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780 CMR 51.00

ADMINISTRATION FOR SINGLE- AND TWO-FAMILY DWELLINGS

(Note: 780 CMR 51.00 is unique to Massachusetts)

780 CMR 5101 SCOPE

5101.1 Title. 780 CMR 51.00 through 99.00 (plus Referenced Standards, Regulations, Appendices and Index) shall be known as the Commonwealth of Massachusetts *Building Code for One- and Two-Family Dwellings*.

5101.2 Scope and Authority. 780 CMR 51.00 through 99.00 is promulgated under authority of M.G.L. c. 143, §§ 93 through 100 in accordance with the legislative intent to establish uniform design and construction regulations throughout the Commonwealth. Municipalities may not modify 780 CMR 51.00 through 99.00 or regulate in the subject areas reserved for the Board of Building Regulations and Standards (hereinafter all referred to as the "BBRS") unless such regulations, ordinances, bylaws or policies are promulgated in accordance with M.G.L. c. 143, §§ 96, 97 and/or 98 as applicable. The provisions of 780 CMR 51.00 through 99.00 shall apply to detached one- and two-family dwellings, not more than three stories in height with separate means of egress, and their accessory structures as follows:

1. The construction, reconstruction, alteration, enlargement, replacement, repair, demolition, removal, or movement and installation of equipment, the inspection of and issuance of and revocation of permits or licenses relative to detached one- and two-family dwellings;
2. The rehabilitation and maintenance of existing buildings;
3. The standards or requirements for materials to be used in connection therewith, including, but not limited to provisions for safety, ingress and egress, energy conservation and sanitary conditions;
4. The establishment of reasonable fees for inspections and the issuance of licenses to individuals engaged as construction supervisors;
5. The certification of inspectors of buildings, building commissioners and local inspectors;
6. The registration of Home Improvement Contractors pursuant to M.G.L. c. 142A, except as such matters are otherwise provided for in the Massachusetts General Laws Annotated, or in the rules and regulations authorized for promulgation under the provisions of 780 CMR 51.00 through 99.00; and
7. Other duties and responsibilities as defined in 780 CMR 110, Special Regulations R1 through R7, as applicable.

5101.3 Application of References. Unless otherwise specifically provided for in 780 CMR 51.00 through 99.00, all references to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of 780 CMR 51.00 through 99.00.

5101.4 Intent Code Remedial. 780 CMR 51.00 through 99.00 shall be construed to secure its expressed intent, which is to ensure public safety, health and welfare insofar as they are affected by building construction, through structural strength, adequate means of egress facilities, sanitary conditions, light and ventilation, energy conservation and fire safety; and, in general, to secure safety to life and property from all hazards incident to the design, construction, reconstruction, alteration, repair, demolition, removal, movement and/or use or occupancy of detached one- and two-family dwelling buildings, structures or premises.

5101.5 Specialized Codes. In accordance with M.G.L. c. 143, § 96, specialized codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition, and inspection promulgated by, and under the authority of the various boards which have been authorized by the general court shall be incorporated into 780 CMR 51.00 through 99.00. Areas regulated by the specialized codes shall require that all such work performed is designed, installed and inspected in accordance with the specialized codes. For governing regulations addressing the approval, design, installation and maintenance of fossil-fuel-burning appliances, refer to the *Massachusetts Fuel Gas and Plumbing Codes* (248 CMR) for gas and the *Massachusetts Fire Prevention Regulations State Fire Code* (527 CMR) for oil. Applicable specialized codes, rules or regulations relating to building systems include, but are not limited to, those identified in 780 CMR 5101.5.1 through 5101.5.7 and those listed in 780 CMR 100.

5101.5.1 Electrical. *Massachusetts State Electrical Code* (527 CMR 12.00).

5101.5.2 Gas. *Massachusetts Fuel Gas Code* (248 CMR).

5101.5.3 Mechanical. *International Mechanical Code*.

5101.5.4 Plumbing. *Massachusetts State Plumbing Code*. (248 CMR).

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5101.5.5 Property Maintenance. *Massachusetts Sanitary Code (105 CMR).*

5101.5.6 Fire Prevention. *Massachusetts Fire Prevention Regulations (527 CMR).*

5101.5.7 Elevator. *Massachusetts State Elevator Code (524 CMR).*

5101.6 Referenced Standards. The standards referenced in 780 CMR 51.00 through 99.00 and listed in Appendix A shall be considered part of the requirements of 780 CMR 51.00 through 99.00 to the prescribed extent of each such reference. Where differences occur between provisions of 780 CMR 51.00 through 99.00 and referenced standards, the provisions of 780 CMR 51.00 through 99.00 shall apply. The administrative provisions of 780 CMR 51.00 through 99.00 shall apply to all standards referenced in Appendix A, other than the specialized codes listed in 780 CMR 5101.5.

Exception: Where enforcement of a provision of 780 CMR 51.00 through 99.00 would violate the conditions of a listing of a material, equipment or appliance, the conditions of the listing and manufacturer's instructions shall apply.

780 CMR 5102 APPLICABILITY

5102.1 General. The provisions of 780 CMR 51.00 through 99.00 shall apply to all matters affecting or relating to detached one- and two-family dwellings as set forth in 780 CMR 5101 and shall apply with equal force to municipal, county, state authorities of or established by the legislature and private detached one- and two-family dwellings, except where such detached one- and two-family dwellings are otherwise provided for by statute.

5102.2 Matters Not Provided For. Any requirements that are essential for the structural, fire or sanitary safety, or interior climate comfort of an existing or proposed detached one- and two-family dwelling, or for the safety of the occupants thereof, which are not specifically provided for by 780 CMR 51.00 through 99.00, shall be determined by the building official. The BBRS shall be notified by the building official in writing within seven working days of any action taken pursuant to 780 CMR 5102.

5102.3 Zoning Bylaw Restrictions. When the provisions in 780 CMR 51.00 through 99.00 specified for structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, energy conservation or fire safety conflict with the local zoning bylaws or ordinances, 780 CMR 51.00 through 99.00 shall control the construction or alteration of detached one- and two-family dwellings unless such bylaws or ordinances are promulgated in accordance with the provisions of M.G.L. c. 143, § 98.

5102.4 General Bylaw Restrictions. When the provisions herein specified for structural strength,

adequate egress facilities, sanitary conditions, equipment, light and ventilation, energy conservation or fire safety conflict with the local general bylaws or ordinances, 780 CMR 51.00 through 99.00 shall control the construction or alteration of detached one- and two-family dwellings unless such bylaws or ordinances are promulgated in accordance with the provisions of M.G.L. c. 143, § 98.

5102.5 Existing Buildings. Existing detached one- and two-family dwellings shall comply with the provisions of 780 CMR 5102, and all other applicable provisions of 780 CMR 51.00 through 99.00, including all applicable requirements of 780 CMR 93.00. Existing detached one- or two-family dwellings or their accessory buildings, or portions thereof, that have been damaged by fire, flood, impact or have suffered similar physical damage, shall not be reoccupied without approval from the building official.

5102.5.1 General. Unless specifically provided otherwise in 780 CMR 51.00 through 99.00, any detached one- and two-family dwelling shall meet and shall be presumed to meet the provisions of the applicable laws, codes, rules or regulations, bylaws or ordinances in effect at the time such detached one- and two-family dwelling was constructed or substantially altered and shall be allowed to continue to be occupied pursuant to its use and occupancy, provided that the detached one- and two-family dwelling shall be maintained in accordance with 780 CMR 5103.

5102.5.2 In cases which applicable codes, rules or regulations, bylaws or ordinances were not in use at the time of such construction or alteration, the provisions of 780 CMR 5103.0 shall apply.

5102.5.3 In cases where the provisions of 780 CMR 51.00 through 99.00 are less stringent than the applicable codes, rules or regulations, bylaws or ordinances at the time of such construction or substantial alteration, the applicable provisions of 780 CMR 51.00 through 99.00 shall apply, providing such application of these provisions does not result in danger to the public, as determined by the building official.

5102.5.4 Moved Structures. Detached one- and two-family dwellings moved into or within the jurisdiction shall comply with the provisions of 780 CMR 93.00.

780 CMR 5103 MAINTENANCE

5103.1 General. All detached one- and two-family dwellings and all parts thereof, both existing and new, and all systems and equipment therein that are regulated by 780 CMR 51.00 through 99.00 shall be maintained in a safe, operable and sanitary condition. All service equipment, means of egress, devices and safeguards that are required by

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780 CMR 51.00 through 99.00, or were required by a previous statute, when erected, altered or repaired, shall be maintained in good working order.

5103.2 Owner Responsibility. The owner, as defined in 780 CMR 52.00, shall be responsible for compliance with the provisions of 780 CMR 5103.0.

780 CMR 5104 VALIDITY

5104.1 General. The provisions of 780 CMR 51.00 through 99.00 are severable, and if any of its provisions shall be held unconstitutional or otherwise invalid by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

**780 CMR 5105 OFFICE OF THE INSPECTOR
OF BUILDINGS OR BUILDING
COMMISSIONER**

5105.1 Appointment. The chief administrative officer of each city or town shall employ and designate an inspector of buildings or building commissioner (hereinafter inspector of buildings) as well as such other local inspectors as are reasonably necessary to assist the inspector of buildings to administer and enforce 780 CMR 51.00 through 99.00 and the rules and regulations made under the authority thereof. The inspector of buildings shall report directly to and be solely responsible to the appointing authority.

5105.2 Alternate. The inspector of buildings is authorized to designate an alternate who shall exercise all the powers of the inspector of buildings during the temporary absence, disability or conflict of interest of the inspector of buildings. Said alternate shall be duly qualified and certified pursuant to 780 CMR 5105.3.

5105.3 Qualifications of the Inspector of Buildings. In accordance with the provisions of M.G.L. c. 143, § 3, each inspector of buildings shall have had at least five years of experience in the supervision of building construction or design or, in the alternative, a four-year undergraduate degree in a field related to building construction or design, or any combination of education and experience which would confer equivalent knowledge and ability, as determined by the BBRS. In addition, each inspector of buildings shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe egress, as well as a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

Each inspector of buildings shall be certified by the BBRS in accordance with the provisions of Special Regulation 780 CMR 110.R7.

Municipalities may require additional qualifications or experience as are deemed

necessary.

5105.4 Qualifications of the Local Inspector. In accordance with the provisions of M.G.L. c. 143, § 3, each local inspector shall have had at least five years of experience in the supervision of building construction or design or, in the alternative, a two-year associate's degree in a field related to building construction or design, or any combination of education and experience which would confer equivalent knowledge and ability, as determined by the BBRS. In addition, such persons shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe egress, as well as a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

Each local inspector shall be certified by the BBRS in accordance with the provisions of Special Regulation 780 CMR 110.R7.

Municipalities may require additional qualifications or experience as are deemed necessary.

5105.5 Reporting Requirements.

5105.5.1 Annual Report by City or Town Clerk. In accordance with the provisions of M.G.L. c. 143, § 3, the clerk of each city or town shall, annually, not later than April 1st, transmit to the BBRS the names and official addresses of each inspector of buildings, building commissioner and local inspector as well as at such other times as required pursuant to Special Regulation 780 CMR 110.R7: *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors*. Such reports shall be submitted on forms prescribed by the BBRS for said purpose.

5105.5.2 New Appointments. Immediately following an appointment, the clerk of each city or town shall report to the BBRS, the name, title and status of each new employee who is appointed as an inspector of buildings, building commissioner or local inspector. Said report shall be provided on forms as prescribed by the BBRS for said purpose and shall be submitted in attestation under the pains and penalties of perjury that said new employee meets or exceeds the minimum qualifications as defined by M.G.L. c. 143, § 3 and 780 CMR 5105.3 and 5105.4, as applicable.

5105.6 Restriction of Employees. Unless authorized by the municipal appointing authority in accordance with 930 CMR 1.00 through 4.00 (the Commonwealth of Massachusetts Ethics Commission), no full-time or part-time building commissioner, inspector of buildings, or full-time or part-time local inspector as defined in 780 CMR 51.00 through 99.00 shall be engaged in, or directly or indirectly connected with, the furnishing of labor, materials or appliances for the construction, alteration or maintenance of a detached one- or

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two-family dwelling, or the preparation of plans or specifications therefore within the city, town or region for which he or she is appointed, unless he or she is the owner of the detached one- or two-family dwelling; nor shall any officer or employee associated with the building department engage in any work which conflicts with his or her official duties or with the interests of the department.

Note: See M.G.L. c. 143, § 3Z: *Part Time Inspector of Buildings, Building Commissioner, Local Inspector, or Alternate Inspector; Other Employment* (Local Option Law relative to part-time employees).

5105.7 Relief from Personal Liability. Insofar as the law allows, while acting for the municipality, the building official charged with the enforcement of 780 CMR 51.00 through 99.00 shall not be deemed personally liable in the discharge of his or her official duties; all such matters are governed by M.G.L. c. 258.

5105.8 Official Records. An official record shall be kept of all business and activities of the department specified in the provisions of 780 CMR 51.00 through 99.00, including, but not limited to, 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 detached one- and two-family dwelling to which they relate remains in existence unless otherwise provided for by law.

In accordance with the provisions of M.G.L. c. 66, § 10(b), all such records shall be open to public inspection at all appropriate times and in accordance with reasonable rules to maintain the integrity and security of such records.

**780 CMR 5106 DUTIES AND POWERS OF
THE BUILDING OFFICIAL**

5106.1 General. The inspector of buildings and local inspector (hereinafter referred to as "building official") shall enforce all of the provisions of 780 CMR 51.00 through 99.00, and any other state statutes, rules and regulations, or ordinances or bylaws which empower the building official. The building official shall act on any question relative to the mode or manner of construction and materials to be used in the construction, reconstruction, alteration, repair, demolition, removal, and/or installation of equipment and the location, use, occupancy and maintenance of all detached one-and two-family dwellings except as otherwise specifically provided for by requirements in 780 CMR 5109.

5106.2 Applications and Permits. The building official shall receive applications and issue permits for the construction, reconstruction, alteration, repair, demolition, removal or change in use or

occupancy of buildings and structures; inspect the premises for which such permits have been issued; and enforce compliance with the provisions of 780 CMR 51.00 through 99.00.

5106.3 Notices and Orders. The building official shall issue all necessary notices, orders or citations to ensure compliance with 780 CMR 51.00 through 99.00.

5106.4 Inspections. The building official shall make such inspections as deemed necessary to ensure compliance with 780 CMR 51.00 through 99.00, or the building official may accept reports of inspection by qualified agencies or individuals subject to the applicable requirements of M.G.L. c. 268A. Reports shall be in writing and be certified by a responsible officer of such agency or by the responsible individual.

5106.5 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 buildings or structures to be constructed, reconstructed, altered, demolished or removed.

**780 CMR 5107 DUTIES AND POWERS OF
THE STATE INSPECTOR
(M.G.L. c. 143, § 3A)**

5107.1 The State Inspector. In every city and town of Massachusetts, 780 CMR 51.00 through 99.00 shall be enforced by the State Inspector of the Department of Public Safety, Division of Inspections, as to any detached one- or two-family dwelling 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 it pertains to such detached one- or two-family dwellings all the powers of a building commissioner or inspector of buildings. All detached one- or two-family dwellings owned by any authority established by the legislature and not owned by the Commonwealth shall be regulated in accordance with 780 CMR 5106.

5107.2 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 51.00 through 99.00; and report in writing his findings to the building officials.

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5107.3 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 51.00 through 99.00; 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.

5107.4 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 5108 RULES AND REGULATIONS

5108.1 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 51.00 through 99.00 to secure the intent thereof.

5108.2 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 51.00 through 99.00. Public hearings shall be held as specified in said law, 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.

5108.3 Activities Requiring Licenses, Registration or Certification. See Special Regulations 780 CMR 110.R1 through R7, as applicable, for the special regulation relating to such license, registration and/or certification.

5108.3.1 Testing Laboratories. When a testing laboratory, branch laboratory and/or project laboratory is engaged to test concrete and/or concrete materials for use in detached one- and two-family dwellings, said laboratory shall be licensed by the BBRS in accordance with 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R1: *Concrete Testing Laboratories Licensing*.

5108.3.2 Field Technicians. When a person is engaged in the activities of field testing of

concrete for use in detached one- or two-family dwellings and/or controlled materials, such person shall be licensed by the BBRS in accordance with Special Regulation 780 CMR 110.R2: *Concrete Testing Personnel Licensing*.

5108.3.3 Manufactured Buildings. No individual, organization or firm shall be engaged in the construction of manufactured buildings for use in the Commonwealth of Massachusetts or shall act as a third-party inspection agency (TPIA) or a dealer of said manufactured buildings unless approved to construct same or act in such capacity by the BBRS in accordance with Special Regulation 780 CMR 110.R3: *Manufactured Buildings, Building Components and Mobile Homes*.

5108.3.4 Native Lumber. No individual, organization or firm shall engage in the production of native lumber for use in detached one- or two-family dwellings within the Commonwealth of Massachusetts unless registered by the BBRS in accordance with 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R4, *The Rules and Regulations Controlling the Use of Native Lumber*.

5108.3.5 Licensing of Construction Supervisors.

5108.3.5.1 Except for those structures governed by Construction Control as identified in the Commonwealth of *Massachusetts Base Building Code* (780 CMR 1.00, 780 CMR 116.00), 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 51.00 through 99.00, unless said individual is licensed in accordance with 780 CMR 110.R5: *Construction Supervisors*.

No person shall be engaged in the supervision of the field erection of a manufactured building unless such person is licensed in accordance with Special Regulation 780 CMR 110.R5: *Construction Supervisors*.

Exception: Any homeowner performing work for which a building permit is required shall be exempt from the licensing provisions of 780 CMR 5108.3.5, provided that if a homeowner engages a person(s) for hire to do such work, that such homeowner shall act as supervisor. This exception shall not apply to the field erection of manufactured buildings constructed pursuant to 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R3. For the purposes of 780 CMR 5108.3.5, a "homeowner" is defined as follows: Person(s) who owns a parcel of land on

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which he or 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 homeowner.

Note: Any licensed construction supervisor who contracts to do work for a homeowner shall be responsible for performing said work in accordance with 780 CMR 51.00 through 99.00, Special Regulation 780 CMR 110.R5 and all referenced standards and/or manufacturer's recommendations, whether or not the licensed contractor secured the permit for said work.

5108.3.5.2 Exemptions from Construction Supervisor License Requirement. A construction supervisor's license is not required for:

1. Erection of rooftop solar collectors, the erection of signs, the erection of tents;
2. Projects which are subject to "construction control" (*see* 780 CMR 2.00 for definition of "Construction control");
3. Agricultural buildings which are not open to the public or otherwise made available for public use;
4. Massachusetts-registered engineers and Massachusetts-registered architects (collectively referred to herein as "registered design professionals"), provided such engineers and/or architects comply with the Construction Supervisor oversight requirements set forth in Special Regulation 780 CMR 110.R5 generally and 780 CMR 5116.0, as applicable; and
5. The practice of any trade licensed by agencies of the Commonwealth, provided that any such work is within the scope of said license, including, but not limited to, wiring, plumbing, gas fitting, fire protection systems, pipefitting, HVAC and refrigeration equipment.

5108.3.5.3 Municipal Construction Licensing. No municipality shall be prohibited from requiring a license for those individuals engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition in those categories of buildings 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.

5108.3.6 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 Special Regulation 780 CMR 110.R6.

5108.3.7 Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors. Except as allowed for conditional appointees, no individual shall perform the duties of municipal inspectors of buildings, building commissioners or local inspectors unless certified by the BBRS as set forth in Special Regulation 780 CMR 110.R7.

5108.4 Enforcement. Whoever violates the provisions of 780 CMR 5108 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 5118 or shall be subject to any other penalty provided for by law.

780 CMR 5109 APPROVAL

5109.1 Approved Materials and Equipment. All materials, equipment and devices subject to approval by the building official shall be constructed and installed in accordance with such approval.

5109.2 Used Materials and Equipment. Used materials, equipment and devices which meet the minimum requirements of 780 CMR 51.00 through 99.00 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.

5109.3 Modifications. Wherever there are practical difficulties involved in carrying out the provisions of 780 CMR 51.00 through 99.00, the building official shall have the authority to grant modifications for individual cases, provided the building official shall first find that special individual reason makes the strict letter of 780 CMR 51.00 through 99.00 impractical and the modification is in compliance with the intent and purpose of 780 CMR 51.00 through 99.00 and that such modification does not lessen health, life, fire safety or structural requirements. The details of actions granting modifications shall be recorded and entered in the files of the building department. A building official may seek assistance from the District State Building Inspector for action under 780 CMR 5109. The

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provisions of 780 CMR 5109 shall not apply to the specialized codes.

5109.3.1 Areas Prone to Flooding. The building official shall not grant modifications to any provision related to areas prone to flooding as established by 780 CMR 51.00 through 99.00 without the granting of a variance to such provisions by the BBRS Building Code Appeals Board as defined in 780 CMR 5122.

5109.4 Alternative Materials and Equipment.

5109.4.1 General. The provisions of 780 CMR 51.00 through 99.00 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 51.00 through 99.00, 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 51.00 through 99.00, and that said alternative is, for the purpose intended, at least the equivalent of that prescribed in 780 CMR 51.00 through 99.00 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.

5109.4.2 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.

5109.4.3 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.

5109.4.4 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 5123 for approval.

780 CMR 5110 APPLICATION FOR PERMIT

5110.1 Permit Application. It shall be unlawful to construct, reconstruct, alter, repair, remove or demolish a detached one-and two-family dwelling; or to install or alter any equipment for which a provision is made or the installation of which is

regulated by 780 CMR 51.00 through 99.00 without first filing a written application with the building official and obtaining the required building permit and all other required permits therefore.

5110.2 Temporary Structures and Uses.

5110.2.1 General. The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

5110.2.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, light, ventilation and sanitary requirements of 780 CMR 51.00 through 99.00 as necessary to ensure the public health, safety and general welfare.

5110.2.3 Termination of Approval. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

5110.3 Exemptions. A building permit is not required for the following activities. Such exemption, however, shall not exempt the activity from any review or permit that may be required pursuant to other laws, bylaws, 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 (12 m^2).
2. Fences six feet (1829 mm) in height or less.
3. Retaining walls that, 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 (1220 mm) of unbalanced fill.
4. Ordinary repairs as defined in 780 CMR 52.00: *Repairs, ordinary* shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam, column or other load-bearing 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

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people or uses other than normally expected for this purpose).

6. Painting, papering, tiling, carpeting, countertops and similar finish work.
7. Swings and other playground equipment accessory to a one- or two-family dwelling.
8. Window awnings nine square feet (0.8361 m^2) or less in area supported by an exterior wall.

5110.4 Form of Application. Applicants shall submit requests for building permits only on the uniform building permit application form contained in Appendix 780 CMR 120.P or on a form that has been approved by the BBRS for such purpose. The application for a permit shall be accompanied by the required fee as prescribed in 780 CMR 5114.

5110.5 By Whom Application is Made. Application for a permit shall be made by the owner or lessee of the detached one- or two-family dwelling 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 M.G.L. c. 142A, *Regulation of Home Improvement Contractors*. 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 Special Regulation 780CMR 110.R6 and M.G.L. c. 142A for additional information regarding the Home Improvement Contractor Registration Program.

5110.6 Recognition of Laws, Rules and Regulations. 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 detached one- or two-family dwelling 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.

5110.7 Construction Documents. The application for a 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

51.00 through 99.00, specific information shall be given to establish such quality, and 780 CMR 51.00 through 99.00 shall not be cited, or the term "legal" or its equivalent used as a substitute for specific information.

When such application for permit includes fire protection systems or portions thereof, the building official shall cause one set of construction documents filed pursuant to 780 CMR 5110.7 to be transmitted simultaneously to the head of the local fire department for his file, review and approval of the fire protection system items specified in 780 CMR 5313 and/or 780 CMR 93.00 as applicable. The head of the local fire department shall within ten working days from the date of receipt by him, approve or disapprove such construction documents. If the head of the local fire department disapproves such construction documents, he or she shall notify the building official (refer to M.G.L. c. 148, § 28A) in writing citing the relevant sections of noncompliance with 780 CMR or the sections of the referenced standards of Appendix A. Upon the request of the head of the local fire department, the building official may grant one or more extensions of time for such review provided, however, that the total review by said head of the local fire department shall not exceed 30 calendar days (the same concurrent 30-day period afforded building department review). If such approval, disapproval or request for extension of time is not received by the building official within said ten working days, the building official may deem the fire protection construction documents implicitly approved by the head of the local fire department.

Construction documents shall be drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that the work will conform to the provisions of 780 CMR 51.00 through 99.00 and relevant laws, ordinances, rules and regulations, as determined by the building official.

At a minimum, construction documents shall include the following:

1. Site plan;
2. Foundation plan and details (as necessary);
3. Floor plans (including basement and attic levels, if applicable); floor plans shall include location of all required fire protection systems and heating systems storage areas.
4. Exterior building elevations;
5. Framing plans and/or building section(s) adequately depicting structural systems;
6. Schedules, legends and/or details adequately depicting doors, windows and related material installations; and
7. Energy conservation information.

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Failure to comply with 780 CMR 5110.7 Items through .7 shall result in denial of the building permit.

5110.7.1 Preparation of Construction Documents. In accordance with M.G.L. c. 112, § 60L and M.G.L. c. 112, §§ 81D through 81T, the design of any structural member, building system or parts thereof not prescriptively provided for in 780 CMR 51.00 through 99.00 may require the services of a registered design professional. A building official may require plans, specifications, calculations and/or details of sufficient clarity to ensure compliance with the relevant requirements of 780 CMR 51.00 through 99.00 and/or relevant laws, ordinances, rules and regulations.

5110.7.2 Information for Construction in Areas Prone to Flooding. Construction documents for detached one- and two-family dwellings to be constructed in flood hazard areas are required to be prepared by a registered architect or registered professional engineer (collectively referred to herein as registered design professionals) and shall include:

1. Delineation of flood hazard areas, floodway boundaries, and flood zones, and the design flood elevation, as appropriate; and
2. The elevation of the proposed lowest floor, including basement; in areas of shallow flooding (AO zones), the height of the proposed lowest floor, including basement, above the highest adjacent grade.

5110.7.3 Design. Plans, computations and specifications involving new construction, alterations, repairs, expansions or additions or change in use or occupancy of any detached one- or two-family dwelling which are prepared by or under the supervision of a Massachusetts-registered architect or Massachusetts-registered professional engineer, as applicable, shall bear his or her original signature and seal. Said signature and seal shall signify that the plans, computations and specifications meet the applicable provisions of 780 CMR 51.00 through 99.00 and all accepted engineering practices. A legally recognized professional performing work as defined by M.G.L. c. 112, § 81R may be exempted from 780 CMR 5110.

5110.7.4 Plot Plan. The construction documents submitted with the application for permit shall be accompanied by a plot plan showing the size and location of new construction and existing structures on the site and distances from lot lines. In the case of demolition, the plot plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site.

5110.8 Amendments to Application. Subject to the limitations of 780 CMR 5110.9, amendments to a plan, application or other records accompanying the

same shall be filed prior to the commencement of the work for which the amendment to the permit is sought or issued. Such amendments shall be deemed part of the original application and shall be submitted in accordance with 780 CMR 5110.1.

5110.9 Time Limitation of Application. An application for a permit for any proposed work shall be deemed to have been abandoned six months after the date of filing, unless such application has been diligently prosecuted or a permit shall have been issued; except that the building official shall grant one or more extensions of time for additional periods not exceeding 90 days each if there is reasonable cause and upon written request by the owner.

780 CMR 5111 PERMITS

5111.1 Action on Application. The building official shall examine or cause to be examined all applications for permits and amendments thereto within 30 days after filing thereof. If the application or the construction documents do not conform to the requirements of 780 CMR 51.00 through 99.00 and all pertinent laws under the building official's jurisdiction, the building official shall reject such application in writing, stating the reasons therefore. If the building official is satisfied that the proposed work conforms to the requirements of 780 CMR 51.00 through 99.00 and all laws and ordinances applicable thereto, the building official shall issue a permit therefore.

5111.2 Zoning. In accordance with the provisions of M.G.L. c. 40A or St. 1956, c. 665 as amended, no permit for the construction, alteration, change of use or moving of any detached one- or two-family dwelling shall be issued if such detached one- or two-family dwelling or use would be in violation of any zoning ordinance or bylaw.

5111.3 Railroad Right-of-way. No permit to build a structure of any kind on land formerly used as a railroad right-of-way or any property appurtenant thereto formerly used by any railroad company in the state shall be issued without first obtaining, after public hearing, the consent in writing to the issuance of such permit from the Secretary of the Executive Office of Transportation and Construction, all in accordance with M.G.L. c. 40, § 54A.

5111.4 Water Supply. No permit shall be issued for the construction of a detached one- or two-family dwelling which would necessitate the use of water therein, unless a supply of water is available therefore, either from a water system operated by a city, town or district, or from a well located on the land where the detached one- or two-family dwelling is to be constructed, or from a water corporation or company, as required by M.G.L. c. 40, § 54.

5111.5 Debris. As a condition of issuing a permit

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for the construction demolition, renovation, rehabilitation or other alteration of a detached one- or two-family dwelling, M.G.L. c. 40, § 54 requires that the debris resulting there from shall be disposed of in a properly licensed solid waste disposal facility as defined by M.G.L. c. 111, § 150A. Signature of the permit applicant, date and number of the building permit to be issued shall be indicated on a form provided by the building department, and attached to the office copy of the building permit retained by the building department. If the debris will not be disposed of as indicated, the holder of the permit shall notify the building official, in writing, as to the location where the debris will be disposed.

5111.6 Workers' Compensation. No permit shall be issued to construct, reconstruct, alter or demolish a detached one- or two-family dwelling until acceptable proof of insurance pursuant to M.G.L. c. 152, § 25C(6) has been provided to the building official.

5111.7 Hazards to Air Navigation. Application for building new structures or adding to existing structures within airport approaches as defined in M.G.L. c. 90, § 35B and any amendments thereto or language substituted therefore, must include a certification by the applicant that:

1. Either a permit from the Massachusetts Aeronautics Commission is not required because the structure is, or will be:

- (a) In an area subject to airport approach regulations adopted pursuant to M.G.L. c. 90, §§ 40A through 40I; or
- (b) in an approach to Logan International Airport; or
- (c) less than 30 feet (9144 mm) above ground level; or

2. A permit from the Massachusetts Aeronautics Commission is required pursuant to M.G.L. c. 90, § 35B and a copy of said permit is enclosed with the application.

Applications for permits to build a new structure or add to an existing structure requiring the filing of a Notice of Proposed Construction or Alteration (FAA Form 7460-1) with the Federal Aviation Administration shall mail a copy of the completed FAA Form 7460-1 to the Massachusetts Aeronautics Commission within three business days after submitting said form to the FAA.

5111.8 Expiration of Permit. Any permit issued shall be deemed abandoned and invalid unless the work authorized by it shall have been commenced within six months after its issuance; however, for cause, and upon written request of the owner, one or more extensions of time, for periods not exceeding six months each, may be granted in writing by the building commissioner or inspector of buildings. Work under such a permit in the opinion of the building commissioner or inspector of buildings

must proceed in good faith continuously to completion so far as is reasonably practicable under the circumstances. It is the sole responsibility of the owner to inform, in writing, the building commissioner or inspector of buildings of any facts which support an extension of time. The building commissioner or inspector of buildings has no obligation under 780 CMR 5111.8 to seek out information which may support an extension of time. The owner may not satisfy this requirement by informing any other municipal and/or state official or department.

For purposes of 780 CMR 5111.8 any permit issued shall not be considered invalid if such abandonment or suspension of work is due to a court order prohibiting such work as authorized by such permit; provided, however, in the opinion of the building commissioner or inspector of buildings, the person so prohibited by such court order, adequately defends such action before the court. Although said permit shall remain valid pending final disposition by the court, no work shall be performed in violation of a valid court order.

5111.9 Previous Approvals. 780 CMR 51.00 through 99.00 shall not require changes in the construction documents, construction or designated use group of a building for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been actively prosecuted within **180 days after the effective date** of 780 CMR 51.00 through 99.00 and is completed with dispatch.

5111.10 Signature to Permit. The building official's signature shall be attached to every permit; or the building official shall authorize a subordinate to affix such signature thereto.

5111.11 Approved Construction Documents. When the building official has determined that the proposed construction conforms to the provisions of 780 CMR 51.00 through 99.00 and other applicable laws, bylaws, rules and regulations under his or her jurisdiction, the building official shall stamp or endorse in writing the three sets of construction documents "Approved." One set of the approved construction documents shall be retained by the building official, one set shall be forwarded to the head of the local fire department (when applicable/see 780 CMR 5110.7 and 780 CMR 5111.8) for purposes of notification and the other set shall be kept at the construction site, open to inspection of the building official or an authorized representative at all reasonable times.

5111.12 Revocation of Permits. The building official shall revoke a permit or approval issued under the provisions of 780 CMR 51.00 through 99.00 in case of any false statement or misrepresentation of fact in the application or on the plans on which the permit or approval was based.

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5111.13 Approval in Part. The building official may issue a permit for the construction of foundations or any other part of a detached one- or two-family dwelling before the construction documents for the whole detached one- or two-family dwelling have been submitted, provided that adequate information and detailed statements have been filed complying with all of the pertinent requirements of 780 CMR 51.00 through 99.00. Work shall be limited to that work approved by the partial approval and further work shall proceed only when the building permit is amended in accordance with 780 CMR 5110.8. The holder of such permit for the foundation or other parts of a detached one- or two-family dwelling shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire detached one- or two-family dwelling will be granted.

