2 Form and Fees: Building systems shall be submitted in the form prescribed by the BBRS and shall be accompanied by all required fees.

R3.9.1.3 Identification: All documents submitted with the application shall be identified to indicate the manufacturer's name, office address and address of the manufacturing facility.

R3.9.1.4 Plans Showing Elements: Plans shall be submitted showing all elements relating to specific systems on properly identifiable sheets.

R3.9.1.5 Application - Approved Architect or Engineer: Each building system application shall bear the signature and seal of an approved registered architect or registered professional engineer certifying that the building system complies with the applicable codes and standards promulgated herein.

R3.9.1.6 On-site Work Identified: All work to be performed on-site, including connection of all systems, equipment and appliances, shall be identified and distinguished from work to be performed in the manufacturing facility.

R3.9.1.7 Space for State Administrative Agencies Approval Stamp: A 3" x 4" blank rectangular space shall be provided on all sheets of plans near the title box for the BBRS's stamp of approval.

R3.9.1.8 Material Grade and Quality: Grade, quality and identification of all material shall be specified.

R3.9.1.9 Calculations and Test Reports: Design calculations and test reports shall be specified.

R3.9.1.9.1 Drawings to Scale: Drawings shall be drawn to scale and be legible.

R3.9.1.9.2 Label and Data Plate Location: Drawings shall indicate the location of the approved label and data plate.

R3.9.1.9.3 Drawings Dated and Identified: Drawings shall be dated and identified. The number of sheets in each set shall be indicated.

R3.9.2 Required Construction Details: Building systems for manufactured buildings shall provide or show, but not be limited to, the details listed below including the method of their testing or evaluation, or both. These requirements shall apply to the building systems for building components only to the extent deemed necessary by the State Enforcement Agencies to permit a proper evaluation of the building component.

R3.9.2.1 General:

a. Details and methods of installation of manufactured buildings or manufactured building components on foundations and/or to each other.
b. All exterior elevations.
c. Cross sections as necessary to identify major building components.
d. Details of flashing, such as at openings and at penetrations through roofs and subcomponent connections. Indicate flashing material and gauge to be used.
e. Attic access and attic ventilation.
f. Exterior wall, roof and soffit material as well as finish.