5111.14 Posting of Permit. A true copy of the building permit shall be kept on the site of operations, open to public inspection during the entire time of prosecution of the work and until the completion of the same.

5111.15 Notice of Start. At least 24-hour notice of start of work under a building permit shall be given to the building official.

**780 CMR 5112 DEMOLITION OR
REMOVAL OF STRUCTURES**

5112.1 Service Connections. Before a detached one- or two-family dwelling is demolished or removed, the owner or agent shall notify all utilities having service connections within the structure such as water, electric, gas, sewer and other connections. A permit to demolish or remove a detached one- or two-family dwelling shall not be issued until a release is obtained from the utilities, stating that their respective service connections and appurtenant equipment, such as meters and regulators, have been removed or sealed and plugged in a safe manner.

All debris shall be disposed of in accordance with 780 CMR 5111.5.

5112.2 Notice to Adjoining Owners. Only when written notice has been given by the applicant to the owners of adjoining lots and to the owners of wired or other facilities, of which the temporary removal is necessitated by the proposed work, shall a permit be granted for the removal of a detached one- or two-family dwelling.

5112.3 Lot Regulation. Whenever a detached one- or two-family dwelling is demolished or removed, the premises shall be maintained free from all unsafe or hazardous conditions by the proper regulation of the lot, restoration of established grades and the erection of the necessary retaining walls and fences in accordance with the provisions of 780 CMR 51.00 through 99.00.

780 CMR 5113 CONDITIONS OF PERMIT

5113.1 Payment of Fees. A permit shall not be issued until the fees prescribed in 780 CMR 5114.0 have been paid.

5113.2 Compliance with Code. The permit shall be a license to proceed with the work and shall not be construed as authority to violate, cancel or set aside any of the provisions of 780 CMR 51.00 through 99.00 or any other law or regulation, except as specifically stipulated by modification or legally granted variation as described in the application. Permits presuming to give authority to violate or cancel the provisions of 780 CMR 51.00 through 99.00 or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction of errors in the construction documents and other data. The building official is also authorized to prevent occupancy or use of a structure where in violation of 780 CMR 51.00 through 99.00 or of any other ordinances of this jurisdiction.

5113.3 Compliance with Permit. All work shall conform to the approved application and the approved construction documents for which the permit has been issued and to any approved amendments to the approved application or the approved construction documents.

5113.4 Compliance with Site Plan. All new work shall be located strictly in accordance with the approved site plan.

780 CMR 5114 FEES

5114.1 General. A permit to begin work for new construction, alteration, removal, demolition or other building operation shall not be issued until the fees prescribed in 780 CMR 5114 shall have been paid to the department of building inspection or other authorized agency of the jurisdiction, nor shall an amendment to a permit necessitating an additional fee be approved until the additional fee has been paid.

5114.2 Special Fees. The payment of the fee for the construction, alteration, removal or demolition for all work done in connection with or concurrently with the work contemplated by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law or ordinance for water taps, sewer connections, electrical permits, erection of signs and display structures, or other appurtenant structures, or fees of inspections, certificates of occupancy or other privileges or requirements, both within and without the jurisdiction of the department of building inspection.

5114.3 New Construction and Alterations. The fees for plan examination, building permit and

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inspections shall be as prescribed in 780 CMR 5114.3.1.

5114.3.1 Fee Schedule. A fee for each plan examination, building permit and inspection shall be paid in accordance with the fee schedule as established by the municipality.

5114.4 Related Fees. The payment of the fee for the construction, alteration, removal or demolition for work done in connection with or concurrently with the work authorized by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

5114.5 Accounting. The building official shall keep an accurate account of all fees collected; and such collected fees shall be deposited in the jurisdiction treasury in accordance with procedures established by the municipality, or otherwise disposed of as required by law.

780 CMR 5115 INSPECTION

5115.1 Preliminary Inspection. Before issuing a permit, the building official shall, if deemed necessary, examine or cause to be examined all detached one- or two-family dwellings and sites for which an application has been filed for a permit to construct, enlarge, alter, repair, remove, demolish or change the use or occupancy thereof.

5115.2 Required Inspections. After issuing a building permit, the building official shall conduct inspections during construction at intervals sufficient to ensure compliance with the provisions of 780 CMR 51.00 through 99.00. The building official shall inform the applicant of the required points of inspection at the time of application. Upon completion of the work for which a permit has been issued, the building official shall conduct a final inspection pursuant to 780 CMR 5115.4. A record of all such examinations and inspections and of all violations of 780 CMR 51.00 through 99.00 shall be maintained by the building official.

In conjunction with specific construction projects, the building official may designate specific inspection points in the course of construction that require the contractor or builder to give the building official 24 hours notice prior to the time when those inspections need to be performed. The building official shall make the inspections within 48 hours after notification. The building official may require the owner, owner's representative or licensed construction supervisor to be present during such inspections.

5115.3 Approved Inspection Agencies. The building official may accept independent third-party reports of approved inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability and subject to any and all applicable requirements of M.G.L. c. 268A

(Conduct of Public Officials and Employees).

5115.4 Final Inspection. Upon completion of the permitted work of the detached one- or two-family dwelling, or before issuance of the certificate of occupancy required by 780 CMR 5120.0, a final inspection shall be made. All variations of the approved construction documents and permit shall be noted and the holder of the permit shall be notified of the discrepancies.

5115.5 Right of Entry. In the discharge of his duties, the building official shall have the authority to enter at any reasonable hour any detached one- or two-family dwelling in the municipality to enforce the provisions of 780 CMR 51.00 through 99.00.

If any owner, occupant or other person refuses, impedes, inhibits, interferes with, restricts or obstructs entry and free access to every part of the detached one- or two-family dwelling where inspection authorized by 780 CMR 51.00 through 99.00 is sought, the building official, or state inspector, may seek, in a court of competent jurisdiction, a search warrant so as to apprise the owner, occupant or other person concerning the nature of the inspection and justification for it and may seek the assistance of police authorities in presenting said warrant.

5115.6 Approval Required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with 780 CMR 51.00 through 99.00. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

5115.7 Identification. The building official shall carry proper identification when inspecting detached one- or two-family dwellings in the performance of duties under 780 CMR 51.00 through 99.00.

5115.8 Jurisdictional Cooperation. The assistance and cooperation of police, fire and health departments and all other officials shall be available to the building official as required in the performance of his duties.

5115.9 Coordination of Inspections. Whenever in the enforcement of 780 CMR 51.00 through 99.00 or another code or ordinance, the responsibility of more than one building official of the jurisdiction is involved, it shall be the duty of the building officials involved to coordinate their inspections and administrative orders as fully as practicable so that the owners and occupants of the detached one- or

two-family dwelling shall not be subjected to visits by numerous inspectors or multiple or conflicting orders. Whenever an inspector from any agency or department observes an apparent or actual violation of some provision of some law, ordinance or code not within the inspector's authority to enforce, the inspector shall report the findings to the building official having jurisdiction.

780 CMR 5116 LICENSED CONSTRUCTION SUPERVISOR SERVICES DURING CONSTRUCTION

5116.1 General. In accordance with 780 CMR 5108.3.5 and Special Regulation 780 CMR 110.R5, the construction, reconstruction, alteration, repair, removal or demolition of all detached one- and two-family dwellings or the field erection of any manufactured building shall be under the control of a licensed construction supervisor. Except for work under the control of a licensed tradesperson subject to other codes and/or regulations, the licensed construction supervisor shall be responsible for ensuring that all construction-related activities are performed in compliance with 780 CMR 51.00 through 99.00 and the approved construction documents, and all manufacturers' recommendations, as applicable.

At a minimum, the license holder, or responsible registered design professional if so employed to perform construction services, as identified on the building permit application or his or her licensed designee, shall be present at some point on the building site to approve construction, reconstruction, alterations, removal or demolition involving the following work:

1. Foundation:
 - (a) Location of and excavation of foundation;
 - (b) Preparation of bearing material;
 - (c) Placement of forms and reinforcing materials (if applicable);
 - (d) Incorporation of vapor retarders (energy conservation)
 - (e) Placing of concrete (or setting of other foundation materials);
 - (f) Setting weather protection methods (if required);
 - (g) Installation of waterproofing and/or damp proofing materials; and
 - (h) Placement of backfill.

Note: If encountered in excavating for foundation placement, the licensed construction supervisor (or registered design professional) shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.

2. Structural frame:
 - (a) Installation of joists, trusses and other structural members and sheathing materials to verify size, species and grade, spacing and

attachment/fastening methods (the licensed construction supervisor shall ensure that any cutting or notching of structural members is performed in accordance with requirements of 780 CMR 51.00 through 99.00);

- (b) Setting of masonry or other structural systems (if used).

3. Energy conservation: Installation of insulation materials, vapor and air infiltration barriers.

4. Fire protection: Installation of smoke and heat detectors and/or systems.

5. Special construction (including, but not limited to):

- (a) Chimneys;

- (b) Retaining walls over four feet (1219 mm) in height above grade.

The building official may require the license holder or his or her licensed designee (or registered design professional) to be present on the building site at other points during the construction, reconstruction, alterations, removal or demolition work as he or she deems appropriate.

Exception: Any homeowner performing work for which a building permit is required shall be exempt from the licensing provisions of 780 CMR 5108.3.5, provided that if a homeowner engages a person(s) for hire to do such work, that such homeowner shall act as supervisor and shall be subject to all applicable provisions of 780 CMR 5116. This exception shall not apply to the field erection of manufactured buildings constructed pursuant to 780 CMR 51.00 through 99.00 and Special Regulation 780 CMR 110.R3 (*see definition of "Homeowner" in 780 CMR 5108.3.5.1*).

Note: Registered design professionals who secure building permits for and/or perform construction services for detached one- and two-family dwellings are not required to be licensed pursuant to 780 CMR 5108.3.5, provided that said registered design professional secures such permit and performs such services under the responsibilities of his or her professional registration.

When required by the building official, at the completion of the work, prior to the issuance of a certificate of occupancy, the licensed construction supervisor, registered professional or homeowner, as applicable, shall submit a copy of the completed checklist contained in Appendix 780 CMR 120.P to the building official in verification that, to the best of his or her knowledge, the work has been executed in accordance with the provisions of 780 CMR 51.00 through 99.00.

780 CMR 5117 WORKMANSHIP

5117.1 General. All work shall be conducted, installed and completed in a workmanlike and

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acceptable manner, and in accordance with manufacturer recommendations, so as to secure the results intended by 780 CMR 51.00 through 99.00.

780 CMR 5118 VIOLATIONS

5118.1 Unlawful Acts. It shall be unlawful for any person, firm or corporation to use, occupy or change the use or occupancy of any detached one- and two-family dwelling or to erect, construct, alter, extend, repair, remove or demolish any detached one- and two-family dwelling or any equipment regulated by 780 CMR 51.00 through 99.00, or cause same to be done, in conflict with or in violation of any of the provisions of 780 CMR 51.00 through 99.00.

5118.2 Notice of Violation. The building official shall serve a notice of violation or order on the person responsible for the erection, construction, alteration, extension, repair, removal, demolition or occupancy of a detached one- and two-family dwelling in violation of the provisions of 780 CMR 51.00 through 99.00, or in violation of a detail statement or a plan approved there under, or in violation of a permit or certificate issued under the provisions of 780 CMR 51.00 through 99.00. Such order shall be in writing and shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

5118.3 Prosecution of Violation. If the notice of violation is not complied with in the time period specified in said notice of violation, the building official may institute the appropriate proceedings at law or in equity to restrain, correct or abate such violation or to require the removal or termination of the unlawful occupancy of the detached one- and two-family dwelling in violation of the provisions of detached one- and two-family dwellings or of the order or direction made pursuant thereto.

5118.4 Violation Penalties. Whoever violates any provision of 780 CMR 51.00 through 99.00, except any specialized code referenced herein, shall be punishable by a fine of not more than \$1,000 or by imprisonment for not more than one year, or both, for each such violation. Each day during which a violation exists shall constitute a separate offense. The building official shall not begin criminal prosecution for such violations until the lapse of 30 days after the issuance of the written notice of violation.

5118.5 Abatement of Violation. The imposition of the penalties herein prescribed shall not preclude the legal officer of the jurisdiction from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal occupancy of a detached one- and two-family dwelling or to stop an illegal act, conduct, business or occupancy of a detached one- and two-family dwelling on or about any premises.

5118.6 Notice or Orders, Service and Content. Every notice or order authorized by 780 CMR, except for notices required by 780 CMR 110.R5 and 780 CMR 110.R6, shall be in writing and shall be served on the person responsible:

1. Personally, by any person authorized by the building official; or
2. By any person authorized to serve civil process by leaving a copy of the order or notice at the responsible party's last and usual place of abode; or
3. By sending the party responsible a copy of the order by registered or certified mail return receipt requested, if he or she is within the Commonwealth; or
4. If the responsible party's last and usual place of abode is unknown, by posting a copy of this order or notice in a conspicuous place on or about the premises in violation and by publishing it for at least three out of five consecutive days in one or more newspapers of general circulation wherein the building or premises affected is situated.

780 CMR 5119 STOP WORK ORDER

5119.1 Notice to Owner. Upon notice from the building official that work on any detached one- and two-family dwelling is being prosecuted contrary to the provisions of 780 CMR 51.00 through 99.00, in an unsafe and dangerous manner or contrary to the approved construction documents submitted in support of the building permit application, such work shall be immediately stopped. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work, and shall state the conditions under which work will be permitted to resume.

5119.2 Unlawful Continuance. Any person who shall continue any work in or about the detached one- and two-family dwelling after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine of not more than \$1,000 or by imprisonment for not more than one year, or both, for each such violation. Each day during which a violation exists shall constitute a separate offense.

**780 CMR 5120 CERTIFICATE OF
OCCUPANCY**

5120.1 General. New buildings and structures. A detached one- and two-family dwelling hereafter shall not be used or occupied in whole or in part until the certificate of use and occupancy shall have been issued by the building commissioner or inspector of buildings or, when applicable, the state inspector. The certificate shall not be issued until all the work has been completed in accordance with the

provisions of the approved permits and of the applicable codes for which a permit is required, except as provided in 780 CMR 5120.3.

5120.2 Buildings or Structures Hereafter Altered. A detached one- and two-family dwelling, in whole or in part altered, including a change of use shall not be occupied or used until a certificate of approval shall have been issued certifying that the work has been completed in accordance with the provisions of the approved permits and of the applicable codes for which a permit is required. Any use or occupancy, which was not discontinued during the work of alteration, shall be discontinued within 30 days after the completion of the alteration unless the required certificate is issued.

5120.3 Temporary Occupancy. Upon the request of the holder of a permit, a temporary certificate of occupancy may be issued before the completion of the entire work covered by the permit, provided that such portion or portions may be occupied safely prior to full completion of the detached one- and two-family dwelling without endangering life or public welfare. Any occupancy permitted to continue during the work shall be discontinued within 30 days after completion of the work unless a certificate of occupancy is issued by the building official.

5120.4 Contents of Certificate. When a detached one- and two-family dwelling is entitled thereto, the building official shall issue a certificate of occupancy within ten days after written application. Upon completion of the final inspection in accordance with 780 CMR 5115.4 and correction of the violations and discrepancies, the certificate of occupancy shall be issued. The certificate of occupancy shall specify, but shall not be limited to, the following.

1. The edition of the code under which the permit was issued.
2. The permit number.
3. The address of the structure.
4. The name and address of the owner.
5. The use group and occupancy, in accordance with the provisions of 780 CMR 51.00 through 99.00.
6. The type of construction.
7. The name of the building official.
8. If an automatic sprinkler system is provided.
9. Any special stipulations and conditions of the building permit.

780 CMR 5121 UNSAFE STRUCTURES

5121.1 General. The provisions of 780 CMR 5121 are established by M.G.L. c. 143, §§ 6, 7, 8, 9 and 10.

5121.2 Inspection. The building official immediately upon being informed by report or otherwise that a detached one- and two-family

dwelling or anything attached thereto or connected therewith is dangerous to life or limb or that any detached one-and two-family dwelling in that city or town is unused, uninhabited or abandoned, and open to the weather, shall inspect the same; and he shall forthwith in writing notify the owner to remove it or make it safe if it appears to him to be dangerous, or to make it secure if it is unused, uninhabited or abandoned and open to the weather. If it appears that such detached one- and two-family dwelling would be especially unsafe in case of fire, it shall be deemed dangerous within the meaning hereof, and the building official may affix in a conspicuous place upon its exterior walls a notice of its dangerous condition, which shall not be removed or defaced without authority from him.

5121.3 Removal or Making Structure Safe. Any person so notified shall be allowed until 12:00 P.M. of the day following the service of the notice in which to begin to remove such detached one- and two-family dwelling or make it safe, or to make it secure, and he or she shall employ sufficient labor speedily to make it safe or remove it or to make it secure; but if the public safety so requires and if the mayor or selectmen so order, the building official may immediately enter upon the premises with the necessary workmen and assistants and cause such unsafe structure to be made safe or demolished without delay and a proper fence put up for the protection of passersby, or to be made secure.

5121.4 Failure to Remove or Make Structure Safe, Survey Board, Survey Report. If an owner of such unsafe detached one- and two-family dwelling refuses or neglects to comply with the requirements of such notice within the specified time limit, and such detached one- and two-family dwelling is not made safe or taken down as ordered therein, a careful survey of the premises shall be made by a board consisting: in a city, of a city engineer, the head of the fire department, as such term is defined in M.G.L. c. 148, § 1, and one disinterested person to be appointed by the building official; and, in a town, of a surveyor, the head of the fire department and one disinterested person to be appointed by the building official. In the absence of any of the above officers or individuals, the mayor or selectmen shall designate one or more officers or other suitable persons in place of the officers so named as members of said board. A written report of such survey shall be made, and a copy thereof served on such owner.

5121.5 Removal of Dangerous or Abandoned Structures. If such a survey report as outlined in 780 CMR 5121.4 declares such detached one- and two-family dwelling to be dangerous or to be unused, uninhabited or abandoned, and open to the weather, and if the owner continues such refusal or neglect, the building official shall cause it to be

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made safe or taken down or to be made secure; and, if the public safety so requires, said building official may at once enter the detached one- and two-family dwelling, the land on which it stands or the abutting land or buildings, with such assistance as he may require, and secure the same; and may remove and evict, under the pertinent provisions of M.G.L. c. 239, or otherwise, any tenant or occupant thereof; and may erect such protection for the public by proper fence or otherwise as may be necessary, and for this purpose may close a public highway. In the case of such demolition, the said building official shall cause such lot to be leveled to conform with adjacent grades by an inorganic fill. The costs and charges incurred shall constitute a lien upon the land on which the detached one- and two-family dwelling is located, and shall be enforced in an action of contract; and such owner shall, for every day's continuance of such refusal or neglect after being so notified, be punished by a fine in accordance with 780 CMR 5118.4. The provisions of M.G.L. c. 139, § 3A, paragraph two, relative to liens for such debt and the collection of claims for such debt shall apply to any debt referred to in 780 CMR 5121, except that the said building official shall act hereunder in place of the mayor or board of selectmen. During the time such order is in effect, it shall be unlawful to use or occupy such detached one- and two-family dwelling or any portion thereof for any purpose.

5121.6 Remedy of Person Ordered to Remove a Dangerous Structure or Make it Safe. Notwithstanding the provisions of 780 CMR 5122, an owner, aggrieved by such order, may have the remedy prescribed by M.G.L. c. 139, § 2, provided that any provision of M.G.L. c. 139, § 2 shall not be construed so as to hinder, delay or prevent the building official from acting and proceeding under 780 CMR 5121; and provided, further, that 780 CMR 5121 shall not prevent the city or town from recovering the forfeiture provided in said 780 CMR 5121.5 from the date of the service of the original notice, unless the order is annulled by the jury.

5121.7 Standards for Making Buildings Safe or Secure. Any owner of a detached one- and two-family dwelling who has been notified that said detached one- and two-family dwelling shall be made safe or secure under 780 CMR 5121.2, shall:

1. Remove all materials determined by the head of the fire department or building official to be dangerous in case of fire.
2. Secure all floors accessible from grade utilizing one of the following methods so long as such method is approved by the head of the fire department or building official in writing:
 - (a) Secure all window and door openings in accordance with the U.S. Fire Administration, National Arson Prevention Initiative Board-Up Procedures, continuously until such time as the

building is reoccupied; or

- (b) Provide 24-hour watchman services continuously until such time as the building is reoccupied; or
- (c) Provide a monitored intruder alarm system at the perimeter of all floors accessible from grade continuously until such time as the building is reoccupied.

Said owner, as the case may be, shall notify the building official that the approved method chosen to secure the building has been incorporated. Said owner shall allow the building official to enter the building for an inspection to ascertain that the building is secured and made safe. Said owner shall allow the head of the fire department to enter the building. The building official shall be supplied with records of maintenance and operation if the provisions of 780 CMR 5121.7.2(b) or (c) are used.

3. Maintain any existing fire alarms or sprinkler systems unless written permission is obtained from the head of the fire department in accordance with M.G.L. c. 148, § 27A to shut off or disconnect said alarms or systems.

4. Maintain utilities unless written permission is obtained from the building official to disconnect said utilities. Permission to disconnect utilities shall not be granted if it will result in inadequate heat to prevent freezing of an automatic sprinkler system or inadequate utilities to maintain any other protection systems.

5. The requirements of 780 CMR 5121.7 (1-4) do not prevent a building official from ordering or taking expeditious, temporary security measures in emergency situations pending the completion of the requirements of 780 CMR 5121.7 (1-4).

For purposes of 780 CMR 5121.7.5, an "emergency situation" shall be defined as: an unexpected incident, which by its very nature may present a threat to public safety personnel who may be required to affect a rescue effort or conduct fire-extinguishment operations.

Upon refusal or neglect of said owner to comply with such notice, any building official acting under the authority of 780 CMR 5121.3 or 5121.5 shall cause to be secured all window and door openings accessible from grade in accordance with the U.S. Fire Administration, National Arson Prevention Initiative Board-Up Procedures or other equivalent procedure approved by the head of the fire department continuously until such time as the building is reoccupied.

Any building that has been made to conform to the provisions of this regulation during vacancy may be reoccupied under its last permitted use and occupancy classification, provided that any systems which were disconnected or shut down during the period of vacancy are restored to a fully functional condition and subject to 780 CMR 5111.2 and

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M.G.L. c. 40A. The local building official shall be notified in writing prior to reoccupancy. If said building is changed in use or occupancy or otherwise renovated or altered it shall be subject to the applicable provisions of 780 CMR 51.00 through 99.00.

5121.8 Marking or Identifying Certain Buildings that are Especially Unsafe in the Case of Fire. Any building official who determines that a building is especially unsafe in case of fire under 780 CMR 5121.2 shall notify the head of the fire department about the existence of said building. The building official, in cooperation with the head of the fire department, shall cause said building to be marked in accordance with the marking requirements established by the Board of Fire Prevention Regulations in 527 CMR 10.00.

780 CMR 5122 BOARD OF APPEALS

5122.1 State Building Code Appeals Board. Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR 51.00 through 99.00, excluding the specialized codes, by any agency or official of the city, town or region, or agency or official of the state charged with the administration or enforcement of 780 CMR 51.00 through 99.00 or any of its rules or regulations, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board as provided in 780 CMR 5122.

Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR 51.00 through 99.00 by any agency or official of a city, town or region charged with the administration or enforcement of 780 CMR 51.00 through 99.00, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board or may appeal first to a local or regional building code appeals board and, if aggrieved thereby, he or she may then appeal to the State Building Code Appeals Board as provided in 780 CMR 5122.

Whoever is aggrieved by the head of the fire department's interpretation, order, requirement, direction or failure to act under the applicable provisions of M.G.L. c. 148, § 26A or 26B, may within 45 days after the service of notice thereof, appeal from such interpretation, order, requirement, direction or failure to act, to the Board of Building Regulations and Standards Board of Appeals as provided in 780 CMR 1.00, 780 CMR 5122 and in accordance with M.G.L. c. 143, § 100.

In the event an appeal is taken directly to the State Building Code Appeals Board from an interpretation, order, requirement or direction, said appeal shall be filed as specified in 780 CMR 5122.3.1 with the State Building Code Appeals Board not later than 45 days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken directly to the State Building Code Appeals Board for the failure to act, the appeal shall be taken not later than 45 days after a request to act has been made by the aggrieved person in writing and served upon the appropriate building official or chief administrative officer of the state or local agency which fails to act.

If the aggrieved person elects to appeal before the local or regional building code appeals board, he shall not be allowed to enter such appeal with the State Building Code Appeals Board until such time as the said local or regional board renders a decision, unless the reason for appeal to the State Building Code Appeals Board is the failure of the local or regional board to act.

5122.2 Membership.

5122.2.1 Three-member Panel. The State Building Code Appeals Board (hereinafter referred to in 780 CMR 5122 as "the Board") shall consist of the membership of the BBRS. The Chairman of the Board may designate any three-members of the Board to act as a three-member panel to hold any public hearing under 780 CMR 5122 and to hear testimony and take evidence. The Chairman of the Board shall select one of the three members to act as chairman of the said three-member panel. If a three-member panel is so designated, the three member panel shall act as the Appeals Board and render a decision as provided in 780 CMR 5122.0.

5122.2.2 Clerk. The administrator of the BBRS shall designate a clerk to the BBRS. The clerk shall keep a detailed record of all decisions and appeals and a record on file showing the name of each appeal properly indexed and the disposition of the appeal. Said record shall be open to public inspection at all times during normal business hours.

5122.2.3 Quorum. A majority of the Board shall constitute a quorum if the appeal is heard by the entire Board.

5122.3 Appeals procedure for State Building Code Appeals Board.

5122.3.1 Entry. Appeals shall be entered on forms provided by the BBRS and shall be accompanied by an entry fee of \$150 or such other amounts as may be determined by the BBRS from time to time. A copy of the appeals application is made part of 780 CMR 51.00 through 99.00 in Appendix B.

The appeal shall be signed by the appellant or his attorney or agent and shall note the name and address of the person or agency on whose behalf the appeal is taken and the name of the person and address wherein service of notice for the appellant is to be made. The appeal shall also state in detail the interpretation, order, requirement, direction or failure to act which are the grounds of the appeals

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as well as the particular section or sections of 780 CMR 51.00 through 99.00 which are involved in the appeal and the reasons for the appellant advances supporting the appeal.

A copy of the appeal shall be served in accordance with 780 CMR 5118.6 by the appellant on the person or state, regional or local agency from whose action or inaction the appeal is taken, on or before entry of the appeal. An affidavit, under oath, that such copy has been served shall be filed with the Board forthwith by the appellant.

5122.3.2 Stay of Proceedings. Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the state, regional or local agency or any person charged with the administration or enforcement of 780 CMR 51.00 through 99.00 presents evidence and the Board or a three-member panel or a single member of the Board, appointed by the chairman for said purpose, finds that upon the evidence presented, a stay would involve imminent peril to life or property. In such an event, stay of all proceedings shall be waived or the Board or three-member-panel or single member may order such other action necessary to preserve public safety.

Before waiving the stay or proceedings, the Board or three-member panel or single member of the Board, appointed by the chairman for said purpose, shall hold a hearing and give the appellant and state, regional or local agency or any person claiming that a stay would involve imminent peril to life or property, notice in writing of the hearing not less than 24 hours before said hearing.

5122.3.3 Documents. Upon entry, the clerk shall request in writing from the state, city, regional or town officer in charge of the matter on appeal, a copy of the record and all other papers and documents relative to the appeal to be transmitted forthwith to the Board. Said state, city, regional or town officer shall, upon receipt of the request of the Board, transmit forthwith all of the papers and documents and a copy of the record relating to the matter on appeal.

5122.3.4 Hearings. The Chairman of the Board shall fix a convenient time and place for a public hearing. Said hearings shall be held not later than 30 days after the entry of such appeal, unless such time is extended by agreement with the appellant. Any such party may appear in person or by agent or attorney at such hearing. The chairman or clerk shall give notice of the time and place of said hearing to all parties to the hearing and to anyone else requesting notice in writing at least ten days prior thereto. Failure to hold a public hearing within 30 days shall not affect the validity of the appeal or any decision rendered. The Board or

three-member panel in its hearings conducted under 780 CMR 5122 shall not be bound by strict rules of evidence prevailing in courts of law or equity.

5122.3.5 Conduct of Hearing. Hearings shall be conducted in accordance with the informal/fair-hearing rules as set forth in 801 CMR 1.02.

5122.4 Decisions.

5122.4.1 Votes Required. If the appeal is conducted by a three-member panel, then the concurrence of two of the three members holding the public hearing shall be required. If the appeal is conducted by the entire Board, then a majority vote of those hearing the case shall be required.

5122.4.2 Standard. The Board or a three-member panel may vary the application of any provision of 780 CMR 51.00 through 99.00 in any particular case, may determine the suitability of alternate materials and methods of construction and provide reasonable interpretations of the provisions of 780 CMR 51.00 through 99.00, provided that the Board or a three-member panel finds that the decision to grant a variance shall not conflict with the general objectives set forth M.G.L. c. 143, § 95 or with the general objectives of 780 CMR 51.00 through 99.00.

5122.4.3 Time for Decision. The Board shall issue decisions in a reasonably prompt manner. In general decisions will reverse, affirm or modify in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within 30 days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and anyone requesting in writing a copy of the decision.

5122.4.4 Contents of Decision. All decisions shall be in writing and state findings of fact, conclusions and reasons for decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting.

5122.4.5 Additional Powers. The Board or a three-member panel may impose in any decision limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to 780 CMR 51.00 through 99.00.

5122.5 Enforcement. Upon receipt of the decision of the Board or a three-member panel, the parties to the appeal shall take action forthwith to comply with the decision unless a later time is specified in the

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decision.

5122.6 Appeals from State Building Code Appeals Board. Any person aggrieved by a decision of the State Building Code Appeals Board may appeal to a court of law or equity in compliance with M.G.L. c. 30A, § 14.

5122.7 Local and Regional Board of Appeals.

5122.7.1 Local and Regional Board of Appeals. Whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR 51.00 through 99.00, excluding the specialized codes, by any agency or official of a city, region or town charged with the administration or enforcement of 780 CMR 51.00 through 99.00 or any of its rules and regulations may appeal first to the appeals board in that city, region or town or to the State Building Code Appeals Board as provided in 780 CMR 5122.

In the event an appeal is taken from an interpretation, order, requirement or direction, said appeal shall be filed with the local or regional appeals board not later than 45 days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken for the failure to act, the appeal shall be taken not later than 45 days after a request to act has been made by the aggrieved person in writing and served to the appropriate building official or chief administrative officer of the city, regional or town agency which fails to act.

5122.7.2 Membership. Any building code board of appeals duly established by ordinance or by law or otherwise in a city, region or town and in existence on January 1, 1975, shall qualify as a local board of appeals under 780 CMR 5122 notwithstanding anything to the contrary contained herein. However, the procedure and rights for appeals for such board of appeals shall be governed by 780 CMR 51.00 through 99.00.

If a city, region or town had not duly established by ordinance or bylaw or otherwise a local or regional building code appeals board prior to January 1, 1975, said city, region or town may establish a local or regional board of appeals, hereinafter referred to as the local board of appeals, consisting of five members appointed by the chief administrative officer of the city, region or town: one member appointed for five years, one for four years, one for three years, one for two years and one to serve for one year; and thereafter each new member to serve for five years or until his successor has been appointed.

5122.7.3 Qualifications of Local Board Members. Each member of a local board of appeals established under 780 CMR 5122.7.2 shall have had at least five years experience in the construction, alteration, repair and maintenance of building and building codes. At least one member

shall be a registered structural official.

5122.7.4 Chairman of Local or Regional Board. The board shall select one of its members to serve as chairman and a detailed record of all proceedings shall be kept on file in the building department.

5122.7.5 Absence of Members. During the absence of a member of a local board of appeals for reason of disability or disqualification, the chief administrative officer of the city, region or town shall designate a substitute who shall meet the qualifications as outlined in 780 CMR 5122.7.3.

5122.7.6 Quorum. A quorum shall be three members.

5122.7.7 Procedures. Entry of appeals shall be governed by 780 CMR 5122.3.1 excepting that a city, region or town may set its own entry fee.

Upon notice of entry appeal, the local building commissioner or inspector of buildings shall transmit a copy of the record and all of the papers and documents to the local board of appeals.

Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the building commissioner or inspector of buildings certifies in writing to the local board of appeals that a stay would involve imminent peril to life or property. Notice in writing of such certification by the building commissioner or inspector of buildings shall be given to the appellant at least 24 hours prior to the hearing. In such an event a hearing on such stay shall be given first priority and be the first matter heard by the local board of appeals at its next scheduled meeting. The hearing on the appeal shall be held as soon as possible thereafter in accordance with 780 CMR 5122.7.8.

The local board of appeals may establish its own rules for procedure not established herein or not inconsistent with 780 CMR 51.00 through 99.00 or with the general objectives set forth in M.G.L. c. 143, § 95.

5122.7.8 Hearings. All hearings shall be public and notice of said hearings shall be advertised in a newspaper of general circulation in the city, region or town in which the appeal is taken at least ten days before said hearing. Notice of the hearing, setting forth the date and time of said hearing, shall be mailed by the local board of appeals to all parties and all those who requested notice in writing at least 14 days before said hearing. Said hearings shall be held not later than 30 days after the entry of such appeal, unless such time is extended by agreement with the appellant. 780 CMR 5122.7.8 as it pertains to notice shall not apply to hearings on a stay as provided in 780 CMR 5122.7.7.

5122.7.9 Decisions of Local Boards. A concurring vote of a majority of all of the

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members present shall be required for any decision. The local board of appeals may vary the application of 780 CMR 51.00 through 99.00 to any particular case, may consider the suitability of alternative materials and methods of construction and may provide reasonable interpretations of the provisions of 780 CMR 51.00 through 99.00, provided that the decision of the local board shall not conflict with the general objectives of 780 CMR 51.00 through 99.00 or with the general objectives of M.G.L. c. 143, § 95. The local board of appeals may impose, in any decision; limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to 780 CMR 51.00 through 99.00.

5122.7.10 Time for decision. The board shall within 30 days after such hearing, unless such time is extended by agreement of the parties, issue a decision or order reversing, affirming or modifying in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within 30 days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and to anyone requesting in writing a copy of the decision.

5122.7.11 Contents of Decision. All decisions shall be in writing and state findings of fact, conclusions and reasons for the decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting. Any decision shall not be considered by any person or agency as a precedent for future decisions.

5122.7.12 Copy of Decision. A copy of any decision by a local board of appeals shall be transmitted to the State Building Code Appeals Board within ten days after the rendering of such decision. If the State Building Code Appeals Board disapproves of said decision of the local board, it may on its own motion, appeal the decision of the local board of appeals according to 780 CMR 5122 and call for a hearing *de novo*.

If the State Building Code Appeals Board does not notify the local board in writing within 45 days from the date of the local board's decision, the said decision shall be deemed approved, provided that the decision shall not conflict with the general objectives of the state building code and the objectives of M.G.L. c. 143, § 95.

5122.7.13 Enforcement of Decision. If said decision is approved by the State Building Code Appeals Board, all parties to the appeal shall take immediate action in accordance with the decision of the local board unless the person aggrieved by

such decision appeals to the State Building Code Appeals Board as provided in 780 CMR 5122.

5122.7.14 Review. Any person, including the State Building Code Appeals Board, aggrieved by a decision of the local board of appeals, whether or not a previous party to the decision, or any municipal officer or official board of the municipality, may, not later than 45 days after the mailing of the decision of the local board, apply to the State Building Code Appeals Board for a hearing *de novo* before the State Board, in accordance with the regulations contained in 780 CMR 5122.

**780 CMR 5123 CONSTRUCTION
MATERIALS SAFETY BOARD**

5123.1 Membership. There shall be a board under the control of the BBRS called the Construction Materials Safety Board (CMSB), which shall consist of 11 members, one of whom shall be a member of the BBRS who shall be *ex-officio* and a voting member of the Board and ten members to be appointed by the chairman of the BBRS: one of whom shall be a member of the Board of Fire Prevention Regulations (BFPR) and who shall be *ex-officio* and a voting member of the board; one of whom shall be a municipal building inspector; one of whom shall be a registered professional engineer who is a structural engineer; one of whom shall be a registered architect; one of whom shall be a representative of a commercial testing laboratory; one of whom shall be a representative of a public testing laboratory; two of whom shall be representatives from the construction industry; one of whom shall be a member of a university faculty engaged in research and teaching in structural materials; and one of whom shall be a member of a university faculty engaged in research and teaching in the area of theoretical and applied mechanics.

5123.2 Duties. The CMSB will review applications for registration or licensing of individuals, laboratories or firms responsible for the inspection, control and testing of construction materials, and review applications and pertinent data relevant to all materials, devices, products and methods of construction not included in 780 CMR 51.00 through 99.00 and report to the BBRS their recommendations. The CMSB will collect information and review cases where disciplinary action against an existing license, whether an individual, laboratory or firm, has been proposed; and make recommendations to the BBRS. The BBRS will issue applications, receive payment for the review of such applications and approvals, registration and licensing fees, and maintain records for the efficient dispatch of the duties of the CMSB.

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5123.3 Testing and Evaluation Groups. The BBRS shall establish and maintain testing and evaluation groups that will have the responsibility of administering and directing, under the supervision of the BBRS, the testing and controls for evaluating individual applicants, laboratories and firms wishing to become registered or licensed.

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780 CMR 52.00

DEFINITIONS

(Note: Chapter 52 is unique to Massachusetts)

780 CMR 5201 GENERAL

5201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of 780 CMR 51.00 through 99.00, have the meanings indicated in 780 CMR 52.00.

5201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

5201.3 Terms Defined in Other Codes. Where terms are not defined in 780 CMR 51.00 through 99.00 such terms shall have meanings ascribed to them as in other code publications of the International Code Council or Code of Massachusetts Regulations (CMRs).

5201.4 Terms not Defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

780 CMR 5202 DEFINITIONS

ACCESSIBLE. Signifies access that requires the removal of an access panel or similar removable obstruction.

ACCESSIBLE, READILY. Signifies access without the necessity for removing a panel or similar obstruction.

ACCESSORY STRUCTURE. In one- and two-family dwellings not more than three stories high with separate means of egress, a building, the use of which is incidental to that of the main building and which is located on the same lot.

[B] ADDITION. An extension or increase in floor area or height of a building or structure.

AIR CIRCULATION, FORCED. A means of providing space conditioning utilizing movement of air through ducts or plenums by mechanical means.

AIR-CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply, exhaust and return-air systems, and shall include any apparatus installed in connection therewith.

[B] ALTERATION. Any construction or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or

purpose of the original installation that requires a permit.

(ALTERNATE INSPECTOR. *A person appointed to act in the absence of the inspector of buildings or building commissioner in case of illness, disability or conflicting interest. An alternate inspector shall meet or exceed the minimum qualifications defined by M.G.L. c. 143, § 3 for an inspector of buildings/building commissioner and shall be certified in accordance with Special Regulation 110.R7 (see Appendix A).*

[B] ANCHORS. See "Supports."

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE). *The ratio of annual output energy to annual input energy, which includes any nonheating season pilot input loss, and for gas or oil-fired furnaces or boilers, does not include electrical energy.*

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which 780 CMR 51.00 through 99.00 provides specific requirements.

APPROVED. Approved refers to approval by the building official as the result of investigation and tests conducted by him or her, or by reason of accepted principles or tests by nationally recognized organizations.

APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

ASPECT RATIO. The ratio of the height to width (h/w) of a shear wall. The shear wall height is the maximum clear height from top of foundation or diaphragm to bottom of diaphragm framing above and the shear wall width is the sheathed dimension in the direction of applied force on the shear wall.

ATTIC. The unfinished space between the ceiling joists of the top story and the roof rafters.

BACKFLOW PREVENTER. A device or means to prevent backflow.

BACKFLOW PREVENTER, REDUCED-PRESSURE-ZONE TYPE. A backflow-prevention device consisting of two independently acting check valves, internally force loaded to a normally closed position and separated by an intermediate chamber (or zone) in which there is an automatic relief means of venting to atmosphere

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internally loaded to a normally open position between two tightly closing shutoff valves and with means for testing for tightness of the checks and opening of relief means.

BACKFLOW, WATER DISTRIBUTION. The flow of water or other liquids into the potable water-supply piping from any sources other than its intended source.

[B] BALCONY, EXTERIOR. An exterior floor projecting from and supported by a structure without additional independent supports.

[B] BASEMENT. That portion of a building that is partly or completely below grade (see "Story above grade").

BASEMENT WALL. The opaque portion of a wall that encloses one side of a basement and has an average below grade wall area that is 50% or more of the total opaque and non-opaque area of that enclosing side.

BASIC WIND SPEED. Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see 780 CMR 5301.2.1) as given in 780 CMR Figure 5301.2(4).

BOARD OF BUILDING REGULATIONS AND STANDARDS (BBRS). *In accordance with M.G.L. c. 143, § 94, the Board responsible for the development and promulgation of 780 CMR 51.00 through 99.00. See M.G.L. c. 143, § 93 for the Board's makeup and 780 CMR 95.00 through 100.00 for additional responsibilities of the BBRS.*

BOILER. A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, by the application of heat from combustible fuels in a self-contained or attached furnace. Note that gas-fired boilers are addressed by 248 CMR and oil-fired boilers are addressed by 527 CMR.

[B] BOND BEAM. A horizontal grouted element within masonry in which reinforcement is embedded.

[B] BRACED WALL LINE. A series of braced wall panels in a single story constructed in accordance with 780 CMR 5602.10 for wood framing or 780 CMR 5603.7 or 5301.1.1 for cold-formed steel framing to resist racking from seismic and wind forces.

[B] BRACED WALL PANEL. A section of a braced wall line constructed in accordance with 780 CMR R602.10 for wood framing or 780 CMR R603.7 or R301.1.1 for cold-formed steel framing, which extend the full height of the wall.

BTU/H. The listed maximum capacity of an appliance, absorption unit or burner expressed in British thermal units input per hour.

BUILDING. Building shall mean any one- and two-family dwelling or portion thereof that is used, or designed or intended to be used, for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, and shall include accessory structures thereto.

BUILDING CODE ENFORCEMENT OFFICIAL. The term used to refer collectively to inspectors of buildings, building commissioners and local inspectors. All building code enforcement officials shall meet or exceed the minimum qualifications for the position as defined by M.G.L. c.143, § 3 and shall be certified in accordance with Special Regulation 780 CMR 110.R7 (see 780 CMR 110; also see definition for "Building official").

BUILDING COMMISSIONER. The administrative chief of the building department in a municipality who is charged with the administration and enforcement of 780 CMR 51.00 through 99.00 (see also "Inspector of buildings" and "Building official"). All building commissioners shall meet or exceed the minimum qualifications for the position as defined in M.G.L. c. 143, § 3 and shall be certified in accordance with Special Regulation 780 CMR 110.R7 (see 780 CMR 110).

BUILDING ENVELOPE. The elements of a building which enclose heated or cooled spaces through which thermal energy is capable of being transferred to or from the exterior or to or from spaces exempted by the provisions of 780 CMR 6101.4.1.

BUILDING, EXISTING. An existing building that has been legally occupied for five or more years and is also a building erected prior to the adoption of 780 CMR 51.00 through 99.00, or one for which a legal building permit has been issued.

BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

[B] BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of 780 CMR 51.00 through 99.00.

BUILDING THERMAL ENVELOPE. See "Building envelope".

BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

CEILING HEIGHT. The clear vertical distance from the finished floor to the finished ceiling.

CENTRAL STATION, CENTRAL STATION FIREALARM SYSTEM AND CENTRAL STATION SERVICES. See NFPA 72, as listed in 780 CMR CMR 100.

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CERTIFICATE OF APPROVAL. A written document from the appropriate building official approving an action, type of material, and the like.

CERTIFICATE OF USE AND OCCUPANCY. The certificate issued by the building code enforcement official which permits the use of a building in accordance with the approved plans and specifications and 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 (In reference to building code enforcement officials). See definitions for "Building commissioner", "Inspector of buildings" and "Local inspector." Also see Special Regulation 780 CMR 110.R7.

CERTIFICATION (In reference to manufactured buildings and building components). Any manufactured building or building component that meets the provisions of Special Regulation 780 CMR 110.R3.

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 and/or regulation governing building construction, equipment or means of egress

[B] CHIMNEY. A primary vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outside atmosphere.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning appliance to a chimney.

[B] CHIMNEY TYPES.

Residential-type Appliance. An approved chimney for removing the products of combustion from fuel-burning, residential-type appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for periods up to one hour. All temperatures shall be measured at the appliance flue outlet. Residential-type appliance chimneys include masonry and factory-built types.

CLADDING. The exterior materials that cover the surface of the building envelope that is directly loaded by the wind.

CLOSET. A small room or chamber used for storage.

CODE OF MASSACHUSETTS REGULATION (CMR). Regulations that are codified by the Secretary of State, Commonwealth of Massachusetts. 780 CMR 100, lists various CMRs applicable to building construction and/or design.

COEFFICIENT OF PERFORMANCE (COP)—COOLING. The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete cooling system or factory-assembled equipment, as tested under a nationally recognized standard or designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP)—HEAT PUMP—HEATING. The ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system under designated operating conditions. Supplemental heat shall not be considered when checking compliance with the heat pump equipment.

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION AIR. The air provided to fuel-burning equipment including air for fuel combustion, draft hood dilution and ventilation of the equipment enclosure.

CONDENSATE. The liquid that separates from a gas due to a reduction in temperature, e.g., water that condenses from flue gases and water that condenses from air circulating through the cooling coil in air conditioning equipment.

CONDENSING APPLIANCE. An appliance that condenses water generated by the burning of fuels.

CONDITIONED AIR. Air treated to control its temperature, relative humidity or quality.

CONDITIONED AREA. That area within a building provided with heating and/or cooling systems or appliances capable of maintaining, through design or heat loss/gain, 68°F (20°C) during the heating season and/or 80°F (27°C) during the cooling season, or has a fixed opening directly adjacent to a conditioned area.

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the conditioned space.

CONDITIONED SPACE. For energy purposes, space within a building that is provided with heating and/or cooling equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season and 85°F (29°C) during the cooling season, or communicates directly with a conditioned space. For mechanical purposes, an area, room or space being heated or cooled by any equipment or appliance.

CONFINED SPACE. A room or space having a volume less than 50 cubic feet per 1,000 Btu/h (4.83 L/W) of the aggregate input rating of all fuel-burning appliances installed in that space.

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CONSTRUCTION CONTROL. The compilation of Building Code requirements found in 780 CMR 1, Section 116 or otherwise referenced in 780 CMR and directed toward all buildings and structures requiring registered architectural services or registered professional engineering services in accordance with M.G.L. c. 143, § 54A; M.G.L. c. 112, §§ 60A through 60L; and, M.G.L. c. 112 §§ 81D through 81T.

[B] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction drawings shall be drawn to an appropriate scale.

CONNECTOR. A system-incorporating heating element in an enclosure in which air enters an opening below the heating element, is heated and leaves the enclosure through an opening located above the heating element.

[B] CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

[B] COURT. A space, open and unobstructed to the sky, located at or above grade level on a lot and bounded on three or more sides by walls or a building.

CRIPPLE WALL. A framed wall extending from the top of the foundation to the underside of the floor framing of the first story above grade plane.

DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DAMPER, VOLUME. A device that will restrict, retard or direct the flow of air in any duct, or the products of combustion of heat-producing equipment, vent connector, vent or chimney.

[B] DEAD LOADS. The weight of all materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items, and fixed service equipment.

[B] DECK. An exterior floor system supported on at least two opposing sides by an adjoining structure and/or posts, piers, or other independent supports.

[B] DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material; and whose surface, or assembly into which it is incorporated, is divided into segments.

DEGREE DAY, COOLING. *A unit, based on temperature difference and time, used in estimating cooling energy consumption and specifying nominal cooling load of a building in summer. For any one day, when the mean temperature is more than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual cooling degree days (CDD) are the sum of the degree days over a calendar year.*

DEGREE DAY, HEATING. *A unit, based on temperature difference and time, used in estimating heating energy consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDD) are the sum of the degree days over a calendar year.*

DESIGN PROFESSIONAL. See definition of "Registered design professional" in 780 CMR 52.00.

DIAMETER. Unless specifically stated, the term "diameter" is the nominal diameter as designated by the approved material standard.

[B] DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements. When the term "diaphragm" is used, it includes horizontal bracing systems.

DIRECT-VENT APPLIANCE. *A system consisting of an appliance, combustion air and flue gas connections between the appliance and the outside atmosphere, and a vent cap supplied by the manufacturer, and constructed so that all air for combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere.*

DRAFT. The pressure difference existing between the appliance or any component part and the atmosphere, that causes a continuous flow of air and products of combustion through the gas passages of the appliance to the atmosphere.

Induced Draft. The pressure difference created by the action of a fan, blower or ejector, that is located between the appliance and the chimney or vent termination.

Natural draft. The pressure difference created by a vent or chimney because of its height, and the temperature difference between the flue gases and the atmosphere.

DRAFT HOOD. A device built into an appliance, or a part of the vent connector from an appliance, which is designed to provide for the ready escape of

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the flue gases from the appliance in the event of no draft, backdraft or stoppage beyond the draft hood; prevent a backdraft from entering the appliance; and neutralize the effect of stack action of the chimney or gas vent on the operation of the appliance.

[B] DRAFT STOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and attics.

DUCT SYSTEM. A continuous passageway for the transmission of air which, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

DWELLING. Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

[B] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

EMERGENCY ESCAPE AND RESCUE OPENING. An operable window, door or similar device that provides for a means of escape and access for rescue in the event of an emergency.

ENERGY. *The capacity for doing work taking a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (work), electrical and chemical in customary units, measured in kilowatt-hours (kWh) or British thermal units (Btu) (J) (see "New energy").*

NEW ENERGY. Energy, other than recovered energy, utilized for the purpose of heating or cooling (see "Energy").

ENERGY ANALYSIS. *A method for determining the annual (8,760 hours) energy use of the proposed design and standard design based on hour-by-hour estimates of energy use.*

ENERGY EFFICIENCY RATIO (EER). *The ratio of net equipment cooling capacity in Btu/h (W) to total rate of electric input in watts under designated operating conditions. When consistent units are used, this ratio becomes equal to COP (see also "Coefficient of performance").*

EQUIPMENT. All piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in 780 CMR 51.00 through 99.00.

EQUIPMENT, EXISTING. Any equipment regulated by 780 CMR 51.00 through 99.00 which

was legally installed prior to the effective date of 780 CMR 51.00 through 99.00, or for which a permit to install has been issued.

EXPOSED FLOOR. *Floors that are part of the building envelope and are not enclosed by other building elements (e.g., cantilevers, floors built on pilings). For insulation purposes, these areas are to be treated as ceilings.*

EXTERIOR ENVELOPE. See "Building envelope".

EXTERIOR INSULATION FINISH SYSTEMS (EIFS). Synthetic stucco cladding systems typically consisting of five layers: adhesive, insulation board, base coat into which fiber-glass reinforcing mesh is embedded, and a finish coat in the desired color.

EXTERIOR WALL. An above-grade wall enclosing conditioned space. Includes between floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and basement walls with an average below grade wall area that is less than 50% of the total opaque and non-opaque area of that enclosing side.

FACTORY-BUILT CHIMNEY. A listed and labeled chimney composed of factory-made components assembled in the field in accordance with the manufacturer's instructions and the conditions of the listing.

FENESTRATION. Skylights, roof windows, vertical windows (whether fixed or moveable); opaque doors; glazed doors; glass block; and combination opaque/glazed doors.

FIBER CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with organic or inorganic non-asbestos fibers, or both. Additives which enhance manufacturing or product performance are permitted. Fiber cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

FIREBLOCKING. Building materials installed to resist the free passage of flame to other areas of the building through concealed spaces.

[B] FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a chimney, for use with solid fuels.

Factory-built Fireplace. A listed and labeled fireplace and chimney system composed of factory-made components, and assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

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Masonry Chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

Masonry Fireplace. A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete.

FIREPLACE STOVE. A free-standing, chimney-connected solid-fuel-burning heater designed to be operated with the fire chamber doors in either the open or closed position.

FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

FIRE SEPARATION DISTANCE. The distance measured from the building face to the closest interior lot line, to the centerline of a street, alley or public way, or to an imaginary line between two buildings on the property. The distance shall be measured at right angles from the lot line.

[B] FLAME SPREAD. The propagation of flame over a surface.

[B] FLAME SPREAD INDEX. The numeric value assigned to a material tested in accordance with ASTM E 84.

FLOOR FURNACE. *A self-contained indirect-fired or electrically heated furnace designed to be suspended from the floor of the space being heated. A fuel-burning floor furnace is designed to take air for combustion from outside the space being heated, and is provided with means for observing flame and lighting the appliance from such space.*

FLUE. See "Vent."

FLUE, APPLIANCE. The passages within an appliance through which combustion products pass from the combustion chamber to the flue collar.

FLUE COLLAR. The portion of a fuel-burning appliance designed for the attachment of a draft hood, vent connector or venting system.

FLUE GASES. Products of combustion plus excess air in appliance flues or heat exchangers.

FOUNDATION. *A base constructed to support any building or structure including, but not limited to, footings, floating foundation, piles and caissons.*

FOUNDATION WALL. *A wall below the floor nearest grade serving as a support for a wall, pier, column or other structural part of a building.*

[B] FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic consisting open or closed cells distributed throughout the plastic and that has a density less than 20 pounds per cubic foot (320 kg/m^3).

FURNACE. *A vented heating appliance designed or arranged to discharge heated air into a conditioned space or through a duct or ducts. Note that 248 CMR and/or 527 CMR may have a definition for "Furnace" that is different than the Seventh Edition, Massachusetts Building Code for One- and Two-family Dwellings (780 CMR) definition.*

GLAZING AREA. The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Includes the area of glazed fenestration assemblies in walls bounding conditioned basements. *For purposes of energy conservation, in doors where the daylight opening area is less than 50% of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the rough opening area for the door including the door and the frame.*

GRADE. The finished ground level adjoining the building at all exterior walls.

GRADE FLOOR OPENING. A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

[B] GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than six feet (1829 mm) from the building between the structure and a point six feet (1829 mm) from the building.

GREENHOUSE. *An enclosed detached or attached accessory structure consisting primarily of light-transmitting materials and used exclusively for growing plants. In accordance with St. 1973, c. 672, the provisions of 780 CMR 51.00 through 99.00 shall not apply to greenhouses covered exclusively with plastic film; however, the provisions of M.G.L. c. 40A shall continue to apply*

GROSS AREA OF EXTERIOR WALLS. The normal projection of all exterior walls, including the area of all windows and doors installed therein.

GROSS FLOOR AREA. *The sum of the areas of all floors of the building, including basements, cellars, mezzanine and intermediate floored tiers and penthouses of headroom height, measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding:*

- 1. Covered walkways, open roofed-over areas, porches and similar spaces.*
- 2. Pipe trenches, exterior terraces or steps,*

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chimneys, roof overhangs and similar features.

GROUND-SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

GUARD. A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

[B] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

[B] HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

HANGERS. See "Supports."

HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances.

HEAT. *The form of energy that is transferred by virtue of a temperature difference or a change in state of a material.*

HEATING DEGREE DAYS (HDD). The sum, on an annual basis, of the difference between 65°F (18°C) and the mean temperature for each day as determined from "NOAA Annual Degree Days to Selected Bases Derived from the 1960-1990 Normals" or other weather data sources acceptable to the code official.

HEAT TRAP. *An arrangement of piping and fittings, such as elbows, or a commercially available product, that prevents thermosiphoning of hot water during standby periods.*

HEATED SLAB. *Slab-on-grade construction in which the heating elements or hot air distribution system is in contact with or placed within the slab or the subgrade.*

HEATED SPACE. *Space within a building which is provided with a positive heat supply (see "Positive heating supply"). Finished living space within a basement with registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space.*

HEAT PUMP. An appliance having heating or heating/cooling capability and that uses refrigerants to extract heat from air, liquid or other sources.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF). *The total heating output of a heat pump during its normal annual usage period for heating, in Btu, divided by the total electric energy input during the same period, in watt hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures, and based on Region 4.*

[B] HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

[B] HEIGHT, STORY. The vertical distance from top to top of two successive tiers of beams or finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

HIGH-TEMPERATURE (H.T.) CHIMNEY. A high temperature chimney complying with the requirements of UL 103. A Type H.T. chimney is identifiable by the markings "Type H.T." on each chimney pipe section.

HOT WATER. Water at a temperature greater than or equal to 110°F (43°C).

HUMIDISTAT. *A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.*

HVAC. *Heating, ventilating and air conditioning.*

HVAC SYSTEM. *The equipment, distribution network and terminals that provide either collectively or individually the processes of heating, ventilating or air conditioning to a building or portion of a building.*

HVAC SYSTEM COMPONENTS. *HVAC system components provide, in one or more factory-assembled packages, means for chilling or heating water, or both, with controlled temperature for delivery to terminal units serving the conditioned spaces of the building. Types of HVAC system components include, but are not limited to, water chiller packages, reciprocating condensing units and water source (hydronic) heat pumps (see "HVAC system equipment").*

HVAC SYSTEM EQUIPMENT. *HVAC system equipment provides, in one (single package) or more (split system) factory-assembled packages, means for air circulation, air cleaning, air cooling with controlled temperature and dehumidification and, optionally, either alone or in combination with a heating plant, the functions of heating and humidifying. The cooling function is either electrically or heat operated and the refrigerant condenser is air, water or evaporatively cooled. Where the equipment is provided in more than one package, the separate packages shall be designed by the manufacturer to be used together. The equipment shall be permitted to provide the heating*

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function as a heat pump or by the use of electric or fossil-fuel-fired elements. (The word "equipment" used without a modifying adjective, in accordance with common industry usage, applies either to HVAC system equipment or HVAC system.)

HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes, defined as the U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 miles per hour (177 km/h), and Hawaii, Puerto Rico, Guam, Virgin Islands, and America Samoa.

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include appliance burners, burner ignitions and electrical switching devices.

INDIVIDUAL WATER SUPPLY. A supply other than an approved public water supply that serves one or more families.

INFILTRATION. *The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind or the effect of differences in the indoor and outdoor air density or both.*

INSPECTOR OF BUILDINGS. *The administrative chief of the building department in a municipality who is charged with the administration and enforcement of 780 CMR 51.00 through 99.00 (see also "Building commissioner" and "Building code enforcement official"). All inspectors of buildings shall meet or exceed the minimum qualifications defined by M.G.L. c. 143, § 3 and shall be certified in accordance with Special Regulation 780 CMR 110.R7.*

INSULATING CONCRETE FORM (ICF). A concrete forming system using stay-in-place forms of rigid foam plastic insulation, a hybrid of cement and foam insulation, a hybrid of cement and wood chips, or other insulating material for constructing cast-in-place concrete walls.

INSULATING SHEATHING. An insulating board having a minimum thermal resistance of R-2 of the core material.

JURISDICTION. The governmental unit that has adopted 780 CMR 51.00 through 99.00 under due legislative authority.

KITCHEN. Kitchen shall mean an area used, or designated to be used, for the preparation of food.

[B] LABEL. An identification applied on a product by the manufacturer which contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency. (See also "Manufacturer's designation" and "Mark.")

LABELED. Devices, equipment or materials to which have been affixed a label, seal, symbol or other identifying mark of a testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above labeled items that attests to compliance with a specific standard.

LIGHT-FRAMED CONSTRUCTION. A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or light gage steel framing members.

LISTED AND LISTING. Terms referring to equipment that is shown in a list published by an approved testing agency qualified and equipped for experimental testing and maintaining an adequate periodic inspection of current productions and whose listing states that the equipment complies with nationally recognized standards when installed in accordance with the manufacturer's installation instructions.

[B] LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

LIVING SPACE. Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

LOCAL ENFORCEMENT AGENCY. *A department or agency in a municipality charged with the enforcement of 780 CMR 51.00 through 99.00 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 51.00 through 99.00. 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 Special Regulation 110.R7.*

[B] LOT. A portion or parcel of land considered as a unit.

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[B] LOT LINE. A line dividing one lot from another, or from a street or any public place.

LOW-RISE RESIDENTIAL BUILDING. *For purposes of energy conservation requirements only, residential occupancy buildings three stories or less in height (also see 780 CMR 61.00 for exceptions to this classification).*

MANUAL. *Capable of being operated by personal intervention (see "Automatic").*

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.*

MANUFACTURED HOME. Manufactured home means a structure, transportable in one or more sections, which in the traveling mode is eight body feet (2438 body mm) or more in width or 40 body feet (12 192 body mm) or more in length, or, when erected on site, is 320 square feet (30 m^2) or more, 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; except that such term shall include any structure that meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the secretary (HUD) and complies with the standards established under this title. For mobile homes built prior to June 15, 1976, a label certifying compliance to the Standard for Mobile Homes, NFPA 501, in effect at the time of manufacture is required. For the purpose of 780 CMR 51.00 through 99.00, a mobile home shall be considered a manufactured home.

[B] MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules. (See also "Mark" and "Label.")

MANUFACTURER'S INSTALLATION INSTRUCTIONS. Printed instructions included with equipment as part of the conditions of listing and labeling.

[B] MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material. (See also "Manufacturer's designation" and "Label.")

MASONRY CHIMNEY. A field-constructed chimney composed of solid masonry units, bricks,

stones or concrete.

MASONRY HEATER. A masonry heater is a solid fuel burning heating appliance constructed predominantly of concrete or solid masonry having a mass of at least 1,100 lb. (500 kg), excluding the chimney and foundation. It is designed to absorb and store a substantial portion of heat from a fire built in the firebox by routing exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes at least one 180-degree (3.14-rad) change in flow direction before entering the chimney and which deliver heat by radiation through the masonry surface of the heater.

MASONRY, SOLID. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

[B] MASONRY UNIT. Brick, tile, stone, glass block or concrete block conforming to the requirements specified in the *International Building Code* Section 2103.

Clay. A building unit larger in size than a brick, composed of burned clay, shale, fire clay or mixtures thereof.

Concrete. A building unit or block larger in size than 12 inches by four inches by four inches (305 mm by 102 mm by 102 mm) made of cement and suitable aggregates.

Glass. Nonload-bearing masonry composed of glass units bonded by mortar.

Hollow. A masonry unit whose net cross-sectional area in any plane parallel to the loadbearing surface is less than 75% of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit whose net cross-sectional area in every plane parallel to the loadbearing surface is 75% or more of its cross-sectional area measured in the same plane.

MASS WALL. Masonry or concrete walls having a mass greater than or equal to 30 pounds per square foot (146 kg/m^2), solid wood walls having a mass greater than or equal to 20 pounds per square foot (98 kg/m^2), and any other walls having a heat capacity greater than or equal to six $\text{Btu}/\text{ft}^2 \cdot ^\circ\text{F}$ [$266\text{ J}/(\text{m}^2 \cdot \text{k})$].

MEAN ROOF HEIGHT. The average of the roof eave height and the height to the highest point on the roof surface, except that eave height shall be used for roof angle of less than or equal to 10 degrees (0.18 rad).

MECHANICAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced draft portion under nonpositive static pressure or a forced draft portion under positive static pressure.

Forced-draft Venting System. A portion of a venting system using a fan or other mechanical

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means to cause the removal of flue or vent gases under positive static pressure.

Induced Draft Venting System. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Power Venting System. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

MECHANICAL EXHAUST SYSTEM. A system for removing air from a room or space by mechanical means.

MECHANICAL SYSTEM. A system specifically addressed and regulated in 780 CMR 51.00 through 99.00 and composed of components, devices, appliances and equipment.

[B] METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of at least three square feet (0.28 m²) per sheet.

[B] METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than three square feet (0.28 m²) per sheet.

[B] MEZZANINE, LOFT. An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located.

[B] MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

MULTIPLE STATION SMOKE ALARM. Two or more single station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

NATIVE LUMBER. Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with Special Regulation 780 CMR 110.R4. Such wood is ungraded but is stamped or certified in accordance with the requirements of Special Regulation 780 CMR 110.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 Special Regulation 780 CMR 110.R4.

NATURAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

NONCOMBUSTIBLE MATERIAL. Materials that pass the test procedure for defining noncombustibility of elementary materials set forth in ASTM E 136.

NONCONDITIONED SPACE. A space that is not a conditioned space by insulated walls, floors or ceilings.

OCCUPANCY. *The purpose for which a building, or portion thereof, is utilized or occupied.*

[B] OCCUPIED SPACE. The total area of all buildings or structures on any lot or parcel of ground projected on a horizontal plane, excluding permitted projections as allowed by 780 CMR 51.00 through 99.00.

OFFICIAL INTERPRETATION. *A written interpretation 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 of any provision of 780 CMR 51.00 through 99.00, or its referenced standards as listed in Appendix A, except the specialized codes.*

OPAQUE AREAS. *All exposed areas of a building envelope which enclose conditioned space, except openings for windows, skylights, doors and building service systems.*

OWNER. *Every person who alone or jointly or severally with others*

1. *has legal title to any building or structure; or*
2. *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*
3. *lessee under a written lease agreement; or*
4. *mortgagee in possession; or*
5. *agent, trustee or other person appointed by the courts.*

Each such person is bound to comply with the provisions of 780 CMR 51.00 through 99.00.

PELLET FUEL-BURNING APPLIANCE. A closed combustion, vented appliance equipped with a fuel feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

PELLET VENT. A vent listed and labeled for use with a listed pellet fuel-burning appliance.

[B] PERMIT. An official document or certificate issued by the authority having jurisdiction that authorizes performance of a specified activity.

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 51.00 through 99.00 prescribing a penalty or fine, as to partner-*

ships 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.

PITCH. See "Slope."

PLATFORM CONSTRUCTION. A method of construction by which floor framing bears on load bearing walls that are not continuous through the story levels or floor framing.

PLENUM. A chamber that forms part of an air-circulation system other than the occupied space being conditioned.

PLUMBING. For the purpose of 780 CMR 51.00 through 99.00, plumbing refers to those installations, repairs, maintenance and alterations regulated by *248 CMR, Commonwealth of Massachusetts Fuel Gas and Plumbing Code*.

PORTABLE FUEL CELL APPLIANCE. A fuel cell generator of electricity, which is not fixed in place. A portable fuel cell appliance utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

POSITIVE COOLING SUPPLY. *Mechanical cooling deliberately supplied to a space, such as through a supply register. Also, mechanical cooling indirectly supplied to a space through uninsulated surfaces of space-cooling components, such as evaporator coil cases and cooling distribution systems which continually maintain air temperatures within the space of 85°F (29°C) or lower during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of 780 CMR 51.00 through 99.00.*

POSITIVE HEAT SUPPLY. *Heat deliberately supplied to a space by design, such as a supply register, radiator or heating element. Also, heat indirectly supplied to a space through uninsulated surfaces of service water heaters and space-heating components, such as furnaces, boilers and heating and cooling distribution systems which continually maintain air temperature within the space of 50°F (10°C) or higher during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of 780 CMR 51.00 through 99.00.*

[B] POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or

harmful physiological effects and conforming in bacteriological and chemical quality to the requirements of the public health authority having jurisdiction.

PRESSURE-RELIEF VALVE. A pressure-actuated valve held closed by a spring or other.

PUBLIC SEWER. A common sewer directly controlled by public authority.

PUBLIC WAY. Any street, alley or other parcel of land open to the outside air leading to a public street, which has been deeded, dedicated or otherwise permanently appropriated to the public for public use and that has a clear width and height of not less than ten feet (3048 mm).

PURGE. To clear of air, gas or other foreign substances.

RADON GAS. *A naturally occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings. Radon mitigation is not a requirement of 780 CMR 51.00 through 99.00. Persons interested in acquiring information about radon mitigation may contact the U.S. Environmental Protection Agency (EPA).*

R-VALUE, THERMAL RESISTANCE. The inverse of the time rate of heat flow through a building thermal envelope element from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F/Btu}$).

RAMP. A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5% slope).

[B] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice *his or her* respective design profession as defined by the statutory requirements of the professional registration laws of the *Commonwealth of Massachusetts*.

RELIEF VALVE, VACUUM. A device to prevent excessive buildup of vacuum in a pressure vessel.

RENEWABLE ENERGY SOURCES. *Sources of energy (excluding minerals) derived from incoming solar radiation, including natural daylighting and photosynthetic processes; from phenomena resulting therefrom, including wind, waves and tides, lake or pond thermal differences; and from the internal heat of the earth, including nocturnal thermal exchanges.*

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[B] REPAIR. The reconstruction or renewal of any part of an existing building 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.*

[B] REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover."

RESIDENTIAL BUILDING TYPE. *Detached one- and two-family dwellings are Type A-1. (Three or more family dwelling units, including apartment buildings, hotels, motels, "rowhousing" and "townhousing" are addressed in the Seventh Edition of the Massachusetts Basic Building Code).*

RETURN AIR. Air removed from an approved conditioned space or location and recirculated or exhausted.

[B] ROOF ASSEMBLY. *A system designed to provide weatherprotection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering. For purposes of addressing 780 CMR 61.00 energy conservation requirements a roof assembly shall be considered as all roof/ceiling components of the building envelope through which heatflows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses conditioned space.*

The gross area of a roof assembly consists of the total interior surface of all roof/ceiling components, including opaque surfaces, dormer and bay window roofs, treyed ceilings, overhead portions of an interior stairway to an unconditioned attic, doors and hatches, glazing and skylights exposed to conditioned space, that are horizontal or sloped at an angle less than 60 degrees (1.1 rad) from the horizontal (see "Exterior wall"). A roof assembly, or portions thereof, having a slope of 60 degrees (1.1 rad) or greater from horizontal shall be considered in the gross area of exterior walls and thereby excluded from consideration in the roof assembly. Skylight shaft walls 12 inches (305 mm) in depth or greater (as measured from the ceiling plane to the roofdeck) shall be considered in the gross area of exterior walls and are thereby excluded from consideration in the roof assembly.

[B] ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

[B] ROOF COVERING SYSTEM. See "Roof assembly".

[B] ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

[B] ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

[B] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

[B] ROOFTOP STRUCTURE. An enclosed structure on or above the roof of any part of a building.

ROOM HEATER. A freestanding heating appliance installed in the space being heated and not connected to ducts.

[B] RUNNING BOND. The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.

SASH CRACK. *The sum of all perimeters of all window sashes, based on overall dimensions of such parts, expressed in feet (mm). If a portion of one sash perimeter overlaps a portion of another sash perimeter, only count the length of the overlapping portions once.*

[B] SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

SEASONAL ENERGY EFFICIENCY RATIO (SEER). *The total cooling output of an air conditioner during its normal annual usage period for cooling, in Btu/h (W), divided by the total electric energy input during the same period, in watt-hours, as determined by DOE 10 CFR Part 430, Subpart B, Test Procedures.*

SEISMIC DESIGN CATEGORY. A classification assigned to a structure based on its Seismic Group and the severity of the design earthquake ground motion at the site.

SHALL. The term, when used in 780 CMR 51.00 through 99.00, is construed as mandatory.

[B] SHEAR WALL. A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing in accordance with 780 CMR 56 of 780 CMR 51.00 through 99.00 and the associated limitations in 780 CMR 5301.2.

SIMULATION TOOL. *An approved software program or calculation-based methodology that projects the hour-by-hour loads and annual energy use of a building.*

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SINGLE PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

SINGLE STATION SMOKE ALARM. An assembly incorporating the detector, control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

SKYLIGHT AND SLOPED GLAZING. *See* 780 CMR 5308.6.1.

SKYLIGHT, UNIT. *See* 780 CMR 5308.6.1.

SLAB-ON-GRADE FLOOR INSULATION. *Insulation around the perimeter of the floor slab or its supporting foundation when the top edge of the floor perimeter slab is above the finished grade or 12 inches (305mm) or less below the finished grade.*

SLOPE. The fall (pitch) of a line of pipe in reference to a horizontal plane. In drainage, the slope is expressed as the fall in units vertical per units horizontal (percent) for a length of pipe.

SMOKE-DEVELOPED RATING. A numerical index indicating the relative density of smoke produced by burning assigned to a material tested in accordance with ASTM E 84.

SOLAR ENERGY SOURCE. *Source of natural daylighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.*

SOLAR HEAT GAIN COEFFICIENT (SHGC). The solar heat gain through a fenestration or glazing assembly relative to the incident solar radiation (Btu/h · ft² · °F).

SOLID MASONRY. Load-bearing or nonload-bearing construction using masonry units where the net cross-sectional area of each unit in any plane parallel to the bearing surface is not less than 75% of its gross cross-sectional area. Solid masonry units shall conform to ASTM C 55, C 62, C 73, C 145 or C 216.

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.*

STACK. Any main vertical DWV line, including offsets, that extends one or more stories as directly as possible to its vent terminal.

[B] STACK BOND. The placement of masonry units in a bond pattern is such that head joints in successive courses are vertically aligned. For the

purpose of 780 CMR 51.00 through 99.00, requirements for stack bond shall apply to all masonry laid in other than running bond.

STANDARD DESIGN. *A version of the proposed design that meets the minimum requirements of 780 CMR 51.00 through 99.00 and is used to determine the maximum annual energy cost requirement for compliance based on total building performance.*

STANDARD TRUSS. Any construction that does not permit the roof/ceiling insulation to achieve the required R-value over the exterior walls.

STATE BUILDING CODE (780 CMR 51.00 through 99.00). *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, Department of Public Safety, who is charged with administrating and enforcing 780 CMR 51.00 through 99.00 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 51.00 through 99.00 relative to all buildings and structures other than those owned by the Commonwealth.*

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages which constitute an automatically-operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

[B] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

[B] STORY ABOVE GRADE. Any story having its finished floor surface entirely above grade, except that a basement shall be considered as a story above grade where the finished surface of the floor above the basement is:

1. More than six feet (1829 mm) above grade plane.
2. More than six feet (1829 mm) above the finished ground level for more than 50% of the total building perimeter.
3. More than 12 feet (3658 mm) above the finished ground level at any point.

STRUCTURAL INSULATED PANELS (SIPS). Factory fabricated panels of solid core insulation with structural skins of oriented strand board (OSB) or plywood.

STRUCTURE. That which is built or constructed.

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SUNROOM. *An addition to an existing building/dwelling unit where the total glazing area of said addition exceeds 40% of the combined gross wall and ceiling area of the addition.*

SUNROOM ADDITION. A one-story structure added to an existing dwelling with a glazing area in excess of 40% of the gross area of the structure's exterior walls and roof.

SUPPLY AIR. Air delivered to a conditioned space through ducts or plenums from the heat exchanger of a heating, cooling or ventilating system.

SUPPORTS. Devices for supporting, hanging and securing pipes, fixtures and equipment.

SYSTEM. *A combination of central or terminal equipment or components or controls, accessories, interconnecting means and terminal devices by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.*

THERMAL CONDUCTANCE. *Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions (Btu/h · ft² · °F) [W/(m² · K)].*

THERMOSTAT. *An automatic control device actuated by temperature and designed to be responsive to temperature.*

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 4,500 pounds (2045 kg), or being of any weight provided its overall length does not exceed 28 feet (8534 mm).*

THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom addition and a dwelling unit, consisting of existing or new wall(s), doors, and/or windows.

THERMAL RESISTANCE, R-VALUE. The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions, per unit area (h · ft² · °F/Btu).

THERMAL TRANSMITTANCE, U-FACTOR. The coefficient of heat transmission (air to air) through a building envelope component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h · ft² · °F).

TRIM. Picture molds, chair rails, baseboards,

handrails, door and window frames, and similar decorative or protective materials used in fixed applications.

TRUSS DESIGN DRAWING. The graphic depiction of an individual truss, which describes the design and physical characteristics of the truss.

U-FACTOR, THERMAL TRANSMITTANCE. The coefficient of heat transmission (air to air) through a building envelope component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h · ft² · °F).

UNCONFINED SPACE. A space having a volume not less than 50 cubic feet per 1,000 Btu/h (4.8 m³/kW) of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

[B] UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt, or other approved material over which a roof covering, with a slope of two to 12 (17% slope) or greater, is applied.

UNITARY COOLING AND HEATING EQUIPMENT. *One or more factory-made assemblies which include an evaporator or cooling coil, a compressor and condenser combination, and which shall be permitted to include a heating function as well. When heating and cooling equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.*

UNITARYHEATPUMP. *One or more factory-made assemblies which include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. When heat pump equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.*

UNUSUALLY TIGHT CONSTRUCTION. Construction meeting the following requirements:

1. Walls comprising the building thermal envelope have a continuous water vapor retarder with a rating of one perm [57.4 ng/(s · m² · Pa)] or less with openings therein gasketed or sealed.
2. *Doors and openable windows meet the air leakage requirements of International Energy Conservation Code Section 502.1.4.1.*
3. Caulking or sealants are applied to areas such as joints around window and door frames between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.

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VAPOR PERMEABLE MEMBRANE. A material or covering having a permeance rating of 5 perms ($52.9 \cdot 10^{-10} \text{ kg/Pa} \cdot \text{s} \cdot \text{m}^2$) or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

[B] VAPOR RETARDER. A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm ($5.7 \cdot 10^{-11} \text{ kg/Pa} \cdot \text{s} \cdot \text{m}^2$) or less, when tested in accordance with the desiccant method using Procedure A of ASTM E96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.

VENT. A passageway for conveying flue gases from fuel-fired appliances, or their vent connectors, to the outside atmosphere.

VENT COLLAR. See "Flue collar."

VENT CONNECTOR. That portion of a venting system which connects the flue collar or draft hood of an appliance to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual, automatically operated fuel burning appliance and that is designed to open the venting system automatically when the appliance is in operation and to close off the venting system automatically when the appliance is in a standby or shutdown condition.

VENT GASES. Products of combustion from fuel-burning appliances, plus excess air and dilution air, in the venting system above the draft hood or draft regulator.

VENT STACK. A vertical vent pipe installed to provide circulation of air to and from the drainage system and which extends through one or more stories.

VENT SYSTEM. Piping installed to equalize pneumatic pressure in a drainage system to prevent trap seal loss or blow-back due to siphonage or back pressure.

[B] VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTING. Removal of combustion products to the outdoors.

VENTING SYSTEM. A continuous open passageway from the flue collar of an appliance to the outside atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and vent connector, if used, assembled to form the open passageway.

VERTICAL PIPE. Any pipe or fitting that makes

an angle of 45 degrees (0.79 rad) or more with the horizontal.

[B] WALLS. Walls shall be defined as follows:

Load-bearing Wall is a wall supporting any vertical load in addition to its own weight.

Nontbearing Wall is a wall which does not support vertical loads other than its own weight.

WIND BORNE DEBRIS REGION. Areas within hurricane-prone regions within one mile of the coastal mean high water line where the basic wind speed is 110 miles per hour (177 km/h) or greater; or where the basic wind speed is equal to or greater than 120 miles per hour (193 km/h); or Hawaii. The coastal mean high water line, in the Massachusetts 110 mph wind zones, forms the outer edge of the red bands overlaid onto the satellite images found on the MA Department of Public Safety website at www.mass.gov/dps. For estimating purposes, the inner edge of the red bands is approximately one mile inland from coastal mean high water. For buildings in close proximity to the inner edge of the red band, to determine whether a building is in a wind borne debris region, the building official shall use a survey, provided with the permit application and the building plan, which indicates the distance, in feet, from the location of the proposed building to the closest location of the coastal mean high water line as described.

WINDER. A tread with non-parallel edges.

[B] WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are plywood, OSB or composite panels.

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.*

[B] YARD. *An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by 780 CMR 51.00 through 99.00, on the lot on which a building is situated.*

ZONE. *A space or group of spaces within a building with heating or cooling requirements, or both, sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.*

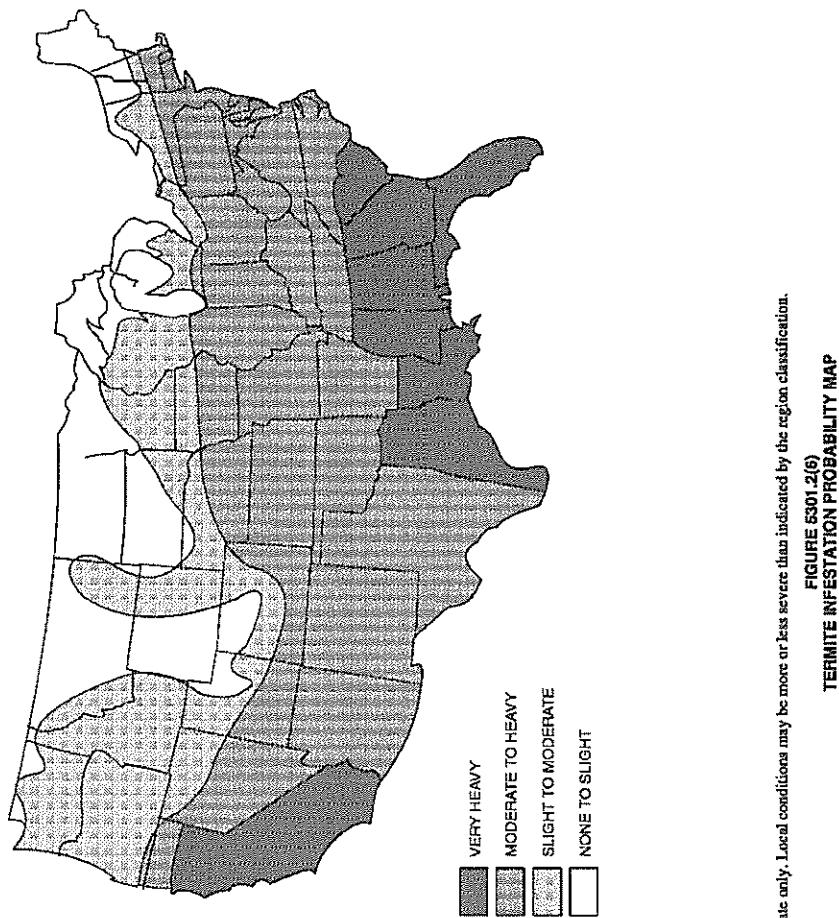
ZONING. *The reservation of certain specified areas within a community or city for buildings and structures, or use of land, for certain purposes with other limitations such as height, lot coverage and other stipulated requirements (see M.G.L. c. 40A and St. 1956, c. 665, as amended).*

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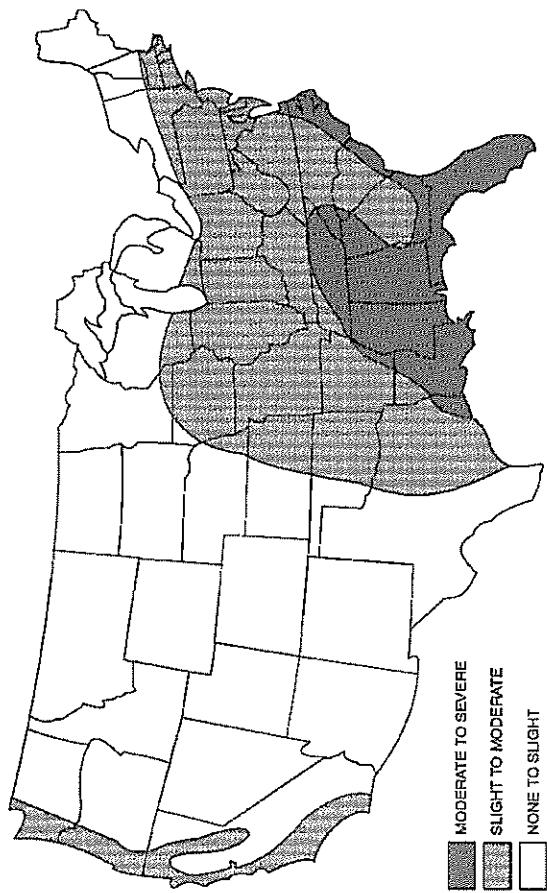
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780 CMR FIGURE 5301.2(6)
TERMITE INFESTATION PROBABILITY MAP



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780 CMR FIGURE 5301.2(7)
DECAY PROBABILITY MAP



NOTES: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

FIGURE 5301.2(7)
DECAY PROBABILITY MAP

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780 CMR 5301 DESIGN CRITERIA

5301.1 Design. Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads as prescribed by 780 CMR 51.00 through 99.00. The construction of buildings and structures shall result in a system that provides a complete load path capable of transferring all loads from their point of origin through the load-resisting elements to the foundation.

5301.1.1 Alternative Provisions. As an alternative to the requirements in 780 CMR 5301.1 the following standards are permitted subject to the limitations of 780 CMR 51.00 through 99.00 and the limitations therein. In lieu of prescriptive compliance, where engineered design is used in conjunction with these standards the engineered design shall be performed by a Massachusetts-registered professional engineer or architect, employ an appropriate engineering rationale consistent with the standards below and utilize the wind and snow loads set forth in 780 CMR 51.00 through 99.00..

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual* (WFCM).
2. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing-Prescriptive Method for One- and Two-family Dwellings* (COFS/PM).

Note that seismic design requirements are not applicable to one- and two-family detached dwellings.

5301.1.2 Construction Systems. The requirements of 780 CMR 51.00 through 99.00 are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

5301.1.3 Engineered Design. When a building of otherwise conventional construction contains structural elements exceeding the limits of 780 CMR 5301 or otherwise, not conforming to 780 CMR 51.00 through 99.00, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered

design shall be provided by a Massachusetts-registered professional engineer or architect and shall utilize the wind and snow loads set forth in 780 CMR 51.00 through 99.00.

5301.2 Climatic and Geographic Design Criteria. Buildings shall be constructed in accordance with the provisions of 780 CMR 51.00 through 99.00 as limited by the provisions of 780 CMR 5301; also see 780 CMR Table 5301.2 (1).

5301.2.1 Wind Limitations. Buildings and portions thereof shall be limited by wind speed, as defined in 780 CMR Table 5301.2(1), and construction methods in accordance with 780 CMR 51.00 through 99.00. Basic wind speeds shall be determined from 780 CMR Table 5301.2(4). Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of 780 CMR 5301 for each portion shall apply. Where loads for windows, skylights and exterior doors are not otherwise specified, the loads listed in 780 CMR Table 5301.2(2) adjusted for height and exposure per 780 CMR Table 5301.2(3), shall be used to determine design load performance requirements for windows and doors.

5301.2.1.1 Design Criteria. Construction in regions where the basic wind speeds from 780 CMR Table 5301.2(4) equal or exceed 110 miles per hour (177.1 km/h) shall be designed in accordance with one of the following:

1. American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM); or
 - 1.1 American Forrest and Paper Association *Guide to Wood Construction in High Wind Areas for One- and Two-Family Dwellings, 110 mph Exposure B*. A Commonwealth of MA version of the checklist can be used in place of the checklist at the end of the guide. The MA version is found in Appendix 780 CMR 120.P
2. *Southern Building Code Congress International Standard for Hurricane Resistant Residential Construction* (SSTD 10); or
3. *Minimum Design Loads for Buildings and Other Structures* (ASCE-7); or
4. American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing-Prescriptive Method for One- and*

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Two-family Dwellings (COFS/PM).

5. Concrete construction shall be designed in accordance with the provisions of 780 CMR 51.00 through 99.00.

5301.2.1.2 Internal Pressure. Windows in buildings located in wind borne debris regions shall have glazed openings protected from windborne debris or the building shall be

designed as a partially enclosed building in accordance with the *International Building Code but utilizing the wind loads set forth in 780 CMR 51.00 through 99.00*. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and of ASTM E 1886 referenced therein.

TABLE 5301.2(1)
MASSACHUSETTS CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND SPEED ^a (mph)	SEISMIC DESIGN CATEGORY ^b (One- and Two-Family Detached Dwellings-only)	SUBJECT TO DAMAGE FROM		WINTER DESIGN TEMP ^c	ICE SHIELD UNDERLAYMENT REQUIRED ^d	FLOOD HAZARD ^e	AIR FREEZING INDEX	MEAN ANNUAL TEMP ^f
			Frost Line Depth ^g	Termite Decay ^h					
Table 5301.2(5)	Table 5301.2(4)	N/A	Figure 5301.2(3)	Figure 5301.2(6)	Figure 5301.2(7)	Appendix 780 CMR 120.1 Table 120.3.2.1	As required by the exterior roof covering manufacturer; roof pitch and local climate must also be considered	Refer to the applicable Flood Insurance Rate Map (FIRM)	Only utilized in the design and construction of frost-protected shallow foundations
									Only utilized in the design and construction of frost-protected shallow foundations

For S₁: 1 foot = 304.8 mm.

a. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The weathering index ("negligible," "moderate" or "severe") shall be determined from the Weathering Probability Map [Figure 5301.2(3)]. The grade of masonry units shall be determined from ASTM C 34, C 35, C 62, C 73, C 90, C 129, C 145, C 216 or C 652, as applicable.

b. The frost line depth shall be a minimum of 4 feet in Massachusetts unless engineering data demonstrates that the frost line depth is less than or greater than 4 feet. Under no circumstances will permanent foundation systems, required to be protected from frost be allowed, set at less than 4 feet without engineering design ensuring foundation frost protection.

c. Site-specific termite conditions should be determined when possible, otherwise Figure 5301.2(6) shall be utilized.

d. Typically "slight" to "moderate."

e. The basic wind speed shall be determined from Table 5301.2(4) for the specific city or town where construction is intended.

f. See Appendix 780 CMR 120.3.2.1.

g. Seismic design is not required for one- and two-family detached dwellings.

h. The community Flood Insurance Rate Map (FIRM) shall be utilized to establish the flood hazard.

i. The requirements of the manufacturer of the exterior roof covering shall be followed with regard to ice shield underlayment; likewise roof pitch and local climate must be considered.

j. Only utilized when one is designing a frost-protected shallow foundation. When applicable, refer to the "100-year return period air freezing index" from Figure 5403.3(2) and for further clarification view the National Climatic Data Center data table "Air Freezing Index USA Method (Base 32° Fahrenheit)" at www.ncdc.noaa.gov/fshrm.

k. Only utilized when one is designing a frost-protected shallow foundation. When applicable, refer to the "100-year return period air freezing index" from Figure 5403.3(2) and for further clarification view the National Climatic Data Center data table "Air Freezing Index USA Method (Base 32° Fahrenheit)" at www.ncdc.noaa.gov/fshrm.

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780 CMR TABLE 5301.2(2)
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN
ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (psf)

ZONE	EFFECTIVE WIND AREA (feet ²)	BASIC WIND SPEED (mph—3-second gust)											
		85	90	100	105	110	120	125	130	140	145	150	170
1	10	10.0-13.0	10.0-14.6	10.0-18.0	10.0-19.8	10.0-21.8	10.5-25.9	11.4-28.1	12.4-30.4	14.3-35.3	15.4-37.8	16.5-40.5	21.1-52.0
1	20	10.0-12.7	10.0-14.2	10.0-17.5	10.0-19.3	10.0-21.2	10.0-25.2	10.7-27.4	11.6-29.6	13.4-34.4	14.4-36.9	15.4-39.4	19.8-50.7
1	50	10.0-12.2	10.0-13.7	10.0-16.9	10.0-18.7	10.0-20.5	10.0-24.4	10.0-26.4	10.6-28.6	12.5-33.3	13.1-35.6	14.1-38.1	18.1-48.9
1	100	10.0-11.9	10.0-13.3	10.0-18.5	10.0-18.2	10.0-19.9	10.0-23.7	10.0-25.7	10.0-27.8	11.4-32.3	12.2-34.6	13.0-37.0	16.7-47.6
2	10	10.0-21.8	10.0-24.4	10.0-30.2	10.0-33.3	10.0-36.5	10.5-43.5	11.4-47.2	12.4-51.0	14.3-59.2	15.4-63.5	16.5-67.9	21.1-87.2
2	20	10.0-19.5	10.0-21.8	10.0-27.0	10.0-29.7	10.0-32.6	10.0-38.8	10.7-42.1	11.6-45.6	13.4-52.0	14.4-56.7	15.4-60.7	19.8-78.0
2	50	10.0-16.4	10.0-18.4	10.0-22.7	10.0-25.1	10.0-27.5	10.0-32.7	10.0-35.5	10.6-38.4	12.3-44.5	13.1-47.8	14.1-51.1	18.1-65.7
2	100	10.0-14.1	10.0-15.8	10.0-19.5	10.0-21.5	10.0-23.6	10.0-28.1	10.0-30.5	10.0-33.0	11.4-38.2	12.2-41.0	13.0-43.9	16.7-56.4
3	10	10.0-32.8	10.0-36.8	10.0-45.4	10.0-50.1	10.0-55.0	10.5-65.4	11.4-71.0	12.4-76.8	14.3-89.0	15.4-95.5	16.5-102.2	21.1-131.3
Roof > 0 to 10 degrees		10.0-27.2	10.0-30.5	10.0-37.6	10.0-41.5	10.0-45.5	10.0-54.2	10.7-58.8	11.6-63.6	13.4-73.8	14.4-79.1	15.4-84.7	19.8-108.7
3	50	10.0-19.7	10.0-22.1	10.0-27.3	10.0-30.1	10.0-33.1	10.0-39.3	10.0-42.7	10.6-46.2	12.3-53.5	13.1-57.4	14.1-61.5	18.1-78.9
3	100	10.0-14.1	10.0-15.8	10.0-19.5	10.0-21.5	10.0-23.6	10.0-28.1	10.0-30.5	10.0-33.0	11.4-38.2	12.2-41.0	13.0-43.9	16.7-56.4
1	10	10.0-11.9	10.0-13.3	10.4-16.5	11.4-18.2	12.5-19.9	14.9-23.7	16.2-25.7	17.5-27.8	20.3-32.1	21.8-35.6	23.3-37.0	30.0-47.6
1	20	10.0-11.6	10.0-13.0	10.0-16.0	10.4-17.6	11.4-19.4	13.6-23.0	14.8-25.0	16.0-27.0	18.5-31.4	19.9-33.7	21.3-36.0	27.3-56.3
1	50	10.0-11.1	10.0-12.5	10.0-15.4	10.0-17.0	10.0-18.6	11.9-22.2	12.9-24.1	13.9-26.0	16.1-30.2	17.3-32.4	18.5-34.6	23.8-44.5
1	100	10.0-10.8	10.0-12.1	10.0-14.9	10.0-16.5	10.0-18.1	10.5-21.5	11.4-23.3	12.4-25.2	14.3-29.3	15.4-31.4	16.5-33.6	21.1-43.2
2	10	10.0-25.1	10.0-28.2	10.4-34.8	11.4-38.3	12.5-42.1	14.9-50.1	16.2-54.3	17.5-58.7	20.3-68.1	21.8-73.1	23.3-78.2	30.0-100.5
2	20	10.0-22.8	10.0-25.6	10.0-31.5	10.4-34.8	11.4-38.2	13.6-45.4	14.8-49.3	16.0-53.3	18.5-61.8	19.9-66.3	21.3-71.0	27.3-91.2
2	50	10.0-19.7	10.0-22.1	10.0-27.3	10.0-30.1	10.0-33.0	11.9-39.3	12.9-42.7	13.9-46.1	16.1-53.5	17.3-57.4	18.5-61.4	23.8-78.9
2	100	10.0-17.4	10.0-19.5	10.0-24.1	10.0-26.6	10.0-29.1	10.5-34.7	11.4-37.6	12.4-40.7	14.3-47.2	15.4-50.6	16.5-54.2	21.1-69.6
3	10	10.0-25.1	10.0-28.2	10.4-34.8	11.4-38.3	12.5-42.1	14.9-50.1	16.2-54.3	17.5-58.7	20.3-68.1	21.8-73.1	23.3-78.2	30.0-100.5
Roof > 10 to 30 degrees		10.0-22.8	10.0-25.6	10.0-31.5	10.4-34.8	11.4-38.2	13.6-45.4	14.7-49.3	16.0-53.3	18.5-61.8	19.9-66.3	21.3-71.0	27.3-91.2
3	50	10.0-19.7	10.0-22.1	10.0-27.3	10.0-30.1	10.0-33.0	11.9-39.3	12.9-42.7	13.9-46.1	16.1-53.5	17.3-57.4	18.5-61.4	23.8-78.9
3	100	10.0-17.4	10.0-19.5	10.0-24.1	10.0-26.6	10.0-29.1	10.5-34.7	11.4-37.6	12.4-40.7	14.3-47.2	15.4-50.6	16.5-54.2	21.1-69.6
1	10	11.9-13.0	13.3-14.6	16.5-18.0	18.2-19.8	19.9-21.8	23.7-25.9	25.7-28.1	27.8-30.4	32.3-35.3	34.6-37.8	37.0-40.5	47.6-52.0
1	20	11.6-12.3	13.0-13.8	16.0-17.1	17.6-18.8	19.4-20.7	23.0-24.6	25.0-26.7	27.0-28.9	31.4-33.5	33.7-35.9	36.0-38.4	46.3-49.3
1	50	11.1-11.5	12.5-12.8	15.4-15.9	17.0-17.5	18.6-19.2	22.2-22.8	24.1-24.8	26.0-25.8	30.2-31.1	32.4-33.3	34.6-35.7	44.4-45.8
1	100	10.8-10.8	12.1-12.1	14.9-14.9	16.5-16.5	18.1-18.1	21.5-21.5	23.3-23.3	25.2-25.2	29.3-29.3	31.4-31.4	33.6-33.6	43.2-53.2
2	10	11.9-15.2	13.3-17.0	16.5-21.0	18.2-23.2	19.9-25.5	23.7-30.3	25.7-32.9	27.8-35.6	32.3-41.2	34.6-44.2	37.0-47.3	47.6-60.8
2	20	11.6-14.5	13.0-16.3	16.0-20.1	17.6-22.2	19.4-24.3	23.0-29.0	25.0-31.4	27.0-34.0	31.4-39.4	33.7-42.3	36.0-45.3	46.3-58.1
2	50	11.1-13.7	12.5-15.3	15.4-18.9	17.0-20.8	18.6-22.9	22.2-27.2	24.1-29.5	26.0-32.0	30.2-37.1	32.4-39.8	34.6-42.5	44.5-54.6
2	100	10.8-13.0	12.1-14.6	14.9-18.0	16.5-19.8	18.1-21.8	21.5-25.9	23.3-28.1	25.2-30.4	29.3-35.3	31.4-37.8	33.6-40.5	43.2-52.0
3	10	11.9-15.2	13.3-17.0	16.5-21.0	18.2-23.2	19.9-25.5	23.7-30.3	25.7-32.9	27.8-35.6	32.3-41.2	34.6-44.2	37.0-47.3	47.6-60.8
Roof > 30 to 45 degrees		11.6-14.5	13.0-16.3	16.0-20.1	17.6-22.2	19.4-24.3	23.0-29.0	25.0-31.4	27.0-34.0	31.4-39.4	33.7-42.3	36.0-45.3	46.3-58.1
3	50	11.1-13.7	12.5-15.3	15.4-18.9	17.0-20.8	18.6-22.9	22.2-27.2	24.1-29.5	26.0-32.0	30.2-37.1	32.4-39.8	34.6-42.5	44.5-54.5
3	100	10.8-13.0	12.1-14.8	14.9-18.0	16.5-19.8	18.1-21.8	21.5-25.9	23.3-28.1	25.2-30.4	29.3-35.3	31.4-37.8	33.6-40.5	43.2-52.0
4	10	13.0-14.1	14.6-15.8	18.0-19.5	19.8-21.5	21.8-23.6	25.9-28.1	28.1-30.5	30.4-33.0	35.3-38.2	37.8-41.0	40.5-43.9	52.0-56.4
4	20	12.4-13.5	13.9-15.1	17.2-18.7	18.9-20.6	20.8-22.6	24.7-26.9	26.8-29.2	29.0-31.6	33.7-36.7	36.1-39.3	38.7-42.1	49.6-54.1
4	50	11.6-12.7	13.0-14.3	16.1-17.6	17.8-19.4	19.5-21.3	23.2-25.4	25.2-27.5	27.2-29.8	31.6-34.3	33.9-37.1	36.2-39.7	46.6-51.0
4	100	11.1-12.2	12.4-13.6	15.3-16.8	16.9-18.5	18.5-20.4	22.0-24.2	23.9-26.3	25.9-28.4	30.0-33.0	32.2-35.4	34.4-37.8	44.2-48.6
Walls	10	13.0-17.4	14.6-19.5	18.0-24.1	19.8-26.6	21.8-29.1	25.9-34.7	28.1-37.6	30.4-40.7	35.3-47.2	37.8-50.6	40.5-45.2	52.0-59.6
5	20	12.4-16.2	13.9-18.2	17.2-22.5	18.9-24.8	20.8-27.2	24.7-32.4	26.8-35.1	29.0-38.0	33.7-44.0	36.1-47.2	38.7-50.5	49.6-54.9
5	50	11.6-14.7	13.0-16.5	16.1-20.3	17.8-22.4	19.5-24.6	23.2-29.3	25.2-31.8	27.2-34.3	31.6-39.8	33.9-42.7	36.2-45.7	46.6-58.7
5	100	11.1-13.5	12.4-15.1	15.3-18.7	16.9-21.6	18.5-22.6	22.0-26.9	23.9-29.2	25.9-31.6	30.0-36.7	32.2-32.2	34.4-42.1	44.2-54.1

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 1.609 km/h.

NOTES: For effective areas between those given above the load may be interpolated, otherwise use the load associated with the lower effective area. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in 780 CMR Table 5301.2(3).

See Figure 780 CMR 5301.2(8) for location of zones.

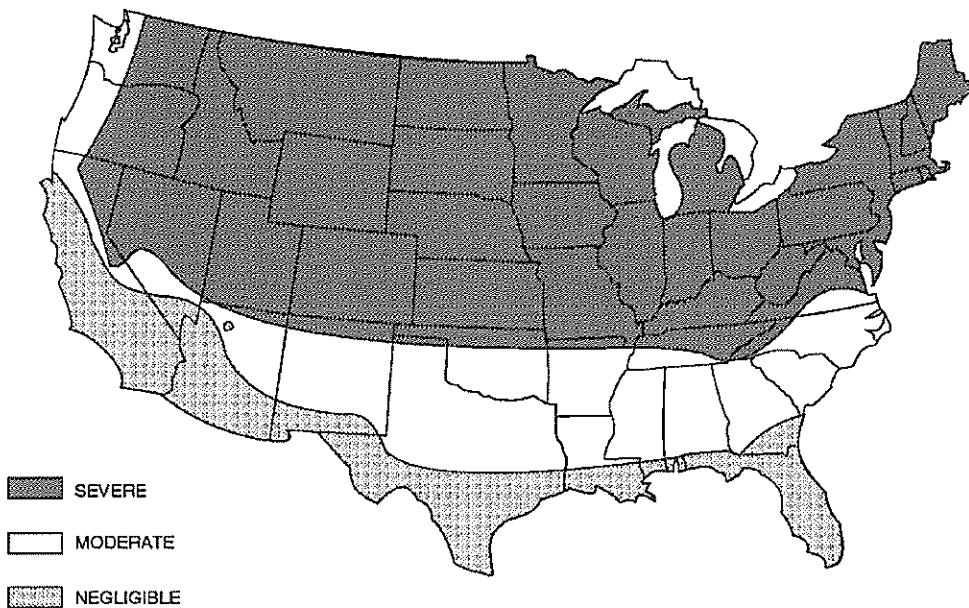
Plus and minus signs signify pressures acting toward and away from the building surfaces.

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780 CMR TABLE 5301.2(3)
HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE 5301.2(2)

MEAN ROOF HEIGHT	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

780 CMR [B] FIGURE 5301.2(3)
WEATHERING PROBABILITY MAP FOR CONCRETE



- a. Alaska and Hawaii are classified as severe and negligible, respectively.
- b. Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by region classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing causing deicing salts to be used extensively.

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TABLE 5301.2(4) MASSACHUSETTS BASIC WIND SPEEDS

<90 MPH	90 MPH	100 MPH	110 MPH
Adams	Acton	New Braintree	Abington
Alford	Agawam	New Marlborough	Middleton
Ashfield	Amherst	New Salem	Millis
Becket	Ashburnham	North Brookfield	Millville
Bernardston	Ashby	Northampton	Milton
Buckland	Athol	Northborough	Nahant
Cheshire	Auburn	Northfield	Avon
Clarksburg	Ayer	Oakham	Bedford
Colrain	Barre	Orange	Needham
Cummington	Belchertown	Otis	Newbury
Dalton	Berlin	Palmer	Belmont
Egremont	Blandford	Paxton	Berkley
Florida	Bolton	Pelham	Beverly
Great Barrington	Boxborough	Pepperell	Billerica
Greenfield	Boylston	Petersham	Blackstone
Hancock	Brimfield	Phillipston	Boston
Hawley	Brookfield	Princeton	Boxford
Heath	Carlisle	Royalston	Braintree
Hinsdale	Charlton	Russell	Bridgewater
Lanesborough	Chelmsford	Rutland	Brockton
Lee	Chester	Sandisfield	Brookline
Lenox	Chesterfield	Shirley	Burlington
Leyden	Chicopee	Shrewsbury	Cambridge
Middlefield	Clinton	Shutesbury	Canton
Monroe	Conway	South Hadley	Chelsea
Monterey	Deerfield	Southampton	Cohasset
Mount Washington	Dracut	Southbridge	Concord
New Ashford	Dunstable	Southwick	Danvers
North Adams	East Brookfield	Spencer	Dighton
Peru	East Longmeadow	Springfield	Douglas
Pittsfield	Easthampton	Sterling	Dover
Plainfield	Erving	Stow	Dudley
Richmond	Fitchburg	Sturbridge	East Bridgewater
Rowe	Gardner	Sunderland	Easton
Savoy	Gill	Templeton	Essex
Sheffield	Gosten	Tolland	Everett
Shelburne	Granby	Townsend	Foxborough
Stockbridge	Granville	Tyngsborough	Framingham
Tyringham	Groton	Wales	Franklin
Washington	Hadley	Ware	Georgetown
West Stockbridge	Hampden	Warren	Gloucester
Williamstown	Hardwick	Warwick	Grafton
Windsor	Harfield	Wendell	Groveland
Worthington	Harvard	West Boylston	Hamilton
	Holden	West Brookfield	Hanover
	Holland	West Springfield	Hanson
	Holyoke	Westfield	Haverhill
	Hubbardston	Westford	Hingham
	Hudson	Westhampton	Holbrook
	Huntington	Westminster	Holliston
	Lancaster	Whately	mm
	Lawrence	Wilbraham	Hopkinton
	Leicester	Williamsburg	Hull
	Leominster	Winchendon	Ipswich
	Leverett	Worcester	Lexington
	Littleton		Lincoln
	Longmeadow		Lynn
	Lowell		Lynnfield
	Ludlow		Malden
	Lunenburg		Manchester
	Maynard		Mansfield
	Methuen		Marblehead
	Millbury		Marlborough
	Monson		Medfield
	Montague		Medford
	Montgomery		Medway
			Melrose
			Mendon
			Merrimac

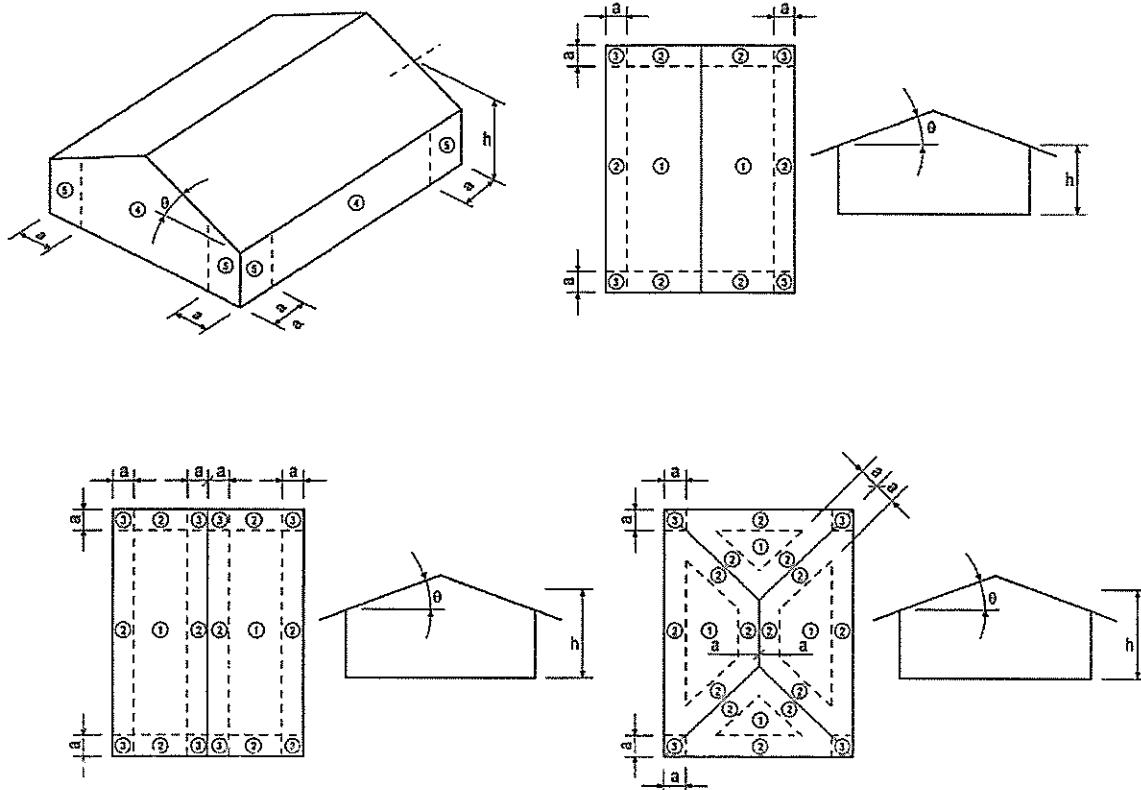
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TABLE 5301.2(5) MASSACHUSETTS GROUND SNOW LOADS

25 PSF	35 PSF	40 PSF	40 PSF	50 PSF		
Brewster	Abington	Alford	Nahant	Acton	Lenox	Topsfield
Carver	Agawam	Arlington	Natick	Adams	Leominster	Townsend
Chatham	Amherst	Ashland	Needham	Amesbury	Leverett	Tyngsborough
Eastham	Avon	Belchertown	New Braintree	Andover	Leyden	Tyningham
Harwich	Braintree	Belmont	New Marlborough	Ashburnham	Littleton	Warwick
Martha's Vineyard	Brockton	Bellingham	New Salem	Ashby	Lowell	Washington
Nantucket	Chicopee	Beverly	Newton	Ashfield	Lunenburg	Wendell
Orleans	Cohasset	Blackstone	Norfolk	Athol	Maynard	Wenham
Plymouth	East Longmeadow	Blandford	Northbridge	Auburn	Merrimac	West Boylston
Provincetown	Easton	Boston	Norwood	Ayer	Methuen	West Newbury
Truro	Foxborough	Brimfield	Peabody	Barre	Middlefield	West Stockbridge
Warcham	Granby	Brookfield	Pelham	Becket	Millbury	Westfield
Wellfleet	Hadley	Brookline	Quincy	Bedford	Monroe	Westford
	Hampden	Cambridge	Revere	Berlin	Montague	Westminster
	Hingham	Canton	Russell	Bernardston	Montgomery	Whately
	Holbrook	Charlton	Salem	Billerica	New Ashford	Williamsburg
	Holyoke	Chelsea	Saugus	Bolton	Newbury	Williamstown
30 PSF		Hull	Dedham	Sheffield	Boxborough	Newburyport
Acushnet	Longmeadow	Douglas	Sherborn	Boxford	North Adams	Winchendon
Attleboro	Ludlow	Dover	Shutesbury	Boylston	North Andover	Windsor
Barnstable	Mansfield	Dudley	Somerville	Buckland	North Brookfield	Worthington
Berkley	Monson	East Brookfield	Southampton	Burlington	North Reading	
Bourne	North Attleborough	Easthampton	Southborough	Carlisle	Northampton	
Bridgewater	Norwell	Everett	Southbridge	Chelmsford	Northborough	
Dartmouth	Palmer	Framingham	Stoneham	Cheshire	Northfield	
Dennis	Plainville	Franklin	Sturbridge	Chester	Oakham	
Dighton	Randolph	Grafton	Sudbury	Chesterfield	Orange	
Duxbury	Rockland	Granville	Sutton	Clarksburg	Otis	
East Bridgewater	Scituate	Great Barrington	Swampscott	Clinton	Oxford	
Fairhaven	Sharon	Hardwick	Tolland	Colrain	Paxton	
Fall River	South Hadley	Haifield	Upton	Concord	Pepperell	
Falmouth	Southwick	Holland	Uxbridge	Conway	Peru	
Freetown	Springfield	Holliston	Wakefield	Cummington	Petersham	
Gosnold	Stoughton	Hopkinton	Wales	Dalton	Phillipston	
Halifax	West Springfield	Lexington	Walpole	Danvers	Pittsfield	
Hanover	Weymouth	Lincoln	Waltham	Deerfield	Plainfield	
Hanson	Wilbraham	Lynn	Ware	Dracut	Princeton	
Kingston		Lynnfield	Warren	Dunstable	Reading	
Lakeville		Malden	Washington	Egremont	Richmond	
Marion		Manchester	Watertown	Erving	Rockport	
Marshfield		Marblehead	Wayland	Essex	Royalston	
Mashpee		Marlborough	Webster	Fitchburg	Rowe	
Mattapoisett		Medfield	Wellesley	Florida	Rowley	
Middleborough		Medford	West Brookfield	Gardner	Rutland	
New Bedford		Medway	Wesborough	Georgetown	Salisbury	
Norton		Melrose	Westhampton	Gill	Sandisfield	
Pembroke		Mendon	Weston	Gloucester	Savoy	
Raynham		Middleton	Westwood	Goshen	Shelburne	
Rehoboth		Milford	Winchester	Greenfield	Shirley	
Rochester		Millis	Winthrop	Groton	Shrewsbury	
Sandwich		Millville	Woburn	Groveland	Spencer	
Seconk		Milton	Worcester	Hamilton	Sterling	
Somerset		Montgomery	Wrentham	Hancock	Stockbridge	
Swansea		Mount Washington		Harvard	Stow	
Taunton				Haverhill	Sunderland	
West Bridgewater				Hawley	Templeton	
Westport				Heath	Tewksbury	
Whitman				Hinsdale		
Yarmouth				Holden		
				Hubbardston		
				Hudson		
				Huntington		
				Ipswich		
				Lancaster		
				Lanesborough		
				Lawrence		
				Lee		
				Leicester		

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780 FIGURE 5301.2(8)
COMPONENT AND CLADDING PRESSURE ZONES



For SI: 1 foot = 304.8 mm, 1 degree = 0.009 rad.

NOTE: $a = 4$ feet in all cases

Exception: Wood structural panels with a minimum thickness of $\frac{7}{16}$ inch (11.1 mm) and a maximum span of eight feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut to cover the glazed openings with attachment hardware provided. Attachments shall be provided in accordance with 780 CMR Table 5301.2.1.2 or shall be designed to resist the components and cladding loads determined in accordance with the provisions of the *International Building Code but utilizing the wind loads set forth in 780 CMR 53.00*.

780 CMR TABLE 5301.2.1.2
WINDBORNE DEBRIS PROTECTION
FASTENING SCHEDULE FOR WOOD
STRUCTURAL PANELS^{a,b,c}

FASTENER TYPE	FASTENER SPACING		
	Panel span \leq 4 foot	4 foot $<$ panel span \leq 6 foot	6 foot $<$ panel span \leq 8 foot
2 $\frac{1}{2}$ " # 6 Wood screws	16"	12"	9"
2 $\frac{1}{2}$ " # 8 Wood screws	16"	16"	12"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 mile per hour = 1.609 km/h.

- a. This table is based on 130 mph wind speeds and a 33-foot mean roof height.
- b. Fasteners shall be installed at opposing ends of the wood structural panel.
- c. Where screws are attached to masonry or masonry/stucco, they shall be attached utilizing vibration-resistant anchors having a minimum ultimate resistant anchors having a minimum ultimate withdrawal capacity of 490 pounds.

5301.2.1.3 Wind Speed Conversion. When referenced documents are based on fastest mile wind speeds, the three second gust wind velocities of **780 CMR Table 5301.2(4)** shall be converted to fastest mile wind velocities using 780 CMR Table 5301.2.1.3.

5301.2.1.4 Exposure Category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness

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that arise from natural topography and vegetation as well as from constructed features. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

1. **Exposure A.** Large city centers with at least 50% of the buildings having a height in excess of 70 feet (21.336mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or ten times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.
2. **Exposure B.** Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
3. **Exposure C.** Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country, grasslands and shorelines in hurricane prone regions.
4. **Exposure D.** Flat, unobstructed areas exposed to wind flowing over open water (excluding shorelines in hurricane prone regions) for a distance of at least one mile (1.61 km). Shore-lines in Exposure D include inland waterways, the Great Lakes and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shore-line a distance of 1,500 feet (457 m) or ten times the height of the building or structure, whichever is greater.

5301.2.2 Seismic Provisions. Reserved.

5301.2.3 Snow Loads. Wood framed construction, cold-formed steel framed construction and masonry and concrete construction in regions with ground snow loads 70 psf (3.35 kN/m^2) or less, shall be in accordance with Chapters 55, 56 and 58. Buildings in regions with ground snow loads

greater than 70 psf (3.35 kN/m^2) shall be designed in accordance with accepted engineering practice.

5301.2.4 Floodplain Construction. Buildings and structures constructed in flood hazard areas (including A or V Zones) as established by *FEMA Flood Insurance Rate Maps* shall be designed and constructed in accordance with 780 CMR 5323.

5301.3 Story Height. Buildings constructed in accordance with these provisions shall be limited to story heights of not more than the following:

1. For wood wall framing, the laterally unsupported bearing wall stud height permitted by 780 CMR Table 5602.3(5) plus a height of floor framing not to exceed 16 inches.

Exception: For wood framed wall buildings with bracing in accordance with 780 CMR Table 5602.10.1, the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet without requiring an engineered design for the building wind force resisting systems provided that the length of bracing required by 780 CMR Table 5602.10.1 is increased by multiplying by a factor of 1.20. Wall studs are still subject to the requirements of 780 CMR 5301.

2. For steel wall framing, a stud height of ten feet, plus a height of floor framing not to exceed 16 inches.

3. For masonry walls, a maximum bearing wall clear height of 12 feet plus a height of floor framing not to exceed 16 inches.

Exception: An additional eight feet is permitted for gable end walls.

4. For insulating concrete form walls, the maximum bearing wall height per story as permitted by 780 CMR 5611 tables plus a height of floor framing not to exceed 16 inches.

Individual walls or walls studs shall be permitted to exceed these limits as permitted by 780 CMR 56.00 provisions, provided story heights are not exceeded. An engineered design, *provided by a Massachusetts-registered professional engineer or architect* shall be provided for the wall or wall framing members when they exceed the limits of 780 CMR 56.00. Where the story height limits are exceeded, an engineered design shall be provided *addressing the overall wind force resisting systems and utilizing the wind loads of 780 CMR 51.00 through 99.00*.

5301.4 Dead Load. The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.

5301.5 Live Load. The minimum uniformly distributed live load shall be as provided in 780 CMR Table 5301.5.

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**780 CMR TABLE 5301.2.1.3
EQUIVALENT BASIC WIND SPEEDS^a**

3-second gust	85	90	100	105	110	120	125	130	140	145	150	160	170
Fastest mile	70	75	80	85	90	100	105	110	120	125	130	140	150

For SI: 1 mile per hour = 1.609 km/h.

a. Linear interpolation is permitted

5301.6 Roof Load. Roof shall be designed for the live load indicated in 780 CMR Table 5301.6 or the snow load *based on the Massachusetts Ground Snow Load 780 CMR Table 5301.2(5)*, whichever is greater.

5301.7 Deflection. The allowable deflection of any structural member under the live load listed in 780 CMR 5301.5 and 5301.6 shall not exceed the values in 780 CMR Table 5301.7.

**780 CMR TABLE 5301.5
MINIMUM UNIFORMLY DISTRIBUTED
LIVE LOADS
(in pounds per square foot)**

USE	LIVE LOAD
Attics with storage ^b	20
Attics without storage ^b	10
Decks ^c	40
Exterior balconies	60
Fire escapes	40
Guardrails and handrails ^d	200
Guardrails in-fill components ^f	50
Passenger vehicle garages ^e	50 ^e
Rooms other than sleeping rooms	40
Sleeping rooms	30
Stairs	40 ^e

For SI: 1 pound per square foot = 0.0479 kN/m², 1 square inch = 645 mm², 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- b. No storage with roof slope not over three units in 12 units.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of four square inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top.
- e. See 780 CMR 5502.2.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to one square foot. This load need not be assumed to act concurrently with any other live load requirement.

**780 CMR TABLE 5301.6
MINIMUM ROOF LIVE LOADS IN
POUNDS-FORCE PER SQUARE FOOT OF
HORIZONTAL PROJECTION**

ROOF SLOPE	TRIBUTARY LOADED AREA IN SQUARE FEET FOR ANY STRUCTURAL MEMBER		
	0 to 200	201 to 600	Over 600
Flat or rise less than 4 inches per foot (1:3)	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1)	16	14	12
Rise 12 inches per foot (1:1) and greater	12	12	12

For SI: 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kN/m², 1 inch per foot = 0.0833 mm/m.

**780 CMR TABLE 5301.7
ALLOWABLE DEFLECTION OF
STRUCTURAL MEMBERS^{a,b,c}**

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3/12 with no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors and plastered ceilings	L/360
All other structural members	L/240
Exterior walls with plaster or stucco finish	H/360
Exterior walls—wind loads ^a with brittle finishes	L/240
Exterior walls—wind loads ^a with flexible finishes	L/120

Note: L = span length, H = span height.

- a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of determining deflection limits herein.
- b. For cantilever members, L shall be taken as twice the length of the cantilever.
- c. For aluminum structural members or panels used in roofs or walls of sun-room additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed L/60. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed L/120.

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5301.8 Nominal Sizes. For the purposes of 780 CMR 51.00 through 99.00, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

780 CMR 5302 LOCATION ON LOT

5302.1 Exterior Walls. Exterior walls with a fire separation distance less than three feet (914 mm) shall have not less than a one-hour fire-resistive rating with exposure from both sides. Projections shall not extend to a point closer than two feet (610 mm) from the line used to determine the fire separation distance.

Exception: Detached garages accessory to a dwelling located within two feet of a lot line may have roof eave projections not exceeding four inches *unless precluded by zoning bylaws*.

Projections extending into the fire separation distance shall have not less than one-hour fire-resistive construction on the underside. The above provisions shall not apply to walls which are perpendicular to the line used to determine the fire separation distance.

Exception: Tool and storage sheds, playhouses and similar structures exempted from permits by 780 CMR 5105.2 are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line *or otherwise conflict with zoning bylaw requirements*.

5302.2 Openings. Openings shall not be permitted in the exterior wall of a dwelling or accessory building with a fire separation distance less than three feet (914 mm). This distance shall be measured perpendicular to the line used to determine the fire separation distance.

Exceptions:

1. Openings shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.
2. Foundation vents installed in compliance with 780 CMR 51.00 through 99.00 are permitted.

5302.3 Penetrations. Penetrations located in the exterior wall of a dwelling with a fire separation distance less than three feet (914 mm) shall be protected in accordance with 780 CMR 5317.3.

Exception: Penetrations shall be permitted in walls that are perpendicular to the line used to determine the fire separation distance.

**780 CMR 5303 LIGHT, VENTILATION
AND HEATING**

5303.1 Habitable Rooms. All habitable rooms shall be provided with aggregate glazing area of not less

than 8% of the floor area of such rooms. Natural ventilation shall be through windows, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants. The minimum openable area to the outdoors shall be 4% of the floor area being ventilated.

Exceptions:

1. The glazed areas need not be openable where the opening is not required by 780 CMR 5310 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 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 need not be provided in rooms where 780 CMR 5303.1 Exception 1 is satisfied and artificial light is provided capable of producing an average illumination of six footcandles (6.46 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

5303.2 Adjoining Rooms. For the purpose of determining light and ventilation requirements, any room shall be considered as a portion of an adjoining room when at least $\frac{1}{2}$ of the area of the common wall is open and unobstructed and provides an opening of not less than $\frac{1}{10}$ of the floor area of the interior room but not less than 25 square feet (2.32 m²).

Exception: Openings required for light and/or ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that there is an openable area between the adjoining room and the sunroom addition or patio cover of not less than $\frac{1}{10}$ of the floor area of the interior room but not less than 20 square feet (1.86 m²). The minimum openable area to the outdoors shall be based upon the total floor area being ventilated.

5303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than three square feet (0.279 m²), $\frac{1}{2}$ of which must be openable.

Exception: The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates shall be 50 cfm (23.6 L/s) for intermittent ventilation or 20 cfm (9.4 L/s) for continuous ventilation. Ventilation air from the space shall be exhausted directly to the outside.

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Notes: Mechanical ventilation of bathrooms containing a shower or bathtub is required at the ventilation rates noted in 780 CMR 5303.3 Exception.

Exhaust fans are not required by 780 CMR 51.00 through 99.00 in half-bathrooms. (For the purposes of 780 CMR 5303, half-bathrooms are defined as those bathrooms that contain only a toilet and sink.)

Massachusetts State Sanitary Code 105 CMR and/or Massachusetts Fuel Gas and Plumbing Code 248 CMR may require exhaust fans.

5303.4 Opening Location. Outdoor intake and exhaust openings shall be located in accordance with 780 CMR 5303.4.1 and 5303.4.2.

5303.4.1 Intake Openings. Mechanical and gravity outdoor air intake openings shall be located a minimum of ten feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in 780 CMR 51.00 through 99.00. Where a source of contaminant is located within ten feet (3048 mm) of an intake opening, such opening shall be located a minimum of two feet (610 mm) below the contaminant source.

For the purpose 780 CMR 5303, the exhaust from dwelling unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

5303.4.2 Exhaust Openings. Outside exhaust openings shall be located so as not to create a nuisance. Exhaust air shall not be directed onto walkways.

5303.5 Outside Opening Protection. Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having a minimum opening size of $\frac{1}{4}$ inch (6.4 mm) and a maximum opening size of $\frac{1}{2}$ inch (12.7 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with 780 CMR 51.00 through 99.00.

5303.6 Stairway Illumination. All interior and exterior stairways shall be provided with *an artificial light source* to illuminate the stairs, including the landings and treads.

Such artificial light source shall comply with all applicable requirements of 527 CMR 12.

5303.6.1 Light Activation. The control for activation of the required interior stairway lighting *shall conform to the requirements of 527 CMR 12.*

5303.7 Required Glazed Openings. Required glazed openings shall open directly onto a street or public alley, or a yard or court located on the same lot as the building.

5303.7.1 Roofed Porches. Required glazed openings may face into a roofed porch where the porch abuts a street, yard or court and the longer side of the porch is at least 65% open and unobstructed and the ceiling height is not less than seven feet (2134 mm).

5303.8 Required Heating. Refer to 105 CMR 410.000 when applicable to rental property.

780 CMR 5304 MINIMUM ROOM AREAS

5304.1 Minimum Area. Every dwelling unit shall have at least one habitable room that shall have not less than *150 square feet* of gross floor area.

5304.2 Other Rooms. Other habitable rooms shall have a floor area of not less than 70 square feet (6.5 m²).

Exception: Kitchens.

5304.3 Minimum Dimensions. Habitable rooms shall not be less than seven feet (2134 mm) in any horizontal dimension.

Exception: Kitchens.

5304.4 Height Effect on Room Area. Portions of a room with a sloping ceiling measuring less than five feet (1524 mm) or a furred ceiling measuring less than seven feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

780 CMR 5305 CEILING HEIGHT

5305.1 Minimum Height. Habitable rooms, hallways, corridors, bathrooms, toilet rooms, laundry rooms and basements shall have a ceiling height of not less than seven feet (2134 mm). The required height shall be measured from the finish floor to the lowest projection from the ceiling.

Exceptions:

1. Beams and girders spaced not less than four feet (1219 mm) on center may project not more than six inches (152 mm) below the required ceiling height.
2. Ceilings in basements without habitable spaces may project to within six feet, eight inches (2032 mm) of the finished floor; and beams, girders, ducts or other obstructions may project to within six feet, four inches (1931 mm) of the finished floor.
3. Not more than 50% of the required floor area of a room or space is permitted to have a sloped ceiling less than seven feet (2134 mm) in height with no portion of the required floor area less than five feet (1524 mm) in height.
4. Bathrooms shall have a minimum ceiling height of six feet eight inches (2036 mm) over the fixture and at the front clearance area for fixtures.

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A shower or tub equipped with a showerhead shall have a minimum ceiling height of six feet eight inches (2036 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.

780 CMR 5306 SANITATION AND ELECTRICAL REQUIREMENTS

(Where applicable, refer to 248 CMR and/or 310 CMR 15.00 Title 5 and/or 105 CMR Chapter V and/or 527 CMR 12).

5306.1 Toilet Facilities. Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower *conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code)*.

5306.2 Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink *conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code)*.

5306.3 Sewage Disposal. All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

5306.4 Water Supply to Fixtures. All plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water; *all such requirements conforming to the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code)*.

5306.5 Electrical Code. See 527 CMR 12.

780 CMR 5307 TOILET, BATH AND SHOWER SPACES

5307.1 Space Required. Fixtures shall be spaced as required by the applicable requirements of 248 CMR (the Massachusetts Fuel Gas and Plumbing Code)

5307.2 Bathtub and Shower Spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than six feet (1829 mm) above the floor (*also see 248 CMR*).

SECTION 5308 GLAZING

5308.1 Identification. Except as indicated in 780 CMR 5308.1.1, and as required by CPSC 16 CFR (Code of Federal Regulations); 1201 and M.G.L. c. 143, §§ 3t, 3U and 3T, each pane of glazing installed in hazardous locations as defined in 780 CMR 5308.4 shall be provided with a manufacturer's, fabricator's or installer's label, designating

the type and thickness of glass and the safety glazing standard with which it complies, which is visible in the final installation. The label shall be acid etched, sandblasted, ceramic-fired, embossed mark, or shall be of a type which once applied cannot be removed without being destroyed.

Note: also refer to 780 CMR 61.00 relative to the National Fenestration Rating Council (NFRC) listing.

Exceptions:

1. For other than tempered glass, labels may be omitted provided the building official approves the use of a certificate, affidavit or other evidence confirming compliance with 780 CMR 51.00 through 99.00.
2. Tempered spandrel glass may be identified by the manufacturer with a removable paper label.

5308.1.1 Identification of Multipane Assemblies. Multi-pane assemblies having individual panes not exceeding one square foot (0.09 m²) in exposed area shall have at least one pane in the assembly identified in accordance with 780 CMR 5308.1. All other panes in the assembly shall be labeled "16 CFR 1201."

5308.2 Louvered Windows or Jalousies. Regular, float, wired or patterned glass in jalousies and louvered windows shall be no thinner than nominal $\frac{3}{16}$ inch (4.76 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

5308.2.1 Wired Glass Prohibited. Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

5308.3 Human Impact Loads. Individual glazed areas including glass mirrors in hazardous locations such as those indicated as defined in 780 CMR 5308.4 shall pass the test requirements of CPSC 16 CFR, Part 1201. Glazing shall comply with the CPSC 16 CFR, Part 1201 criteria for Category I or Category II as indicated in 780 CMR Table 5308.3.

Exceptions:

1. Polished wired glass for use in fire doors and other fire resistant locations shall comply with ANSI Z97. 1.
2. Louvered windows and jalousies shall comply with 780 CMR 5308.2.

5308.4 Hazardous Locations. The following locations, as established by M.G.L. c. 143, § 3T and as specified in 780 CMR 5308, shall be considered specific hazardous locations for the purposes of glazing:

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Glazing in all unframed swinging doors.

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**780 CMR TABLE 5308.3
MINIMUM CATEGORY CLASSIFICATION OF GLAZING**

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category Class)	GLAZING IN DOORS (Category Class)	GLAZED PANELS REGULATED BY 780 CMR 5308.4.7. (Category Class)	GLAZED PANELS REGULATED BY 780 CMR 5308.4.6. (Category Class)	GLAZING IN DOORS AND ENCLOSURES REGULATED BY 780 CMR 5308.4.5. (Category Class)	SLIDING GLASS DOORS PATIO TYPE (Category Class)
9 sq. ft. or less	I	I	NR ^a	I	II	II
More than 9 sq. ft.	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m².

^aNR means "No Requirement."

5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any part of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface.

6. Glazing, in an individual fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24-inch (610 mm) arc of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface.

7. Glazing in an individual fixed or operable panel, other than those locations described in 780 CMR 5308.4.5 and 6, that meets all of the following conditions:

7.1. Exposed area of an individual pane greater than nine square feet (0.836 m²).

7.2. Bottom edge less than 18 inches (457 mm) above the floor.

7.3. Top edge greater than 36 inches (914 mm) above the floor.

7.4. One or more walking surfaces within 36 inches (914 mm) horizontally of the glazing.

8. All glazing in railings regardless of an 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, hot tubs and spas where the bottom edge of the glazing is less than 60 inches (1524 mm) above a walking surface and within 60 inches (1524 mm) horizontally of the water's edge. This shall apply to single glazing and all panes in multiple glazing.

10. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

11. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.

12. *Fixed glazed panels adjacent to entrance and exit doors which, because of their location, present a barrier in the normal path traveled by persons going into or out of these buildings, and because of their size and design may be mistaken as means of egress*

Exception: The following products, materials and uses are exempt from the above hazardous locations:

1. Openings in doors through which a three-inch (76 mm) sphere is unable to pass.

2. Decorative glass in 780 CMR 5308.4.1., 6, or 7.

3. Glazing in 780 CMR 5308.4.6., when there is an intervening wall or other permanent barrier between the door and the glazing.

4. Glazing in 780 CMR 5308.4.6., in walls perpendicular to the plane of the door in a closed position or where access through the door is to a closet or storage area three feet (914 mm) or less in depth. Glazing in these applications shall comply with 780 CMR 5308.4.7.

5. Glazing in 780 CMR 5308.4.7. and 10., when a protective bar is installed on the accessible side(s) of the glazing 36 inches x two inches (914 mm x 51 mm) above the floor. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot (74.5 kg/m) without contacting the glass and be a minimum of 1½ inches (38 mm) in height.

6. Outboard panes in insulating glass units and other multiple glazed panels in 780 CMR 5308.4.7., when the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surface, or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.

7. Louvered windows and jalousies complying with the requirements of 780 CMR 5308.2.

8. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

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9. Safety glazing in 780 CMR 5308.4.10. and 11. is not required where:

- 9.1. The side of a stairway, landing or ramp has a guardrail or handrail, including balusters or in-fill panels, complying with the provisions of 780 CMR 1003.3.12 and 1607.7 *Sixth Edition, Massachusetts Building Code*; and
- 9.2. The plane of the glass is greater than 18 inches (457 mm) from the railing.

5308.5 Site Built Windows. Site built windows shall comply with 780 CMR 2404 of the *Sixth Edition, Massachusetts State Building Code but utilizing the wind loads of 780 CMR 51.00 through 99.00; note that seismic design is not required.*

5308.6 Skylights and Sloped Glazing. Skylights and sloped glazing shall comply with 780 CMR 5308.6.1 through 5308.6.9.

5308.6.1 Definitions.

SKYLIGHTS AND SLOPED GLAZING.

Glass or other transparent or translucent glazing material installed at a slope of more than 15 degrees (0.26 rad) from vertical. Glazing materials in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls are included in this definition.

UNIT SKYLIGHT. A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the roof assembly while preserving the weather resistant barrier of the roof.

5308.6.2 Permitted Materials. The following types of glazing may be used:

1. Laminated glass with a minimum 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m^2) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be 0.030 inch (0.76 mm).
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. Approved rigid plastics.

5308.6.3 Screens, General. For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of 780 CMR 5308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in 780 CMR 5308.6.5.

5308.6.4 Screens with Multiple Glazing. When the inboard pane is fully tempered, heat-strengthened, or wired glass, a retaining screen meeting the requirements of 780 CMR 5308.6.7

shall be installed below the glass, except for either condition listed in 780 CMR 5308.6.5. All other panes in the multiple glazing may be of any type listed in 780 CMR 5308.6.2.

5308.6.5 Screens not Required. Screens shall not be required when fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions are met:

1. Glass area 16 square feet (1.49 m^2) or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than $\frac{3}{16}$ inch (4.76 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
2. Glass area greater than 16 square feet (1.49 m^2). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than ten feet (3048 mm) above a walking surface or other accessible area.

5308.6.6 Glass in Greenhouses. Any glazing material is permitted to be installed without screening in the sloped areas of greenhouses, provided the greenhouse height at the ridge does not exceed 20 feet (6096 mm) above grade.

5308.6.7 Screen Characteristics. The screen and its fastenings shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and have a mesh opening of no more than one inch by one inch (25.4 mm by 25.4 mm).

5308.6.8 Curbs for Skylights. All unit skylights installed in a roof with a pitch flatter than three units vertical in 12 units horizontal (25% slope) shall be mounted on a curb extending at least four inches (102 mm) above the plane of the roof unless otherwise specified in the manufacturer's installation instructions.

5308.6.9 Testing and Labeling. Unit skylights shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating, and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA I01/I.S.2/NAFS.

780 CMR 5309 GARAGES AND CARPORTS

5309.1 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 residence shall be equipped with solid wood doors not less than $1\frac{1}{8}$ inches (35 mm) in thickness, solid or honeycomb core steel doors not less than $1\frac{1}{8}$ inches (35 mm) thick, or 20-minute fire-rated doors.

All such panel doors shall be labeled with a minimum 20-minute fire-resistance rating.

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Self-closing devices and fire-resistive-rated door frames are not required. All door openings between the garage floor and the dwelling shall be provided with a raised sill with a minimum height of four inches (102 mm).

5309.1.1 Duct Penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall have no openings into the garage.

5309.2 Separation Required. The garage shall be separated from the residence and its attic area by not less than *5/8 inch Type X gypsum board or equivalent (15.9 mm)* gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than *5/8-inch (15.9 mm)* Type X gypsum board or equivalent. Where the separation is a floor-ceiling assembly, the structure supporting the separation shall also be protected by not less than *5/8-inch (15.9 mm)* gypsum board or equivalent.

5309.3 Floor Surface. Garage floor surfaces shall be of approved noncombustible material.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway. *Concrete floors shall be installed as required by 780 CMR 5506.*

5309.4 Carports. Carports shall be open on at least two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of 780 CMR 5309 for garages.

Exception: Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

5309.5 Flood Hazard Areas. For buildings located in flood hazard areas as established by *the applicable FEMA Flood Insurance Rate Map(s)* garage floors shall be:

1. Elevated to or above the design flood elevation as determined in 780 CMR 5323; or
2. Located below the design flood elevation provided they are at or above grade on all sides, are used solely for parking, building access, or storage, meet the requirements of 780 CMR 5323, and are otherwise constructed in accordance with 780 CMR 51.00 through 99.00.

5309.6 Automatic Garage door Openers. Automatic garage door openers, if provided, shall be listed in accordance with UL 325.

780 CMR 5310 EMERGENCY ESCAPE AND RESCUE OPENINGS

5310.1 Emergency Escape and Rescue Required. Basements with habitable space and every sleeping room shall have at least one openable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with 780 CMR 5310.3. The net clear opening dimensions required by 780 CMR 5310 shall be obtained by the normal operation of the emergency escape and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with 780 CMR 5310.2.

5310.1.1 Minimum Opening Area. All emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.530 m²).

Exceptions:

1. *Grade floor openings shall have a minimum net clear opening of five square feet (0.465 m²).*
2. *Double hung windows used for emergency escape shall be permitted to have a net clear opening of 3.3 square feet (0.31 m²) provided that at least one operable sash meets the minimum height and width required by 780 CMR 5310.1.2 and 5310.1.3 and operational constraints defined by 780 CMR 5310.1.4.*

5310.1.2 Minimum Opening Height. The minimum net clear opening height shall be 24 inches (610 mm).

5310.1.3 Minimum Opening Width. The minimum net clear opening width shall be 20 inches (508 mm).

5310.1.4 Operational Constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.

5310.2 Window Wells. The minimum horizontal area of the window well shall be nine square feet (0.84 m²), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

Exception The ladder or steps required by 780 CMR 5310.2.1 shall be permitted to encroach

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a maximum of six inches (152 mm) into the required dimensions of the window well.

5310.2.1 Ladder and Steps. Window wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by 780 CMR 5310.2.1 shall not be required to comply with 780 CMR 5311.5 and 5311.6. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least three inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the window well.

5310.3 Bulkhead Enclosures. Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by 780 CMR 5310.1.1. Bulkhead enclosures shall also comply with 780 CMR 5311.5.8.2.

5310.4 Bars, Grills, Covers and Screens. Bars, grills, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with 780 CMR 5310.1.1 through 5310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening. *Also see 527 CMR as referenced in Appendix A.*

780 CMR 5311 MEANS OF EGRESS

5311.1 General. Stairways, ramps, exterior exit balconies, hallways and doors shall comply with 780 CMR 5311.

5311.2 Construction.

5311.2.1 Attachment. Required exterior exit balconies, stairs and similar exit facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

5311.2.2 Under Stair Protection. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with $\frac{1}{2}$ -inch (12.7 mm) gypsum board.

5311.3 Hallways. The minimum width of a hallway shall be not less than three feet (914 mm).

5311.4 Doors.

5311.4.1 Exit Doors Required. Egress from all dwelling units shall be by means of two exit doors, remote as possible from each other and leading directly to grade. Such doors

shall be provided at the normal level of entry/exit. In addition, all other floors within a dwelling unit shall have at least one means by which a continuous and unobstructed path leads to the exit doors. Such continuous and unobstructed paths shall be by means of stairways, corridors, hallways or combinations thereof.

Exception 1: In split-level and raised ranch style layouts, the two separate exit doors required by 780 CMR 5311 are permitted to be located on different levels.

Exception 2: Where site topography prevents direct access at two remote locations to grade from the normal level of entry/exit, the two separate exit doors required by 780 CMR 5311.4.1 are permitted to be located on different levels.

5311.4.2 Exit Door Types and Sizes. The minimum nominal width of at least one of the exit doors required by 780 CMR 5311.4 shall not be less than 36 inches (914 mm) in width and the minimum nominal height shall be 6 feet, eight inches (2032 mm). The 36-inch (914 mm) exit door shall be side-hinged. All other required exit doors and doors leading to or from enclosed stairways, or to interior vestibules shall not be less than 32 inches (813 mm) in nominal width or less than six feet, eight inches (2032 mm) in nominal height and maybe of the sliding or side-hinged type. The 36-inch (914 mm) required exit door shall provide for direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage. The 32-inch (813 mm) secondary exit door may provide egress through an attached garage, provided that the attached garage is also provided with a 32-inch (813 mm) exit door meeting the requirements of 780 CMR 5311. Side-hinged swinging doors provided to meet these requirements are permitted to swing inward.

Other exterior doors, in excess of the two required exit doors, whether side-hinged or sliding-type doors, shall not be required to comply with these minimum dimensions.

5311.4.2.1 Interior Doors. All doors providing access to habitable rooms shall have a minimum nominal width of 30 inches (762 mm) and a minimum nominal height of six feet, six inches (1981 mm).

Exceptions:

1. *Doors providing access to bathrooms are permitted to be 28 inches (711 mm) in nominal width.*

2. *Doors providing access to bathrooms in existing buildings are permitted to be 24 inches (610 mm) in nominal width.*

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5311.4.3 Landings at Doors. There shall be a floor or landing on each side of each exterior door.

Exceptions:

1. Where a stairway of two or fewer risers is located on the exterior side of a door, other than the required exit door, a landing is not required for the exterior side of the door.

The floor or landing at the exit door required by 780 CMR 5311.4.1 shall not be more than $1\frac{1}{2}$ inches (38 mm) lower than the top of the threshold. The floor or landing at exterior doors other than the exit door required by 780 CMR 5311.4.1 shall not be required to comply with this requirement but shall have a rise no greater than that permitted in 780 CMR 5311.5.3.

2. The landing at an exterior doorway shall not be more than $7\frac{3}{4}$ inches (196 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing.

The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

5311.4.4 Type of Lock or Latch. All egress doors shall be readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

5311.5 Stairways.

5311.5.1 Width. Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than $4\frac{1}{2}$ inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than $31\frac{1}{2}$ inches (787 mm) where a handrail is installed on one side and 27 (698 mm) where handrails are provided on both sides.

Exception: The width of spiral stairways shall be in accordance with 780 CMR 5311.5.8.

5311.5.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than six feet $6\frac{1}{2}$ inches (1981 mm) measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

Exception: Minimum headroom under a sloped ceiling in an existing building shall be maintained for a minimum width of 36 inches (914 mm) as measured from the side of the stair with the continuous handrail.

5311.5.3 Stair treads and risers.

5311.5.3.1 Riser Height. The maximum riser height shall be *8 $\frac{1}{4}$ inches (210 mm)*. The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

5311.5.3.2 Tread Depth. The minimum tread depth shall be *nine inches (229 mm)*. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm). Winder treads shall have a minimum tread depth *equal to the tread depth of the straight run portion of the stairs* measured as above at a point 12 inches (305 mm) from the side where the treads are narrower. Winder treads shall have a minimum tread depth of *three inches (76 mm)* at any point. Within any flight of stairs, the greatest winder tread depth at the 12 inch (305 mm) walk line shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

Exception: 45 degree winders are allowed to go to a minimum of two inches (51 mm) at any point

5311.5.3.3 Profile. Nosings shall not project more than $1\frac{1}{2}$ inches (38 mm) beyond the face of the riser below. Open risers are permitted, provided that the opening between treads does not permit the passage of a five-inch-diameter (127 mm) sphere.

Exceptions:

1. A nosing is not required where the tread depth is a minimum of 11 inches (279 mm).

2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

5311.5.4 Landings for Stairways. There shall be a floor or landing at the top and bottom of each stairway.

Exception A floor or landing is not required at the top of an interior flight of stairs, provided a door does not swing over the stairs.

A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

The width of each landing shall not be less than the stairway served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

5311.5.5 Stairway Walking Surface. The walking surface of treads and landings of stairways shall be sloped no steeper than one unit

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vertical in 48 inches horizontal (2% slope).

5311.5.6 Handrails. Handrails shall be provided on at least one side of each continuous run of treads or flight with *three* or more risers.

5311.5.6.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

5311.5.6.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inch (38 mm) between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at the turn.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.

5311.5.6.3 Handrail Grip Size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. **Type I.** Handrails with a circular cross section shall have an outside diameter of at least 1¼ inches (32 mm) and not greater than 2½ inches (70 mm). If the handrail is not circular it shall have a perimeter dimension of at least four inches (102 mm) and not greater than 6¼ inches (160 mm) with a maximum cross section of dimension of 2½ inches(57 mm).

2. **Type II.** Handrails with a perimeter greater than 6¼ inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of ¾ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least ⅜ inch (8 mm) within ⅝ inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least ⅜ inch (10 mm) to a level that is not less than 1¼ inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be 1¼ inches (32 mm) to a maximum of 2¾ inches (70 mm). Edges shall have a minimum radius of 0.01 inches (0.25 mm).

5311.5.7 Illumination. All stairs shall be provided with illumination in accordance with 780 CMR 5303.6.

5311.5.8 Special Stairways. Circular stairways, spiral stairways, winders and bulkhead enclosure

stairways shall comply with all requirements of 780 CMR 5311.5 except as specified in 780 CMR 5311.5.8.1 and 5311.5.8.2.

5311.5.8.1 Spiral Stairways. Spiral stairways are permitted, provided the minimum width shall be 26 inches (660 mm) with each tread having a 7½-inches (190 mm) minimum tread depth at 12 inches from the narrower edge. All treads shall be identical, and the rise shall be no more than 9½ inches (241 mm). A minimum headroom of six feet six inches (1982 mm) shall be provided.

5311.5.8.2 Bulkhead Enclosure Stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of 780 CMR 5311.4.3 and 5311.5 where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed eight feet (2438 mm), and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

5311.6 Ramps.

5311.6.1 Maximum Slope. Ramps *that are part of a means of egress and are attached to a dwelling unit* shall have a maximum slope of one unit vertical in eight units horizontal (12.5%).

5311.6.2 Landings Required. A minimum three-foot-by-three-foot (914 mm by 914 mm) landing shall be provided:

1. At the top and bottom of ramps,
2. Where doors open onto ramps,
3. Where ramps change direction.

5311.6.3 Handrails Required. Handrails shall be provided on at least one side of all ramps *that are part of a means of egress and are attached to a dwelling unit(s) where the ramp exceeds a slope of one unit vertical in 12 units horizontal (8.33% slope).*

Exception: For persons with disabilities, handrails shall be provided on both sides of the ramp when the vertical rise between landings exceeds six inches (152 mm).

5311.6.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

5311.6.3.2 Handrail Grip Size. Handrails on ramps shall comply with 780 CMR 5311.5.6.3.

5311.6.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or

safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inches (38 mm) between the wall and the handrails.

780 CMR 5312 GUARDS

5312.1 Guards Required. Porches, balconies or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914 mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads.

Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

5312.2 Guard Opening Limitations. Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of a sphere *five inches (127 mm)* or more in diameter.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere six inches (152 mm) cannot pass through.
2. Openings for required guards on the sides of stair treads shall not allow a sphere 5½ inches (137 mm) to pass through.

780 CMR 5313 LIFE SAFETY SYSTEMS

5313.1 Definitions.

COMBINATION APPLIANCE: shall mean a combination photoelectric smoke detector and carbon monoxide alarm appliance which is ac powered with battery backup. Such combination appliance shall employ both simulated voice and tone alarms features which clearly distinguishes between carbon monoxide and smoke notification, in accordance with NFPA 720, 5.3.4

MULTIPLE-STATION ALARM DEVICE. Two or more single-station devices (smoke or heat detector or carbon monoxide detector) that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate

SINGLE-STATION ALARM DEVICE. An assembly incorporating the detector (smoke or heat detector or carbon monoxide detector), control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

SMOKE DETECTOR. A listed device that senses visible or invisible particles of combustion. Only photoelectric or combination photoelectric/ionization type smoke detectors shall be permitted in Massachusetts

SYSTEM-TYPE DEVICE. A device designed to be connected to a fire alarm control unit (panel). Low-power radio transmitting (wireless) systems are included as part of this definition.

5313.2 Household Fire-warning Systems.

5313.2.1 General. The household fire-warning system shall be single or multiple station or of the system type and shall consist of smoke detectors and heat detectors as required in 780 CMR 5313.

Where more than 12 smoke alarms (detectors) are installed, system-type devices must be utilized.

5313.2.2 Listing and Installation Requirements. All fire detection, notification and protection equipment and devices shall be listed and installed in accordance with the provisions of 780 CMR 5313.2, the manufacturer's instructions, the listing criteria, 527 CMR 12.00 and NFPA 72, as applicable.

5313.2.3 Interconnection within a Dwelling Unit. When more than one code-required detector must be installed, the code-required detectors shall be compatible and interconnected in such a manner that the actuation of one detector will activate all of the audible alarms.

5313.2.4 Audible Alarm Intensity. All required alarm sounding appliances shall have a minimum rating of 85 dBA at ten feet (3048 mm). Where audible appliances are installed to provide signals for sleeping areas, they shall have a sound level of at least 75 dBA measured at the pillow level in the sleeping area.

5313.2.5 Power source. All power sources and wiring must be permanent and in accordance with 527 CMR 12.00.

5313.2.5.1 Primary Electrical Power for Single-station and Multiple-station Devices. Power for single- and multiple-station devices shall be supplied from a permanently wired connection directly to an AC primary source of power. All power for AC-powered devices shall be taken from either a dedicated locked branch circuit or a single branch circuit, which also provides other electrical service to a habitable space. The power source shall be on the supply side, ahead of any switches.

5313.2.5.2 Primary Electrical Power for System-type Household Fire-warning Systems. System-type household fire-warning systems that include a listed control unit with automatic detectors and occupant notification appliances shall be powered from a permanently wired AC primary power source. Such AC primary power shall be supplied either from a dedicated locked branch circuit or the unswitched portion of a branch circuit also used for power and lighting of a habitable space, in accordance with the requirements of NFPA 72 and 527 CMR 12.00.

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Exception: Wireless systems when installed in accordance with NFPA 72

5313.2.5.3 Secondary Electrical Power. In addition to required primary electrical power, all household fire-warning systems shall have secondary (standby) power supplied from monitored batteries in accordance with NFPA 72. For fire alarm control units (panels), the panel battery shall serve as the source of secondary electrical power. For wireless systems, the panel battery shall serve as the source of secondary electrical power.

5313.2.6 Acceptance Testing. When the installation of the household fire-warning system is complete, it shall be subject to a 100% acceptance test in accordance with 780 CMR 5313 and NFPA 72.

5313.2.7 Maintenance. It shall be the responsibility of the owner, as defined in 780 CMR 52.00, to properly maintain the household fire-warning system in accordance with manufacturer's recommendations and NFPA 72.

5313.2.8 Manufactured Homes (Housing). The installation of household fire-warning systems for buildings designed and constructed as manufactured homes and/or housing as defined by 24 CFR, Part 5208.2, shall be in accordance with approved methods for such homes and/or housing as defined 24 CFR and as such are not governed by 780 CMR 51.00 through 99.00.

5313.2.9 Smoke Detector Required Locations within the dwelling unit. Smoke detectors shall be installed in the following locations (also refer to Board of Building Regulations and Standards Official Interpretation No. 49-98):

1. In each bedroom (sleeping room).
2. Outside each separate bedroom (sleeping room) in the immediate vicinity of the bedroom (sleeping room).
3. Near the base of all stairs where such stairs lead to another occupied floor.
4. On each additional story of the dwelling, including basements and cellars but not including crawl spaces and unoccupied attics. In dwellings or 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.
5. For each 1,200 square feet (111 m^2) of area or part thereof.

5313.2.10 Smoke Detector Required Locations in Common Areas of Two-family Dwellings. In addition to the requirements of 780 CMR 5313.1.9.1 through .4., two-family dwellings that contain common areas such as basements, hallways and/or interior stairways that serve both dwelling units, but are not within the

dwelling units, shall also be provided with smoke detectors and/or heat detectors, as required, in the following locations:

1. *Smoke detectors—In all common basements.*
2. *Smoke detectors—In all common hallways.*
3. *Smoke detectors—In all common stairways on each level outside the dwelling unit doorways.*
4. *When common area smoke detectors are of the single/multiple-station type they shall be interconnected with listed compatible heat detectors containing a sounding device within each dwelling unit. Said heat detectors shall be on every level within each dwelling unit and shall meet the audibility requirement of 780 CMR 5313.2.4.*
5. *When common area smoke detectors are of the system type, there shall be at least one system-type alarm notification device that meets the requirements of 780 CMR 5313.2.4 on each level within each dwelling unit*
6. *Dwelling unit smoke detectors shall only sound within the dwelling unit.*

5313.2.11 Photo-electric Smoke Detectors. Any smoke detector located within 20 feet (6096 mm) of a kitchen or a bathroom shall be a photo-electric-type smoke detector. Photo-electric-type smoke detectors shall be allowed to be located closer than three feet (914 mm) horizontally from a kitchen or a bathroom door when hallway or other room size restricts detector mounting options.

Exception: A bathroom not containing a tub, shower, jacuzzi or steam room.

5313.2.12 Smoke Detector Placement. Photo-electric type smoke detectors and combination photoelectric/ionization type smoke detectors shall be installed in accordance with the manufacturer's specific installation requirements. In the absence of manufacturer's recommendations, smoke detectors shall be mounted on the ceiling at least four inches (102 mm) from a wall or on a wall with the top of the alarm not less than four inches (102 mm) nor more than 12 inches (305 mm) below the ceiling.

Exception: Smoke detector placement for solid joist or beam construction or for high, sloped, shed or peaked ceilings all shall be in accordance with manufacturer's recommendations and NFPA 72.

5313.2.13 Smoke Detector Requirements in Existing Dwellings. See 780 CMR 93.

5313.3 Heat Detectors.

5313.3.1 Required Heat Detectors. A single heat detector listed for the ambient environment shall be installed in:

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- 1. Any integral garage ("garage under") or attached garage to the main house (detached garages do not require a heat detector).*
- 2. A new addition attached garage to an existing dwelling shall require a single heat detector installed in the garage in accordance with all applicable criteria of 780 CMR 5313. If the existing house contains a fire detection system that is compatible with the garage heat detector, then said garage heat detector shall be interconnected to the existing dwelling fire detection system. Where the dwelling-proper existing fire detection system is not compatible with the garage heat detector, the garage heat detector shall be connected to a sounder (occupant notification appliance) or compatible heat detector containing a sounding device, located in the dwelling-*

proper and within 20 feet (6096 mm) of the nearest door to the garage from the dwelling-proper. The required garage heat detector is not required to incorporate audible alarm notification nor is any audible notification device required in the garage.

5313.3.2 Heat Detector Placement. For flat-finished ceilings, the single heat detector shall be placed on or near the center of the garage ceiling; for sloped ceilings having a rise to run of greater than one foot in eight feet (305 mm in 2438 mm), the single heat detector shall be placed in the approximate center of the vaulted ceiling but no closer than four inches (102 mm) to any wall.

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5313.3 Heat Detector Interconnection. *The required single heat detector shall be listed for and required to be interconnected to all smoke detectors of the required household fire alarm system, such that the activation of the heat detector will activate all of the audible alarms of the required household fire alarm system throughout the building. The required heat detector is not required to incorporate audible alarm notification nor is any audible notification device required in the garage.*

5313.4 Carbon Monoxide Detectors.

Note: Also refer to 527 CMR 31.00 and 248 CMR as carbon monoxide detector required locations set forth in 527 CMR 31.00 and 248 CMR must also be satisfied

5313.4.1 General. *Carbon monoxide detectors shall either be: listed, interconnected 120V or shall be part of a listed low-voltage combination system or wireless system as defined in NFPA 720.*

5313.4.1.1 Secondary power to CO alarms: *All CO alarms shall have secondary (standby) power supplied from monitored batteries in accordance with NFPA 72. For fire alarm control units (panels), the panel battery shall serve as the source of secondary electrical power. For wireless systems, the panel battery shall serve as the source of secondary electrical power.*

5313.4.2 Carbon Monoxide Detector Listing and Installation Requirements. *All carbon monoxide detectors shall be UL 2034 listed or UL 2075 listed, as applicable, and installed in accordance with the provisions of 780 CMR 51.00 through 99.00, the manufacturer's instructions, the listing criteria, 527 CMR 12.00 and NFPA 720. Required carbon monoxide detectors are not required to be interconnected to the required household fire alarm system but, where interconnection is desired, such carbon monoxide detectors shall be compatible with all interconnected fire detection devices and fire alarms shall have precedence over carbon monoxide alarms.*

5313.4.3 Carbon Monoxide Detector Required Locations. *One carbon monoxide detector shall be installed on each story of a dwelling unit, including basements and cellars (but not including crawl spaces and uninhabitable attics) in accordance with the manufacturer's instructions and the applicable requirements of NFPA 720. When mounting a carbon monoxide alarm on a story with a bedroom, the alarm, at a minimum, shall be located outside the bedroom. A carbon monoxide alarm shall be installed no more than ten ft. outside any bedroom door – these requirements do not alter the fact that all*

bedrooms must be equipped with smoke detectors/alarms but if a combination appliance is utilized, note that for CO only purposes a CO alarm is required no more than ten feet from a bedroom door and outside of the bedroom per 527 CMR 31.00.

5313.4.4 Alarm Intensity. *All alarm-sounding appliances shall have a minimum rating of 85 dBA at ten feet (3048 mm).*

5313.4.5 Maintenance. *It shall be the responsibility of the owner to properly maintain the carbon monoxide detectors in accordance with the manufacturer's instructions and NFPA 720.*

5313.5 Sprinklers.

5313.5.1 Dwellings Requiring Sprinklers. *Automatic sprinklers installed in accordance with NFPA 13D shall be installed in one- and two-family dwellings having an aggregate area greater than 14,400 square feet (1338 m²), including basements but not including garages and unfinished attics.*

780 CMR 5314 FOAM PLASTIC

5314.1 General. The provisions of 780 CMR 5314 shall govern the requirements and uses of foam plastic insulation.

5314.1.1 Surface Burning Characteristics. Except where otherwise noted in 780 CMR 5314.2, all foam plastic or foam plastic cores in manufactured assemblies used in building construction shall have a flame-spread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84.

5314.1.2 Thermal Barrier. Foam plastic, except where otherwise noted, shall be separated from the interior of a building by minimum $\frac{1}{2}$ -inch (12.7 mm) gypsum board or an approved finish material equivalent to a thermal barrier to limit the average temperature rise of the unexposed surface to no more than 250°F (121°C) after 15 minutes of fire exposure to the ASTM E 119 standard time temperature curve. The gypsum board shall be installed using a mechanical fastening system in accordance with 780 CMR 5702.3.5. Reliance on adhesives to ensure that the gypsum board will remain in place when exposed to fire shall be prohibited.

5314.2 Specific Requirements. The following requirements shall apply to all uses of foam plastic unless specifically approved in accordance with 780 CMR 5314.3 or by other sections of 780 CMR 51.00 through 99.00.

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5314.2.1 Masonry or Concrete Construction. Foam plastics may be used without the thermal barrier described in 780 CMR 5314.1 when the foam plastic is protected by a minimum one-inch (25.4 mm) thickness of masonry or concrete.

5314.2.2 Roofing. Foam plastic may be used in a roof-covering assembly without the thermal barrier when the foam is separated from the interior of the building by wood structural panel sheathing in accordance with 780 CMR 5803, not less than $\frac{15}{32}$ inch (11.9 mm) in thickness bonded with exterior glue and identified as Exposure 1, with edge supported by blocking or tongue-and-groove joints. The smoke-developed rating shall not be limited.

5314.2.3 Attics and Crawlspaces. Within attics and crawl-spaces where entry is made only for service of utilities, foam plastics shall be protected against ignition by 1½-inch-thick (38 mm) mineral fiber insulation, $\frac{1}{4}$ -inch-thick (6.4 mm) wood structural panels, $\frac{3}{8}$ -inch (9.5 mm) particleboard, $\frac{1}{4}$ -inch (6.4 mm) hardboard, $\frac{3}{8}$ -inch (9.5 mm) gypsum board, or corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

5314.2.4 Foam-filled Doors. Foam-filled doors are exempt from the requirements of 780 CMR 5314.1.

5314.2.5 Siding Backer Board. Foam plastic board of not more than $\frac{1}{2}$ -inch (12.7 mm) thickness may be used as siding backer board when separated from interior spaces by not less than two inches (51 mm) of mineral fiber insulation or $\frac{1}{2}$ -inch (12.7 mm) gypsum wallboard or installed over existing exterior wall finish in conjunction with re-siding, providing the plastic board does not have a potential heat of more than 2,000 Btu per square foot ($22\ 720\ kJ/m^2$) when tested in accordance with NFPA 259.

5314.2.6 Interior trim. Foam plastic trim defined as picture molds, chair rails, baseboards, handrails, ceiling beams, door trim and window trim may be installed, provided:

1. The minimum density is 20 pounds per cubic foot (3.14 kg/m³).
2. The maximum thickness of the trim is 0.5 inch (12.7 mm) and the maximum width is four inches (102 mm).
3. The trim constitutes no more than 10% of the area of any wall or ceiling.
4. The flame-spread rating does not exceed 75 when tested per ASTM E 84. The smoke-developed rating is not limited.

5314.2.7 Sill Plates and Headers. Foam plastic shall be permitted to be spray applied to a sill plate and header without thermal barrier subject to all of the following:

1. The maximum thickness of the foam plastic shall be 3½ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m³).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke developed index of 450 or less when tested in accordance with ASTM E84.

5314.3 Specific Approval. Plastic foam not meeting the requirements of 780 CMR 5314.1 and 5314.2 may be specifically approved on the basis of one of the following approved tests: ASTM E 84, FM 4880, UL 1040, NFPA 286, ASTM E 152, or UL 1715, or fire tests related to actual end-use configurations. The specific approval may be based on the end use, quantity, location and similar considerations where such tests would not be applicable or practical.

5314.4 Interior finish. Foam plastics that are used as interior finish shall also meet the flame-spread requirements for interior finish.

5314.5 Termite damage. The use of foam plastics in areas of "very heavy" termite infestation probability shall be in accordance with 780 CMR 5320.4.

780 CMR 5315 FLAME SPREAD AND SMOKE DENSITY

5315.1 Wall and Ceiling. Wall and ceiling finishes shall have a flame-spread classification of not greater than 200.

Exception: Flame-spread requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than $\frac{1}{28}$ inch (0.907 mm) in thickness cemented to the surface of walls or ceilings if these materials have a flame-spread characteristic no greater than paper of this thickness cemented to a noncombustible backing.

5315.2 Smoke-developed Index. Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

5315.3 Testing. Tests shall be made in accordance with ASTM E 84.

5315.4 Alternate Test Method. As an alternate to having a flame-spread classification of not greater than 200 and a smoke developed index of not greater than 450 when tested in accordance with ASTM E 84, wall and ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

During the 40 kW exposure, the interior finish shall comply with 780 CMR 5315.4.1. During the 160 kW exposure, the interior finish shall comply

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with 780 CMR 5315.4.2. During the entire test, the interior finish shall comply with 780 CMR 5315.4.3

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. During the 160 kW exposure, the interior finish shall comply with the following:
 - 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
 - 2.2. Flashover, as defined in NFPA 286, shall not occur.
3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m².

780 CMR 5316 INSULATION

(also see 780 CMR 61.00 as such relates to energy conservation requirements)

5316.1 Insulation. Insulation materials, including facings, such as vapor retarders or vapor permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall have a flame-spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84.

Exceptions:

1. When such materials are installed in concealed spaces, the flame-spread and smoke-developed limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. Cellulose loose-fill insulation, which is not spray applied, complying with the requirements of 780 CMR 5316.3, shall only be required to meet the smoke-developed index of not more than 450.

5316.2 Loose-fill Insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall have a flame-spread rating not to exceed 25 with an accompanying smoke-developed factor not to exceed 450 when tested in accordance with CAN/ULC-S 102.2.

Exception: Cellulose loose-fill insulation shall not be required to comply with this test method provided that such insulation complies with the requirements of 780 CMR 5316.3.

5316.3 Cellulose Loose-fill Insulation. Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Parts 1209 and 1404.

5316.4 Exposed Attic Insulation. All exposed insulation materials installed on attic floors shall have a critical radiant flux not less than 0.12 watt per

square centimeter.

5316.5 Testing. Tests for critical radiant flux shall be made in accordance with ASTM E 970.

780 CMR 5317 DWELLING UNIT SEPARATION

5317.1 Two-family Dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than one-hour fire-resistance rating when tested in accordance with ASTM E 119. Fire-resistance-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.

Exception: A fire resistance rating of ½ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

5317.1.1 Supporting Construction. When floor assemblies are required to be fire-resistance-rated by 780 CMR 5317.1, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

5317.2 Townhouses. *For other than one- and two-family dwellings, refer to all applicable construction requirements of the Sixth Edition, Massachusetts State Building Code while utilizing the wind and snow loading of 780 CMR.*

5317.3 Rated Penetrations. Penetrations of wall or floor/ceiling assemblies required to be fire-resistance-rated in accordance with 780 CMR 5317.1 or 5317.2 shall be protected in accordance with 780 CMR 5317.3.

5317.3.1 Through Penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with 780 CMR 5317.3.1.1 or 5317.3.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes or steel conduits, the annular space shall be permitted to be protected as follows:

1. In concrete or masonry wall or floor assemblies where the penetrating item is a maximum six inches (152 mm) nominal diameter and the opening is a maximum 144 square inches (92 900 mm²), concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating.

2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of

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water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

5317.3.1.1 Fire-resistance-rated Assembly. Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

5317.3.1.2 Penetration Firestop System. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor/ceiling assembly penetrated.

5317.3.2 Membrane Penetrations. Membrane penetrations shall comply with 780 CMR 5317.3.1. Where walls are required to have a minimum one-hour fire resistance rating, recessed light fixtures shall be so installed such that the required fire resistance will not be reduced.

Exceptions:

1. Steel electrical boxes that do not exceed 16 square inches ($0.0103m^2$) in area provided the total area of such openings does not exceed 100 square inches ($0.0645 m^2$) for any 100 square feet ($9.29 m^2$) of wall area. Outlet boxes on opposite sides of the wall shall be separated as follows:

- 1.1. By a horizontal distance of not less than 24 inches (610 mm);
 - 1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
 - 1.3. By solid fire blocking in accordance with 780 CMR 5602.8.1;
 - 1.4. By protecting both outlet boxes by listed putty pads; or
 - 1.5. By other listed materials and methods.

2. Membrane penetrations for listed electrical outlet boxes of any materials are permitted provided such boxes have been tested for use in fire resistance-rated assemblies and are installed in accordance with the instructions included in the listing. Outlet boxes on opposite sides of the wall shall be separated as follows:

- 2.1. By a horizontal distance of not less than 24 inches (610 mm);
 - 2.2. By solid fire-blocking in accordance with 780 CMR 5602.8;
 - 2.3. By protecting both outlet boxes by listed putty pads; or

2.4. By other listed materials and methods.

3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

780 CMR 5318 MOISTURE VAPOR RETARDERS

5318.1 Moisture Control. In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

1. *See the vapor retarder requirements of 780 CMR 61.00.*
2. Where the framed cavity or space is ventilated to allow moisture to escape.

780 CMR 5319 PROTECTION AGAINST DECAY

5319.1 Location Required. *The following locations shall require the use of an approved species and grade of lumber, pressure treated in accordance with AWPA C1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, C31, C33, P1, P2 and P3, or decay-resistant heartwood of redwood, black locust, or cedars.*

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches (457 mm) or wood girders when closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.
2. All wood framing members that rest on concrete or masonry exterior foundation walls and are less than eight inches (203 mm) from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated from such slab by an impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than 0.5 inch (12.7 mm) on tops, sides and ends.
5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than six inches (152 mm) from the ground.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier.
7. Wood furring strips or other wood framing

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members attached directly to the interior of exterior masonry walls or concrete walls below grade except where an approved vapor retarder is applied between the wall and the furring strips or framing members.

5319.1.1 Ground Contact. All wood in contact with the ground and that supports permanent structures intended for human occupancy shall be approved pressure preservative treated wood suitable for ground contact use, except un-treated wood may be used where entirely below groundwater level or continuously submerged in fresh water.

5319.1.2 Geographical Areas. In geographical areas where experience has demonstrated a specific need, approved naturally durable or pressure preservatively treated wood shall be used for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances when such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members. Depending on local experience, such members may include:

1. Horizontal members such as girders, joists and decking.
2. Vertical members such as posts, poles and columns.
3. Both horizontal and vertical members.

5319.1.3 Posts, Poles and Columns. Posts, poles and columns supporting permanent structures that are embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather shall be approved pressure preservatively treated wood suitable for ground contact use.

5319.1.4 Wood Columns. Wood columns shall be approved wood of natural decay resistance or approved pressure preservatively treated wood.

Exceptions:

1. Posts or columns which are either exposed to the weather or located in basements or cellars, supported by piers or metal pedestals projecting one inch (25.4 mm) above the floor or finished grade and six inches (152 mm) above exposed earth, and are separated there from by an approved impervious moisture barrier.
2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than eight inches (203 mm) from exposed ground, are separated there from by an impervious moisture barrier.

5319.2 Quality Mark. Lumber and plywood required to be pressure preservatively treated in accordance with 780 CMR 5319.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

5319.2.1 Required Information. The required quality mark on each piece of pressure preservatively treated lumber or plywood shall contain the following information:

1. Identification of the treating plant.
2. Type of preservative.
3. The minimum preservative retention.
4. End use for which the product was treated.
5. Standard to which the product was treated.
6. Identity of the approved inspection agency.
7. The designation "Dry," if applicable.

Exception: Quality marks on lumber less than one inch (25.4 mm) nominal thickness, or lumber less than nominal one inch by five inches (25.4 mm by 127 mm) or two inches by four inches (51 mm by 102 mm) or lumber 36 inches (914 mm) or less in length shall be applied by stamping the faces of exterior pieces or by end labeling not less than 25% of the pieces of a bundled unit.

5319.3 Fasteners. Fasteners for pressure preservative and fire-retardant-treated wood shall be of hot-dipped galvanized steel, stainless steel, silicon bronze or copper *but such fasteners must be acceptable for the chemical preservatives utilized.*

780 CMR 5320 PROTECTION AGAINST TERMITES

5320.1 Subterranean Termite Control. In areas favorable to termite damage as established by 780 CMR Table 5301.2(1), methods of protection shall be by chemical soil treatment, pressure preservatively treated wood in accordance with the AWPA standards listed in 780 CMR 5319.1, naturally termite-resistant wood or physical barriers (such as metal or plastic termite shields), or any combination of these methods. *All chemicals and chemical treatment and disposal methods shall conform to all governing laws and regulations.*

5320.1.1 Quality Mark. Lumber and plywood required to be pressure preservatively treated in accordance with 780 CMR 5320.1 shall bear the quality mark of an approved inspection agency which maintains continuing supervision, testing and inspection over the quality of the product and which has been approved by an accreditation body which complies with the requirements of the American Lumber Standard Committee treated

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wood program.

5320.2 Chemical Soil Treatment. The concentration, rate of application and treatment method of the termiticide shall be consistent with and never less than the termiticide label.

5320.3 Pressure Preservatively Treated and Naturally Resistant Wood. Heartwood of redwood and eastern red cedar shall be considered termite resistant. Pressure preservatively treated wood and naturally termite-resistant wood shall not be used as a physical barrier unless a barrier can be inspected for any termite shelter tubes around the inside and outside edges and joints of a barrier.

5320.3.1 Field Treatment. Field cut ends, notches and drilled holes of pressure preservatively treated wood shall be retreated in the field in accordance with AWPA M4.

5320.4 Foam plastic Protection. In areas where the probability of termite infestation is "very heavy" as indicated in 780 CMR Figure 5301.2(6), extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be at least six inches (152 mm).

Exceptions:

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
2. When in addition to the requirements of 780 CMR 5320.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

780 CMR 5321 SITE ADDRESS

5321.1 Premises Identification. See *M.G.L. c. 148, § 59, enforced by the head of the fire department.*

780 CMR 5322 ACCESSIBILITY

5322.1 Scope. Refer to 780 CMR 5311.6.

780 CMR 5323 FLOOD-RESISTANT CONSTRUCTION

5323.1 General. Buildings and structures constructed in flood hazard areas (including A or V Zones) as established by *FEMA Flood Insurance Rate Maps* shall be designed and constructed in accordance with Appendix 780 CMR 120.G.

(PAGES 567 THROUGH 570 ARE RESERVED FOR FUTURE USE)

780 CMR 54.00

FOUNDATIONS

780 CMR 5401 GENERAL

5401.1 Application. The provisions of 780 CMR 54.00 shall control the design and construction of the foundation and foundation spaces for all *one- and two-family detached dwellings and accessory buildings*. Wood foundations shall be designed and installed in accordance with AF&PA Report No. 7.

Exceptions:

1. The provisions of 780 CMR 54.00 shall be permitted to be used for wood foundations only in the following situations:
 - 1.1. In buildings that have no more than two floors and a roof.
 - 1.2. When interior basement and foundation walls are provided at intervals not exceeding 50 feet.
2. In addition to the provisions of 780 CMR 54.00, the design and construction of foundations in areas prone to flooding as established by *the community's Flood Insurance Rate Map (FIRM) published by the Federal Emergency Management Agency* shall meet the provisions of 780 CMR 5323.

5401.2 Requirements. Foundation construction shall be capable of accommodating all loads according to 780 CMR 5301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice *and 780 CMR 5401.6*. Gravel fill used as footings for wood and precast concrete foundations shall comply with 780 CMR 5403.

5401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection so as to not create a hazard. Lots shall be graded so as to drain surface water away from foundation walls. The grade away from foundation walls shall fall a minimum of six inches (152 mm) within the first ten feet (3048 mm). *Temporary and finished grading shall be such that surface water runoff, either during or after completion of construction, shall not be directed to, nor create flooding or damage to adjacent property.*

Exception: Where lot lines, walls, slopes or other physical barriers prohibit six inches (152 mm) of fall within ten feet (3048 mm), drains or swales shall be provided to ensure drainage away from the structure.

5401.4 Soil Tests. In areas likely to have expansive, compressible, shifting or other unknown soil characteristics, the building official shall determine whether to require a soil test to determine the soil's

characteristics at a particular location. This test shall be made by an approved agency using an approved method.

5401.4.1 Geotechnical Evaluation. In lieu of a complete geotechnical evaluation, the load-bearing values in 780 CMR Table 5401.4.1 shall be assumed *for the design of foundations.*

TABLE 5401.4.1 PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATION MATERIALS^a

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500 ^b

For SI: 1 pound per square foot = 0.0479 kN/m².

- a. When soil tests are required by 780 CMR 5401.4, the allowable bearing capacities of the soil shall be part of the recommendations.
- b. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.
- c. *Also refer to 780 CMR Appendix 120.R for additional guidance.*

5401.5 Compressible or Shifting Soil. When top or subsoils are compressible or shifting, such soils shall be removed to a depth and width sufficient to assure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering, or pre-saturation.

5401.6 Engineered Fill Used to Support Foundations. *Where footings or foundations are supported on compacted fill material the compacted fill shall comply with the specifications prepared by a registered professional engineer. The specifications shall be detailed in a report which shall be submitted to and approved by the building official prior to commencement of work. The report, as a minimum, shall contain the following:*

- 1. Specifications for the preparation of the site prior to the placement of the compacted fill material.*

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- 2. Specifications for the material to be used as compacted fill including engineering properties.**
- 3. Test method(s) to be used to determine the physical and engineering properties of the fill material after placement and compaction.**
- 4. Specifications for the placement and in-place density of the fill material.**
- 5. Type and frequency of field tests required in order to determine the in-place engineering properties of the fill after placement and compaction.**

Upon completion of the placement of the fill, the registered professional engineer shall prepare and submit a report to the building official as to suitability, or otherwise, of the engineered fill to support the proposed foundation system.

Exception: Compacted fill not more than 12 inches (305 mm) in depth, provided that that fill is adequately compacted using appropriate mechanical means.

780 CMR 5402 MATERIALS

5402.1 Wood Foundations. Wood foundation systems shall be designed and installed in accordance with the provisions of 780 CMR 51.00 through 99.00.

5402.1.1 Fasteners. Fasteners used below grade to attach plywood to the exterior side of exterior basement or crawl-space wall studs, or fasteners used in knee wall construction, shall be of Type 304 or 316 stainless steel. Fasteners used above grade to attach plywood and all lumber-to-lumber fasteners except those used in knee wall construction shall be of Type 304 or 316 stainless steel, silicon bronze, copper, hot-dipped galvanized (zinc coated) steel nails, or hot-tumbled

galvanized (zinc coated) steel nails. Electrogalvanized steel nails and galvanized (zinc coated) steel staples shall not be permitted.

5402.1.2 Wood Treatment. All lumber and plywood shall be treated in accordance with AWPA C22, and shall bear the label of an accredited agency showing 0.60 retention. Where lumber and/or plywood is cut or drilled after treatment, the treated surface shall be field treated with Copper Napthenate, the concentration of which shall contain a minimum of 2% copper metal, by repeated brushing, dipping or soaking until the wood absorbs no more preservative.

5402.2 Concrete. Concrete shall have a minimum specified compressive strength as shown in 780 CMR Table 5402.2. Concrete subject to weathering as indicated in 780 CMR Table 5301.2(1) shall be air entrained as specified in 780 CMR Table 5402.2. The maximum weight of fly ash, other pozzolans, silica fume, or slag that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs, and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in ACI 318. In addition to the cements permitted by ACI 318, cement complying with ASTM C 1157 is permitted.

5402.3 Precast Concrete. Approved precast concrete foundations shall be designed and installed in accordance with the provisions of 780 CMR 51.00 through 99.00 and the manufacturer's installation instructions.

780 CMR TABLE 5402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE

TYPE OR LOCATIONS OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH ^a (f'_c)		
	Weathering potential ^b		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500 ^c
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 ^c
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000 ^d	3,000 ^d
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000 ^{d,e}	3,500 ^{d,e}

For SI: 1 pound per square inch = 6.895 kPa.

a. At 28 days psi.

b. See Table 530 1.2(1) for weathering potential.

c. Concrete in these locations that may be subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Footnote d.

d. Concrete shall be air entrained. Total air content (percent by volume of concrete) shall not be less than 5% or more than 7%.

e. See 780 CMR 5402.2 for minimum cement content.

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780 CMR 5403 FOOTINGS

5403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, wood foundations, or other approved structural systems which shall be of sufficient design to accommodate all loads according to 780 CMR 5301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered *fill in accordance with 780 CMR 5401.6.*

5403.1.1 Minimum Size. Minimum sizes for concrete and masonry footings shall be as set forth in 780 CMR Table 5403.1 and 780 CMR Figure 5403.1(1). The footing width, W, shall be based on the load-bearing value of the soil in accordance with 780 CMR Table 5401.4.1. Spread footings shall be at least six inches (152 mm) in thickness. Footing projections, P, shall be at least two inches (51 mm) and shall not exceed the thickness of the footing. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with 780 CMR Table 5401.4.1. Footings for wood foundations shall be in accordance with the details set forth in 780 CMR 5403.2, and 780 CMR Figures 5403.1(2) and 5403.1(3).

**780 CMR TABLE 5403.1
MINIMUM WIDTH OF CONCRETE OR
MASONRY FOOTINGS (inches)^a**

	LOAD-BEARING VALUE OF SOIL (psf)			
	1500	2000	3000	4000
Conventional light-frame construction				
1-story	12	12	12	12
2-story	15	12	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12	12	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12	12	12
2-story	29	21	14	12
3-story	42	32	21	16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- a. Where minimum footing width is 12 inches, a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted to be used.

5403.1.2 Continuous Footings in Seismic Design Categories D₁ and D₂. Reserved.

5403.1.3 Seismic Reinforcing. Reserved.

5403.1.3.1 Foundations with Stemwalls. Reserved.

5403.1.3.2 Slabs-on-ground with Turned-down Footings. Reserved.

5403.1.4 Minimum Depth. All exterior footings shall be placed *on undisturbed ground or on engineered fill and shall be frost protected as required by 780 CMR 5403.1.4.1.*

5403.1.4.1 Frost Protection. Except where otherwise protected from frost, *footings, foundation walls, piers and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:*

1. Extending *a minimum of 48 inches (1219 mm) below finished grade at all points.*
2. Constructing in accordance with 780 CMR 5403.3;
3. Constructing in accordance with ASCE 32-01;
4. Erected on solid rock.

Exceptions:

1. Freestanding accessory structures, except garages, with an area of 400 square feet (37 m²) or less and an eave height of ten feet (3048 mm) or less shall not be required to be protected.
2. *When the foundation grade is established by a registered architect or registered professional engineer.*

Footings shall not bear, *or be placed* on frozen soil.

5403.1.4.2 Seismic Conditions. Reserved.

5403.1.5 Slope. The top surface of footings shall be level. The bottom surface of footings shall not have a slope exceeding one unit vertical in ten units horizontal (10% slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed one unit vertical in ten units horizontal (10% slope).

5403.1.6 Foundation Anchorage. When braced wall panels are supported directly on continuous foundations, the wall wood sill plate or cold-formed steel bottom track shall be anchored to the foundation in accordance with 780 CMR 5403.

The wood sole plate at exterior walls on monolithic slabs and wood sill plate *supporting floor systems* shall be anchored to the foundation with *½-inch (minimum)-diameter (12.7mm) A 307 steel anchor bolts with nuts and plate washers* spaced a maximum of six feet (1829 mm) on center. There shall be a minimum of two bolts per plate section with bolts located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section.

Anchor bolts shall extend a minimum of seven inches (178 mm) into masonry or concrete. Sills and sole plates shall be protected against decay and termites where required by 780 CMR 5318

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and **5319.** Cold-formed steel framing systems shall be fastened to the wood sill plates or anchored directly to the foundation as required in 780 CMR 5505.3.1 or 5603.1.1.

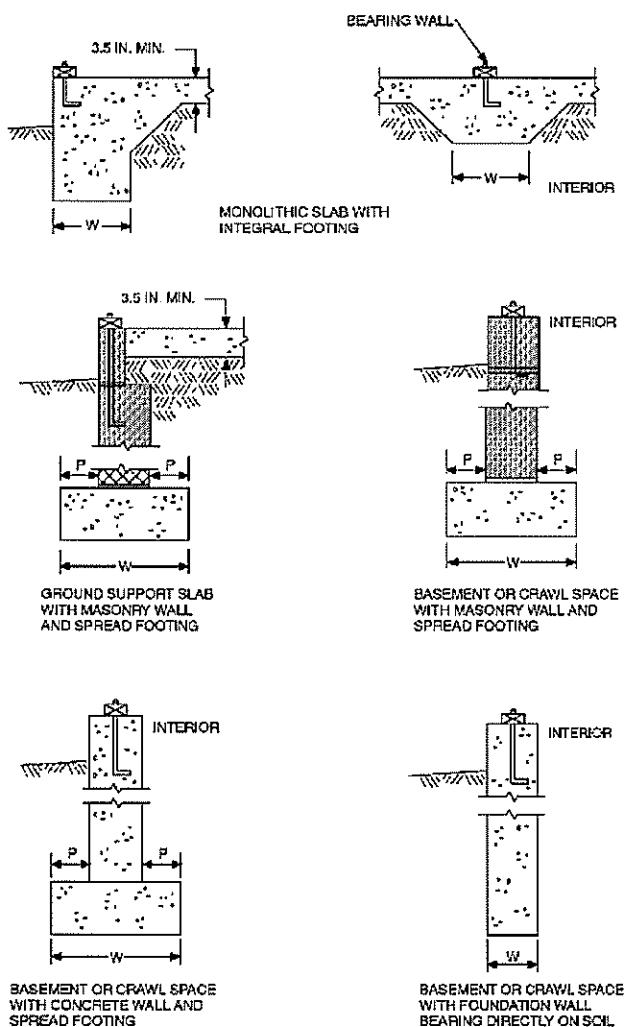
Exception: Foundation anchor straps, spaced as required to provide equivalent anchorage to $\frac{1}{2}$ -inch-diameter (12.7mm) anchor bolts and installed in accordance with manufacturer's printed instructions.

5403.1.6.1 Foundation Anchorage in Seismic Design Categories C, D₁ and D₂. Reserved.

5403.1.7 Footings on or Adjacent to Slopes. The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical in three units horizontal (33.3% slope) shall conform to 780 CMR 5403.1.7.1 through 5403.1.7.4.

5403.1.7.1 Building Clearances from Ascending Slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in 780 CMR 5403.1.7.4 and 780 CMR Figure 5403.1.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100% slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

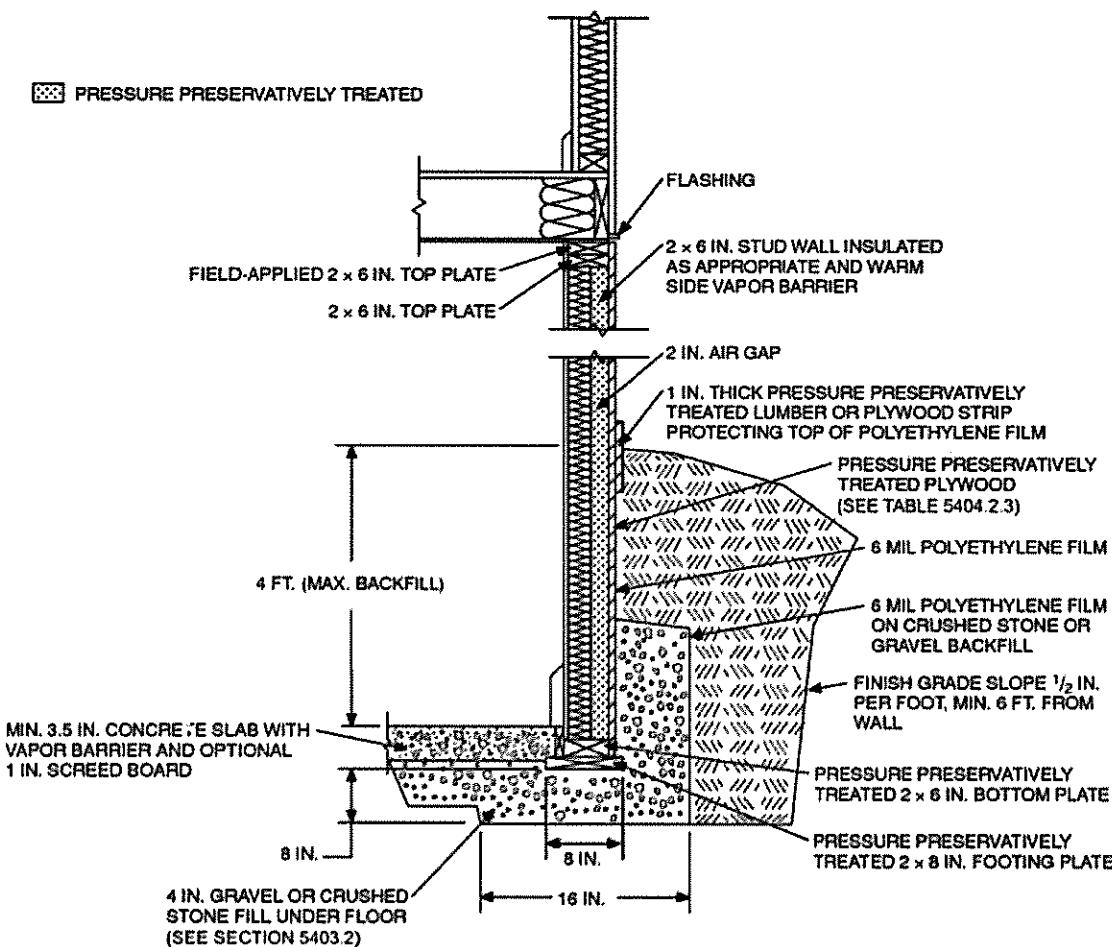
780 CMR FIGURE 5403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS



For SI: 1 inch = 25.4 mm.

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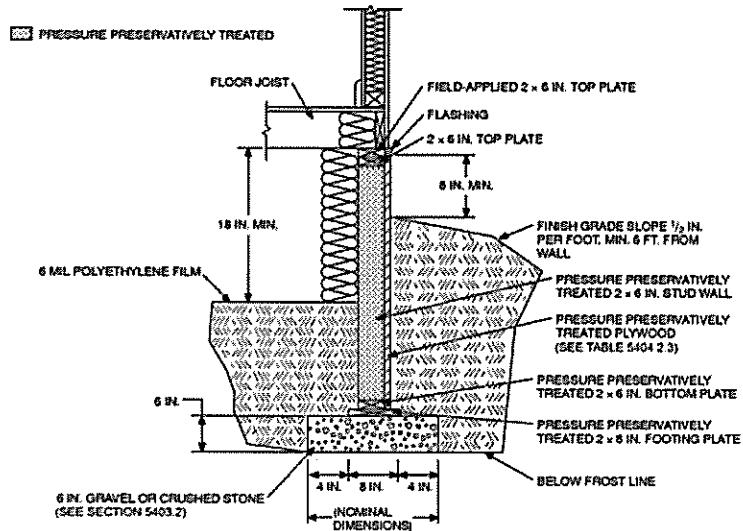
780 CMR FIGURE 5403.1(2)
 PERMANENT WOOD FOUNDATION BASEMENT WALL SECTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

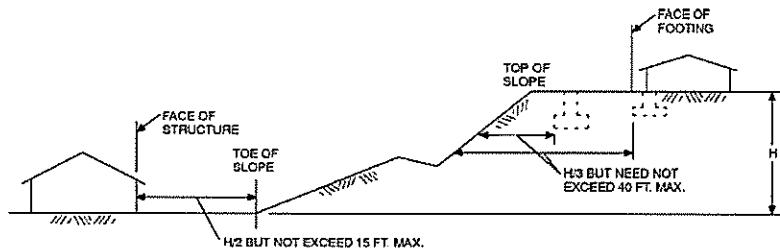
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**780 CMR FIGURE 5403.1(3)
PERMANENT WOOD FOUNDATION CRAWL SPACE SECTION**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

**780 CMR FIGURE 5403.1 .7.1
FOUNDATION CLEARANCE FROM SLOPES**



For SI: 1 foot = 304.8 mm.

5403.1.7.2 Footing Setback from Descending Slope Surfaces. Footings on or adjacent to slope surfaces shall be founded in material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in 780 CMR 5403.1.7.4 and Figure 5403.1.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than one unit vertical in one unit horizontal (100% slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

5403.1.7.3 Foundation Elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter

at point of discharge or the inlet of an approved drainage device a minimum of 12 inches (305 mm) plus 2%. Alternate elevations are permitted subject to the approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

5403.1.7.4 Alternate Setback and Clearances. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a qualified engineer to demonstrate that the intent of 780 CMR 5403 has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion

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characteristics of slope material.

5403.1.8 Foundations on Expansive Soils. Foundation and floor slabs for buildings located on expansive soils shall be designed in accordance with *780 CMR Chapter 18, as applicable, of the Sixth Edition, Massachusetts State Building Code.*

Exception: Slab-on-ground and other foundation systems which have performed adequately in soil conditions similar to those encountered at the building site are permitted subject to the approval of the building official.

5403.1.8.1 Expansive Soils Classifications. Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with 780 CMR 5403.1.8.1.1., 2. and 3. shall not be required if the test prescribed in 780 CMR 5403.1.8.1.4 is conducted:

1. Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D 4318.

2. More than 10% of the soil particles pass a No. 200 sieve (75 mm), determined in accordance with ASTM D 422.
3. More than 10% of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion Index greater than 20, determined in accordance with ASTM D4829.

5403.2 Footings for Wood Foundations. Footings for wood foundations shall be in accordance with 780 CMR Figure 5403.1(2) and 780 CMR Figure 5403.1(3). Gravel shall be washed and well graded. The maximum size stone shall not exceed $\frac{3}{4}$ inch (19.1 mm). Gravel shall be free from organic, clayey or silty soils. Sand shall be coarse, not smaller than $\frac{1}{16}$ -inch (1.6 mm) grains and shall be free from organic, clayey or silty soils. Crushed stone shall have a maximum size of $\frac{1}{2}$ inch (12.7 mm).

5403.3 Frost Protected Shallow Foundations. *Reserved.*

780 CMR TABLE 5403.3
MINIMUM INSULATION REQUIREMENTS FOR FROST-PROTECTED
FOOTINGS IN HEATED BUILDINGS*
RESERVED

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780 CMR FIGURE 5403.3(1)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS
RESERVED

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780 CMR FIGURE 5403.3(3)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS
ADJACENT TO UNHEATED SLAB-ON-GROUND STRUCTURE
RESERVED

780 CMR FIGURE 5403.3(4)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO
HEATED STRUCTURE
RESERVED

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780 CMR 5404 FOUNDATION WALLS

5404.1 Concrete and Masonry Foundation Walls.

Concrete and masonry foundation walls shall be selected and constructed in accordance with the provisions of 780 CMR 5404 or in accordance with ACI 318, NCMA TR68-A or ACI 530/ASCE 5/TMS 402 or other approved structural standards. *Foundation walls which are not constructed in accordance with the prescriptive provisions of 780 CMR 51.00 through 99.00 shall be designed by a registered professional engineer or registered architect and shall comply with applicable standards as referenced in 780 CMR 100.00 Appendix A.*

5404.1.1 Masonry Foundation Walls. Concrete masonry and clay masonry foundation walls shall be constructed as set forth in 780 CMR Tables 5404.1.1(1), 5404.1.1(2), 5404.1.1(3) and 5404.1.1(4) and shall also comply with the provisions of 780 CMR 5404 and the applicable provisions of 780 CMR 5606, 5607 and 5608. Rubble stone masonry foundation walls shall be

constructed in accordance with 780 CMR 5404.1.8 and 5606.2.2.

5404.1.2 Concrete Foundation Walls. Concrete foundation walls shall be constructed as set forth in 780 CMR Tables 5404.1.1(1), 5404.1.1(2), 5404.1.1(3) and 5404.1.1(4), and shall also comply with the provisions of 780 CMR 5404 and the applicable provisions of 780 CMR 5402.2.

5404.1.3 Design required. A design in accordance with accepted engineering practice and prepared by a registered professional engineer or registered architect shall be provided for concrete or masonry foundation walls when any of the following conditions exist:

1. Walls are subject to hydrostatic pressure from groundwater.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top and bottom.

780 CMR TABLE 5404.1.1(1)
PLAIN CONCRETE AND PLAIN MASONRY FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	PLAIN CONCRETE MINIMUM NOMINAL WALL THICKNESS (inches)			PLAIN MASONRY ^a MINIMUM NOMINAL WALL THICKNESS (inches)		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL	GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6	6	6	6 solid ^d or 8 6 solid ^d or 8	6 solid ^d or 8 8	6 solid ^d or 8 10
	5	6	6	6			
6	4	6	6	6	6 solid ^d or 8 6 solid ^d or 8	6 solid ^d or 8 8	6 solid ^d or 8 10
	5	6	6	6			
	6	6	8 ^e	8 ^e			
7	4	6	6	6	6 solid ^d or 8	8	8
	5	6	6	8 ^e	6 solid ^d or 8	10	10
	6	6	8	8		12	
	7	8	8	10	10	12	10 solid ^d
8	4	6	6	6	6 solid ^d or 8 6 solid ^d or 8	6 solid ^d or 8 10	8 12
	5	6	6	8			
	6	8 ^e	8	10	10	12	12 solid ^d
	7	8	10	10	12	12 solid ^d	Footnote e
	8	10	10	12	10 solid ^d	12 solid ^d	Footnote e
9	4	6	6	6	6 solid ^d or 8	6 solid ^d or 8 10	8 12
	5	6	8 ^e	8			
	6	8	8	10	10	12	12 solid ^d
	7	8	10	10	12	12 solid ^d	Footnote e
	8	10	10	12	12 solid ^d	Footnote e	Footnote e
	9	10	12	Footnote f	Footnote e	Footnote e	Footnote e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 Pa.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond. UngROUTED hollow masonry units are permitted except where otherwise indicated.
- b. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.
- c. Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.
- d. Solid grouted hollow units or solid masonry units.
- e. Wall construction shall be in accordance with 780 CMR Table 5404.1.1(2) or a design shall be provided.
- f. A design is required.
- g. Thickness may be 6 inches, provided minimum specified compressive strength of concrete, f'_c , is 4,000 psi.

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780 CMR TABLE 5404.1.1(2)
REINFORCED CONCRETE AND MASONRY^a FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^{b,c} FOR 8-INCH NOMINAL WALL THICKNESS		
		Soil classes ^d		
		GW, GP, SW and SP soils	GM, GC, SM, SM-SC and ML soils	SC, MH, ML-CL and inorganic CL soils
6	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	6	#4 at 48" o.c.	#4 at 40" o.c.	#5 at 48" o.c.
7	4	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 40" o.c.
	7	#4 at 40" o.c.	#5 at 40" o.c.	#6 at 48" o.c.
8	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 40" o.c.
	7	#5 at 48" o.c.	#6 at 48" o.c.	#6 at 40" o.c.
	8	#5 at 40" o.c.	#6 at 40" o.c.	#6 at 24" o.c.
9	5	#4 at 48" o.c.	#4 at 48" o.c.	#5 at 48" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	7	#5 at 48" o.c.	#6 at 48" o.c.	#6 at 32" o.c.
	8	#5 at 40" o.c.	#6 at 32" o.c.	#6 at 24" o.c.
	9	#6 at 40" o.c.	#6 at 24" o.c.	#6 at 16" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least five inches.
- d. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.
- e. Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

780 CMR TABLE 5404.1.1(3)
REINFORCED CONCRETE AND MASONRY^a FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	VERTICAL REINFORCEMENT SIZE AND SPACING ^{b,c} FOR 12-INCH NOMINAL WALL THICKNESS		
		Soil classes ^d		
		GW, GP, SW and SP soils	GM, GC, SM, SM-SC and ML soils	SC, MH, ML-CL and inorganic CL soils
7	4	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 64" o.c.	#4 at 48" o.c.
	7	#4 at 72" o.c.	#4 at 48" o.c.	#5 at 56" o.c.
8	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 56" o.c.	#5 at 72" o.c.
	7	#4 at 64" o.c.	#5 at 64" o.c.	#4 at 32" o.c.
	8	#4 at 48" o.c.	#4 at 32" o.c.	#5 at 40" o.c.
9	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 56" o.c.	#5 at 64" o.c.
	7	#4 at 56" o.c.	#4 at 40" o.c.	#6 at 64" o.c.
	8	#4 at 64" o.c.	#6 at 64" o.c.	#6 at 48" o.c.
	9	#5 at 56" o.c.	#7 at 72" o.c.	#6 at 40" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 8.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.
- e. Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

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780 CMR TABLE 5404.1 .1 (4)
REINFORCED CONCRETE AND MASONRY^a FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^b (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^{bc} FOR 10-INCH NOMINAL WALL THICKNESS		
		Soil Classes ^d		
		GW, GP, SW and SP soils	GM, GC, SM, SM-SC and ML soils	SC, MH, ML-CL and inorganic CL soils
7	4	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6	#4 at 56" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	7	#4 at 56" o.c.	#5 at 56" o.c.	#5 at 40" o.c.
8	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 48" o.c.
	6	#4 at 56" o.c.	#4 at 48" o.c.	#5 at 56" o.c.
	7	#4 at 48" o.c.	#4 at 32" o.c.	#6 at 56" o.c.
	8	#5 at 56" o.c.	#5 at 40" o.c.	#7 at 56" o.c.
9	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 48" o.c.
	6	#4 at 56" o.c.	#4 at 40" o.c.	#4 at 32" o.c.
	7	#4 at 56" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	8	#4 at 32" o.c.	#6 at 48" o.c.	#4 at 16" o.c.
	9	#5 at 40" o.c.	#6 at 40" o.c.	#7 at 40" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 6.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 5405.1.
- e. Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

5404.1.4 Seismic Design Categories D₁ and D₂.
Reserved.

5404.1.5 Foundation Wall Thickness Based on Walls Supported. The thickness of concrete and masonry foundation walls shall not be less than the thickness of the wall supported, except that foundation walls of at least eight-inch (203 mm) nominal thickness shall be permitted under brick-veneered frame walls and under ten-inch-wide (254mm) cavity walls where the total height of the wall supported, including gables, is not more than 20 feet (6096 mm), provided the requirements of 780 CMR 5404.1.1 and 5404.1.2 are met.

5404.1.5.1 Pier and Curtain Wall Foundations. Pier and curtain wall foundations shall be permitted to be used to support light-frame construction not more than two stories in height, provided the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings placed integrally with the exterior wall footings.
2. The minimum actual thickness of a

load-bearing masonry wall shall be not less than four inches (102 mm) nominal or 3% inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with 780 CMR 5606.8.

3. Piers shall be constructed in accordance with 780 CMR 5606.5 and 780 CMR 5606.5.1, and shall be bonded into the load-bearing masonry wall in accordance with 780 CMR 5608.1.1 or 780 CMR 5608.1.1.2.

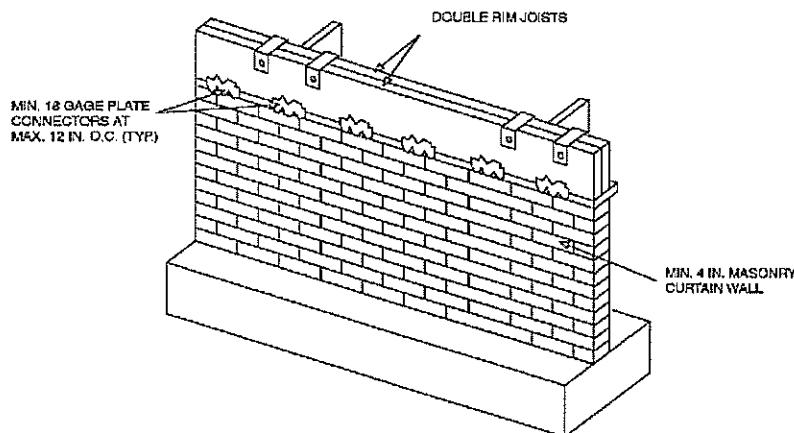
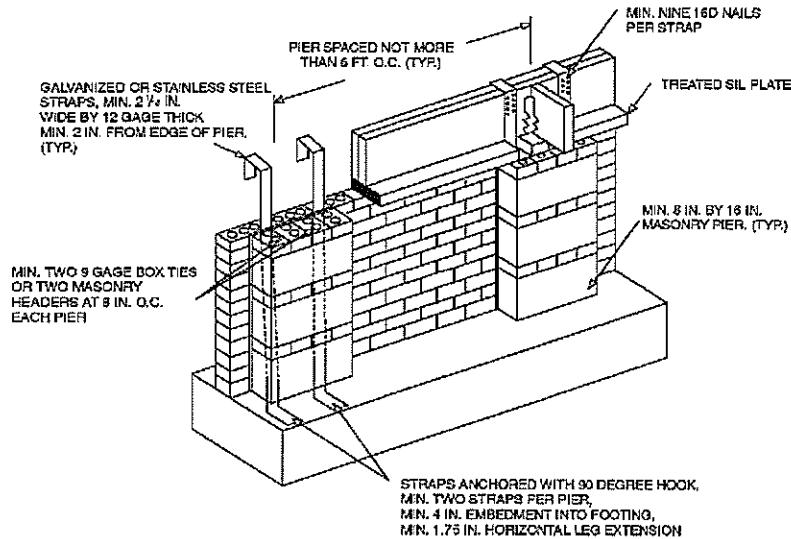
4. The maximum height of a four-inch (102 mm) load-bearing masonry foundation wall supporting wood framed walls and floors shall not be more than four feet (1219 mm) in height.

5. Anchorage shall be in accordance with 780 CMR 5403.1.6, 780 CMR Figure 5404.1.5(1), or as specified by engineered design accepted by the building official.

6. The unbalanced fill for four-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry or 12 inches (305 mm) for hollow masonry.

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780 CMR FIGURE 5404.1.5(1)
FOUNDATION WALL CLAY MASONRY CURTAIN WALL
WITH CONCRETE MASONRY PIERS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.79/ 45 rad.

5404.1.6 Height above Finished Grade. Concrete and masonry foundation walls shall extend above the finished grade adjacent to the foundation at all points a minimum of four inches (102 mm) where masonry veneer is used and a minimum of six inches (152 mm) elsewhere.

5404.1.7 Backfill Placement. Backfill shall not be placed against the wall until the wall has sufficient strength and has been anchored to the floor above, or has been sufficiently braced to prevent damage by the backfill. *Backfill material shall be free draining and free of organic materials, construction debris, cobbles and boulders, shall be placed in lifts not exceeding*

12 inches (305 mm) and shall be mechanically compacted.

Exception: Such bracing is not required for walls supporting less than four feet (1219 mm) of unbalanced back-fill.

5404.1.8 Rubble Stone Masonry. Rubble stone masonry foundation walls shall have a minimum thickness of 16 inches (406 mm), shall not support an unbalanced backfill exceeding eight feet (2438 mm) in height, shall not support a soil pressure greater than 30 psf (481 kg/m^2).

5404.2 Wood Foundation Walls. Wood foundation walls shall be constructed in accordance with the

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provisions of 780CMR 5404.2.1 through 5404.2.6 and with the details shown in 780 CMR Figures 5403.1(2) and 5403.1(3).

5404.2.1 Identification. All load-bearing lumber shall be identified by the grade mark of a lumber grading or inspection agency which has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5404 shall be accepted. Wood structural panels shall conform to DOC PS 1 or DOC PS 2 and shall be identified by a grade mark or certificate of inspection issued by an approved agency.

5404.2.2 Stud Size. The studs used in foundation walls shall be two-inch-by-six-inch (51 mm by

152 mm) members. When spaced 16 inches (406 mm) on center, a wood species with an Fb value of not less than 1,250 (8612 kPa) as listed in AF&PA/NDS shall be used. When spaced 12 inches (305 mm) on center, an Fb of not less than 875 (6029 kPa) shall be required.

5404.2.3 Height of Backfill. For wood foundations that are not designed and installed in accordance with AF&PA Report No.7, the height of backfill against a foundation wall shall not exceed four feet (1219 mm). When the height of fill is more than 12 inches (305 mm) above the interior grade of a crawl space or floor of a basement, the thickness of the plywood sheathing shall meet the requirements of 780 CMR Table 5404.2.3.

TABLE 5404.2.3
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 ^a	Minimum thickness (inches)	Span Rating	Grade ^a	Minimum thickness (inches) ^{b,c}	Span Rating
24	12	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}$	32/16
					B	$1\frac{5}{32}^c$	32/16
	16	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}^c$	32/16
					B	$1\frac{9}{32}^c$ (4, 5 ply)	40/20
36	12	B	$1\frac{5}{32}$	32/16	A	$1\frac{5}{32}$	32/16
					B	$1\frac{5}{32}^c$ (4, 5 ply)	32/16
	16	B	$1\frac{5}{32}^c$	32/16	B	$1\frac{9}{32}^c$ (4, 5 ply)	40/20
					A	$1\frac{9}{32}$	40/20
48	12	B	$1\frac{5}{32}$	32/16	B	$2\frac{3}{32}$	48/24
					A	$1\frac{5}{32}^c$	32/16
	16	B	$1\frac{9}{32}$	40/20	B	$1\frac{9}{32}^c$ (4, 5 ply)	40/20
					A	$1\frac{9}{32}^c$	40/20
					A	$2\frac{3}{32}$	48/24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per cubic foot = 0.1572kN/m³.

a. Plywood shall be of the following minimum grades in accordance with DOC PS 1 or DOC PS 2:

1. DOC PS 1 Plywood grades marked:
 - 1.1. Structural I C-D (Exposure 1)
 - 1.2. C-D (Exposure 1)
2. DOC PS 2 Plywood grades marked:
 - 2.1. Structural I Sheathing (Exposure 1)
 - 2.2. Sheathing (Exposure 1)

3. 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:

- 3.1. Structural I A-C, Structural I B-C or Structural I C-C (Plugged) in accordance with DOC PS 1
- 3.2. A-C Group 1, B-C Group 1, C-C (Plugged) Group 1 or MDO Group 1 in accordance with DOC PS 1
- 3.3. Single Floor in accordance with DOC PS 1 or DOC PS 2

b. Minimum thickness $1\frac{5}{32}$ inch, except crawl space sheathing may be $\frac{3}{8}$ inch for face grain across studs 16 inches on center and maximum two-foot depth of unequal fill.

c. For this fill height, thickness and grade combination, panels that are continuous over less than three spans (across less than three stud spacings) require blocking 16 inches above the bottom plate. Offset adjacent blocks and fasten through studs with two 16d corrosion-resistant nails at each end.

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5404.2.4 Backfilling. Wood foundation walls shall not be backfilled until the basement floor and first floor have been constructed or the walls have been braced. For crawl space construction, backfill or bracing shall be installed on the interior of the walls prior to placing backfill on the exterior. *Backfill material shall be free draining and free of organic materials, construction debris, cobbles and boulders, shall be placed in lifts not exceeding 12 inches (305 mm) and shall be mechanically compacted.*

5404.2.5 Drainage and Dampproofing. Wood foundation basements shall be drained and dampproofed in accordance with 780CMR 5405 and 5406, respectively.

5404.2.6 Fastening. Wood structural panel foundation wall sheathing shall be attached to framing in accordance with 780 CMR Table 5602.3(1) and 780 CMR 5402.1.1.

5404.3 Wood Sill Plates. Wood sill plates shall be a minimum of two-inch by four-inch (51 mm by 102 mm) nominal lumber. Sill plate anchorage shall be in accordance with 780 CMR 5403.1.6 and 5602.11.

5404.4 Insulating Concrete Form Foundation Walls. Insulating concrete form (ICF) foundation walls shall be designed and constructed in accordance with the provisions of 780 CMR 5404 or in accordance with the provisions of ACI 318. When ACI 318 is used to design insulating concrete form foundation walls, project drawings, typical details and specifications *shall bear the seal of the a Massachusetts-registered architect or a Massachusetts-registered professional engineer.*

5404.4.1 Applicability Limits. The provisions of 780 CMR 5404.4.1 shall apply to the construction of insulating concrete form foundation walls for

buildings not greater than 60 feet (18 288 mm) in plan dimensions, and floors not greater than 32 feet (9754 mm) or roofs not greater than 40 feet (12 192 mm) in clear span. Buildings shall not exceed two stories in height above-grade with each story not greater than ten feet (3048 mm) high. Foundation walls constructed in accordance with the provisions of 780 CMR 5404.4.1 shall be limited to buildings subjected to a maximum ground snow load of 70 psf (3.35 kN/m²) and located in Seismic Design Category A, B or C.

5404.4.2 Flat Insulating Concrete Form Wall Systems. Flat ICF wall systems shall comply with 780 CMR Figure 5611.3, shall have a minimum concrete thickness of 5.5 inches (140 mm), and shall have reinforcement in accordance with 780 CMR Table 5404.4(1), 5404.4(2) or 5404.4(3).

5404.4.3 Waffle Grid Insulating Concrete Form Wall Systems. Waffle-grid wall systems shall have a minimum nominal concrete thickness of six inches (152 mm) for the horizontal and vertical concrete members (cores) and shall be reinforced in accordance with 780 CMR Table 5404.4(4). The minimum core dimension shall comply with 780 CMR Table 5611.4 (2) and 780 CMR Figure 5611.4.

5404.4.4 Screen Grid Insulating Concrete Form Wall Systems. Screen-grid ICF wall systems shall have a minimum nominal concrete thickness of six inches (152 mm) for the horizontal and vertical concrete members (cores). The minimum core dimensions shall comply with 780 CMR Table 5611.4(2) and 780 CMR Figure 5611.5. Walls shall have reinforcement in accordance with 780 CMR Table 5404.4(5).

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780 CMR TABLE 5404.4(1)
5.5-INCH THICK FLAT ICF FOUNDATION WALLS^{a,b,c,d}

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^e (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^f		
		Soil group I ^f	Soil group II ^f	Soil group III ^f
8	4	#4@48"	#4@48"	#4@48"
	5	#4@48"	#3@12"; #4@22"; #5@32"	#3@8"; #4@14"; #5@20"; #6@26"
	6	#3@ 12"; #4@22"; #5@30"	#3@8"; #4@ 14"; #5@20"; #6@24"	#3@6"; #4@ 10"; #5@14"; #6@20"
	7	#3@8"; #4@ 14"; #5@22"; #6@26"	#3@5"; #4@ 10"; #5@ 14"; #6@ 18"	#3@4"; #4@6"; #5@ 10"; #6@ 14"
9	4	#4@48"	#4@48"	#4@48"
	5	#4@48"	#3@12"; #4@20"; #5@28"; #6@36"	#3@8"; #4@14"; #5@20"; #6@22"
	6	#3@10"; #4@20"; #5@28"; #6@34"	#3@6"; #4@12"; #5@18"; #6@20"	#4@8"; #5@ 14"; #6@ 16"
	7	#3@8"; #4@14"; #5@20"; #6@22"	#4@8"; #5@12"; #6@16"	#4@6"; #5@10"; #6@12"
	8	#3@6"; #4@10"; #5@14"; #6@16"	#4@6"; #5@10"; #6@12"	#4@4"; #5@6"; #6@8"
10	4	#4@48"	#4@48"	#4@48"
	5	#4@48"	#3@10"; #4@18"; #5 @26"; #6@30"	#3@6"; #4@14"; #5 @18"; #6@20"
	6	#3@ 10"; #4@ 18"; #5@24"; #6@30"	#3@6"; #4@ 12"; #5@16"; #6@18"	#3@4"; #4@8"; #5@12"; #6@14"
	7	#3@6"; #4@ 12"; #5@16"; #6@18"	#3@4"; #4@8"; #5@12"	#4@6"; #5@8"; #6@10"
	8	#4@8"; #5@ 12"; #6@ 14"	#4@6"; #5@8"; #6@ 12"	#4@4"; #5@6"; #6@8"
	9	#4@6"; #5@ 10"; #6@ 12"	#4@4"; #5@6"; #6@8"	#5@4"; #6@6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table but in no case greater than 48 inches on center.
- b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- c. Deflection criteria: L/240.
- d. Interpolation between rebar sizes and spacing is not permitted.
- e. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- f. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

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780 CMR TABLE 5404.4(2)
7.5-INCH THICK FLAT ICF FOUNDATION WALLS^{a,b,c,d,e}

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^g		
		Soil group I ^g	Soil group II ^g	Soil group III ^g
8	6	N/R	N/R	N/R
	7	N/R	#3@8"; #4@14"; #5@20"; #6@28"	#3@6"; #4@10"; #5@16"; #6@20"
9	6	N/R	N/R	#3@8"; #4@14"; #5@20"; #6@28"
	7	N/R	#3@6"; #4@12"; #5@18"; #6@26"	#3@4"; #4@8"; #5@14"; #6@18"
	8	#3@8"; #4@14"; #5@22"; #6@28"	#3@4"; #4@8"; #5@14"; #6@18"	#3@4"; #4@6"; #5@10"; #6@14"
10	6	N/R	N/R	#3@6"; #4@12"; #5@18"; #6@26"
	7	N/R	#3@6"; #4@12"; #5@18"; #6@24"	#3@4"; #4@8"; #5@12"; #6@18"
	8	#3@6"; #4@12"; #5@20"; #6@26"	#3@4"; #4@8"; #5@12"; #6@16"	#3@4"; #4@6"; #5@8"; #6@12"
	9	#3@6"; #4@10"; #5@14"; #6@20"	#3@4"; #4@6"; #5@10"; #6@12"	#4@4"; #5@6"; #6@10"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.
- b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- c. N/R denotes "not required."
- d. Deflection criteria: L/240.
- e. Interpolation between rebar sizes and spacing is not permitted.
- f. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- g. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

780 CMR TABLE 5404.4(3)
9.5-INCH THICK FLAT ICF FOUNDATION WALLS^{a,b,c,d,e}

HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^g		
		Soil I ^g	Soil II ^g	Soil III ^g
8	7	N/R	N/R	N/R
	6	N/R	N/R	N/R
9	7	N/R	N/R	#3@6"; #4@12"; #5@18"; #6@26"
	8	N/R	#3@6"; #4@12"; #5@18"; #6@26"	#3@4"; #4@8"; #5@14"; #6@18"
10	5	N/R	N/R	N/R
	6	N/R	N/R	#3@ 10"; #4@ 18"; #5@26"; #6@36"
	7	N/R	N/R	#3@6"; #4@10"; #5@18"; #6@24"
	8	N/R	#3@6"; #4@12"; #5@16"; #6@24"	#3@4"; #4@8"; #5@12"; #6@16"
	9	N/R	#3@4"; #4@8"; #5@12"; #6@18"	#3@4"; #4@6"; #5@10"; #6@12"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.
- b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- c. N/R denotes "not required."
- d. Deflection criteria: L/240.
- e. Interpolation between rebar sizes and spacing is not permitted.
- f. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- g. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

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780 CMR TABLE 5404.4(4)
WAFFLE GRID ICF FOUNDATION WALLS^{a,b,c,d,e}

MINIMUM NOMINAL WALL THICKNESS ^f (inches)	HEIGHT OF BASEMENT WALL (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^h		
			Soil group I ^h	Soil group II ^h	Soil Grup ^h
6	8	4	#4@48"	#3@12"; #4@24"	#3@12"
		5	#3 @12"; #5@24"	#4@ 12"	#7 @12"
		6	#4@ 12"	Design required	Design required
		7	#7@ 12"	Design required	Design required
	9	4	#4@48"	#3 @12"; #5 @24"	#3 @12"
		5	#3 @12"	#4@ 12"	Design required
		6	#5@ 12"	Design required	Design required
		7	Design required	Design required	Design required
	10	4	#4@48"	#4@12"	#5@12"
		5	#3@ 12"	Design required	Design required
		6	Design required	Design required	Design required
		7	Design required	Design required	Design required
8	8	4	N/R	N/R	N/R
		5	N/R	#3 @ 12"; #4@24"; #5@36"	#3 @12"; #5 @24"
		6	#3@12"; #4@24"; #5@36"	#4@ 12"; #5@24"	#4@ 12"
		7	#3 @12"; #6@24"	#4@ 12"	#5 @12"
	9	4	N/R	N/R	N/R
		5	N/R	#3@12"; #5@24"	#3@12"; #5@24"
		6	#3 @12"; #4@24"	#4@ 12"	#4@ 12"
		7	#4@ 12"; #5@24"	#5 @12"	#5 @12"
		8	#4@ 12"	#5 @12"	#8 @12"
	10	4	N/R	#3 @ 12"; #4@24"; #6@36"	#3 @12"; #5 @24"
		5	N/R	#3 @ 12"; #4@24"; #6@36"	#4@ 12"; #5 @24"
		6	#3 @12"; #5@24"	#4@ 12"	#5 @12"
		7	#4@ 12"	#5@12"	#6@12"
		8	#4@ 12"	#6@ 12"	Design required
		9	#5 @12"	Design required	Design required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased 12 inches but in no case greater than 48 inches on center.
- b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- c. N/R denotes "not required."
- d. Deflection criteria: 1/240.
- e. Interpolation between rebar sizes and spacing is not permitted.
- f. Refer to 780 CMR Table 5611.4(2) for wall dimensions.
- g. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- h. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

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780 CMR TABLE 5404.4(5)
SCREEN-GRID ICF FOUNDATION WALLS^{a,b,c,d,e}

MINIMUM NOMINAL WALL THICKNESS ^f (inches)	MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING		
			Soil classes		
			Soil group I ^h	Soil group II ^h	Soil group III ^h
6	8	4	#4@48"	#3@12", #4@24"; #5@36"	#3@12", #5@24"
		5	#3@12", #4@24"	#3@12"	#4@12"
		6	#4@12"	#5@12"	Design required
		7	#4@12"	Design required	Design required
	9	4	#4@48"	#3@12", #4@24"	#3@12", #6@24"
		5	#3@12", #5@24"	#4@12"	#7@12"
		6	#4@12"	Design required	Design required
		7	Design required	Design required	Design required
	10	8	Design required	Design required	Design required
		4	#4@48"	#3@12", #5@24"	#3@12"
		5	#3@12"	#4@12"	#7@12"
		6	#4@12"	Design required	Design required
		7	Design required	Design required	Design required
		8	Design required	Design required	Design required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement in the shaded cells shall be increased 12 inches.
- b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- c. N/R denotes "not required."
- d. Deflection criteria: 1/240.
- e. Interpolation between rebar sizes and spacing is not permitted.
- f. Refer to 780 CMR Table 5611.4(2) for wall dimensions.
- g. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back-fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- h. Soil classes are in accordance with the Unified Soil Classification System. Refer to 780 CMR Table 5405.1.

5404.4.5 Concrete Material. Ready-mixed concrete for insulating concrete form walls shall be in accordance with 780 CMR 5402.2. Maximum slump shall not be greater than six inches (152 mm) as determined in accordance with ASTM C 143. Maximum aggregate size shall not be larger than $\frac{3}{4}$ inch (19.1 mm).

Exception: Concrete mixes conforming to the ICF manufacturer's recommendations.

5404.4.6 Reinforcing Steel.

5404.4.6.1 General. Reinforcing steel shall meet the requirements of ASTM A 615, A 706 or A 996. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). Vertical and horizontal wall reinforcements shall be placed no closer to the outside face of the wall than one-half the wall thickness. Steel reinforcement for foundation walls shall have concrete cover in accordance with ACI 318.

Exception: Where insulated concrete forms are used and the form remains in place as cover for the concrete, the minimum concrete cover for the reinforcing steel is permitted to be reduced to $\frac{3}{4}$ inch (19.1 mm).

5404.4.6.2 Horizontal Reinforcement. When vertical reinforcement is required, ICF foundation walls shall have horizontal reinforcement in accordance with 780 CMR 5404.4.6.2. ICF foundation walls up to eight feet (2438 mm) in height shall have a minimum of one continuous No. 4 horizontal reinforcing bar placed at 48 inches (1219mm) on center with one bar located within 12 inches (305 mm) of the top of the wall story. ICF Foundation walls greater than eight feet (2438 mm) in height shall have a minimum of one continuous No. 4 horizontal reinforcing bar placed at 36 inches (914 mm) on center with one bar located within 12 inches (305 mm) of the top of the wall story.

5404.4.6.3 Wall Openings. Vertical wall reinforcement required by 780 CMR 5404.4.2, 5404.4.3 or 5404.4.4 that is interrupted by wall openings shall have additional vertical reinforcement of the same size placed within 12 inches (305 mm) of each side of the opening.

5404.4.7 Foam Plastic Insulation. Foam plastic insulation in insulating concrete foam

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construction shall comply with 780 CMR 5404.

5404.4.7.1 Material. Insulating concrete form material shall meet the surface burning characteristics of 780 CMR 5314.1.1. A thermal barrier shall be provided on the building interior in accordance with 780 CMR 5314.1.2.

5404.4.7.2 Termite Hazards. In areas where hazard of termite damage is very heavy in accordance with 780 CMR Figure 5301.2(6), foam plastic insulation shall be permitted below grade on foundation walls in accordance with one of the following conditions:

1. When in addition to the requirements in 780 CMR 5320.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
2. The structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure preservatively treated wood.
3. On the interior side of basement walls.

5404.4.8 Foundation Wall Thickness Based on Walls Supported. The thickness of ICF foundation walls shall not be less than the thickness of the wall supported above.

5404.4.9 Height above Finished Ground. ICF foundation walls shall extend above the finished ground adjacent to the foundation at all points a minimum of four inches (102 mm) where masonry veneer is used and a minimum of six inches (152 mm) elsewhere.

5404.4.10 Backfill Placement. Backfill shall be placed in accordance with 780 CMR 5404.1.7.

5404.4.11 Drainage and dampproofing/ Waterproofing. ICF foundation basements shall be drained and dampproofed/waterproofed in accordance with 780 CMR 5405 and 5406.

780 CMR 5405 FOUNDATION DRAINAGE

5405.1 Concrete or Masonry Foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or

usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least one foot (305 mm) beyond the outside edge of the footing and six inches (153 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum of two inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than six inches (153 mm) of the same material.

Exception: A drainage system is not required when the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in 780 CMR Table 5405.1.

5405.2 Wood Foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be adequately drained in accordance with 780 CMR 5405.2.1 through 5405.2.3.

5405.2.1 Base. A porous layer of gravel, crushed stone or coarse sand shall be placed to a minimum thickness of four inches (102 mm) under the basement floor. Provision shall be made for automatic draining of this layer and the gravel or crushed stone wall footings.

5405.2.2 Moisture Barrier. A six-mil-thick (0.15 mm) polyethylene moisture barrier shall be applied over the porous layer with the basement floor constructed over the polyethylene.

5405.2.3 Drainage System. In other than Group I soils, a sump shall be provided to drain the porous layer and footings. The sump shall be at least 24 inches (610mm) in diameter or 20 inches square (0.0 129 m²), shall extend at least 24 inches (610 mm) below the bottom of the basement floor and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge into an approved sewer system or to daylight.

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780 CMR TABLE 5405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL
CLASSIFICATION SYSTEM

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS ^a	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION ^b
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines.	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines.	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines.	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines.	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures.	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures.	Good	Medium	Low
Group II	GC	Clayey gravels, gravel-sand-clay mixtures.	Medium	Medium	Low
	SC	Clayey sands, sand-clay mixture.	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium	Medium	Medium to Low
Group III	CH	Inorganic clays of high plasticity, fat clays.	Poor	Medium	High
		Inorganic silts, micaceous or diatomaceous sandy or silty soils, elastic silts.	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity.	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts.	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils.	Unsatisfactory	Medium	High

For SI: 1 inch = 25.4 mm.

- a. The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.
- b. Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

780 CMR 5406 FOUNDATION
WATERPROOFING AND DAMPROOFING

5406.1 Concrete and Masonry Foundation Dampproofing. Except where required to be waterproofed by 780 CMR 5406.2, foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be dampproofed from the top of the footing to the finished grade. Masonry *foundation* walls shall have not less than $\frac{3}{8}$ inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be damp-proofed with a bituminous coating, three pounds per square yard (1.63 kg/m^2) of acrylic modified cement, $\frac{1}{8}$ -inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887 or any material permitted for waterproofing in 780 CMR 5406.2. Concrete *foundation* walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in 780 CMR 5406.2 to the exterior of the wall.

5406.2 Concrete and Masonry Foundation

Waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose habitable or usable spaces located below grade shall be waterproofed with a membrane extending from the top of the footing to the finished grade. The membrane shall consist of two-ply hot-mopped felts, 55 pound (25 kg) roll roofing, six-mil (0.15 mm) polyvinyl chloride, six-mil (0.15 mm) polyethylene or 40-mil (1 mm) polymer-modified asphalt. The joints in the membrane shall be lapped and sealed with an adhesive compatible with the waterproofing membrane.

Exception: Organic solvent based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings are permitted to be used to seal ICF walls. Cold setting asphalt or hot asphalt shall conform to type C of ASTM D 449. Hot

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asphalt shall be applied at a temperature of less than 200°.

Through-wall formwork ties shall be removed from both faces of the foundation wall which enclose basements, cellars, below-grade garages or any space having the potential to be converted to useable or occupiable space and patched with hydraulic cement.

5406.3 Dampproofing for Wood Foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be dampproofed in accordance with 780 CMR 5406.3.1 through 5406.3.4.

5406.3.1 Panel Joint Sealed. Plywood panel joints in the foundation walls shall be sealed full length with a caulking compound capable of producing a moisture-proof seal under the conditions of temperature and moisture content at which it will be applied and used.

5406.3.2 Below grade moisture barrier. A six-mil-thick (0.15 mm) polyethylene film shall be applied over the below-grade portion of exterior foundation walls prior to backfilling. Joints in the polyethylene film shall be lapped six inches (152 mm) and sealed with adhesive. The top edge of the polyethylene film shall be bonded to the sheathing to form a seal. Film areas at grade level shall be protected from mechanical damage and exposure by a pressure preservatively treated lumber or plywood strip attached to the wall several inches above finish grade level and extending approximately nine inches (229 mm) below grade. The joint between the strip and the wall shall be caulked full length prior to fastening the strip to the wall. Other coverings appropriate to the architectural treatment may also be used. The polyethylene film shall extend down to the bottom of the wood footing plate but shall not overlap or extend into the gravel or crushed stone footing.

5406.3.3 Porous Fill. The space between the excavation and the foundation wall shall be backfilled with the same material used for footings, up to a height of one foot (305 mm) above the footing for well-drained sites, or Chap. ½ the total back-fill height for poorly drained sites. The porous fill shall be covered with strips of 30-pound (13.6 kg) asphalt paper or six-mil (0.15 mm) polyethylene to permit water seepage while avoiding infiltration of fine soils.

5406.3.4 Backfill. The remainder of the excavated area shall be backfilled with the same type of soil as was removed during the excavation.

780 CMR 5407 COLUMNS

5407.1 Wood Column Protection. Wood columns shall be protected against decay as set forth in

780 CMR 5319.

5407.2 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.

5407.3 Structural Requirements. Columns shall be restrained to prevent lateral displacement at the bottom *and top* end. 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 weight pipe or approved equivalent.

780 CMR 5408 UNDER-FLOOR SPACE

5408.1 Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls. The minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m² for each 100 m²) of under-floor space area. One such ventilating opening shall be within three feet (914 mm) of each corner of said building.

5408.2 Openings for Under-floor Ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot (0.0929 m²) for each 150 square feet (100 m²) of underfloor space area. One such ventilating opening shall be within three feet (914 mm) of each corner of the building. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed ¼ inch (6.4 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast iron grills or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being ⅛ inch (3.2 mm).

Exceptions:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings may be reduced to 1/1500 of the under-floor area where the ground surface is treated with an approved vapor retarder material and the required openings are placed so as to provide cross-ventilation of the space. The installation of operable louvers shall not be prohibited.

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3. Under-floor spaces used as supply plenums for distribution of heated and cooled air shall comply with the requirements of 780 CMR 6601.4.

4. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cfm (10 m^2) for each 50 square feet (1.02 L/s) of underfloor space floor area and ground surface is covered with an approved vapor retarder material.

5. Ventilation openings are not required when the ground surface is covered with an approved vapor retarder material, the space is supplied with conditioned air and the perimeter walls are insulated in accordance with 780 CMR 6102.1.7.

5408.3 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 18 inches by 24 inches ($457 \text{ mm} \times 610 \text{ mm}$). Openings through a perimeter wall shall be 16 inches by 24 inches ($407 \text{ mm} \times 610 \text{ mm}$). When any portion of the through wall access is below grade, an areaway of not less than 16 inches by 24 inches shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. See 780 CMR 6305.1.4 for access requirements where mechanical equipment is located under floors.

5408.4 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. All construction materials shall be removed before a building is occupied or used for any purpose.

5408.5 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 (152 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.

5408.6 Flood Resistance. For buildings located in areas prone to flooding as established *by the community Flood Insurance Rate Maps (FIRM)*.

1. Walls enclosing the underfloor space shall be provided with flood openings in accordance with 780 CMR 5323.2.2.

2. The finished ground level of the underfloor space shall be equal to or higher than the outside finished ground level.

Exception: Underfloor spaces that meet the requirements of FEMA/FIA TB 11-1.

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NON-TEXT PAGE

780 CMR 55.00

FLOORS

780 CMR 5501 GENERAL

5501.1 Application. The provisions of 780 CMR 55.00 shall control the design and construction of the floors for all buildings including the floors of attic spaces used to house mechanical and/or plumbing fixtures and equipment.

5501.2 Requirements. Floor construction shall be capable of accommodating all loads according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

780 CMR 5502 WOOD FLOOR FRAMING

5502.1 Identification. Load-bearing dimension lumber for joists, beams and girders shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20.

In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780CMR 5502 shall be accepted.

5502.1.1 Preservatively Treated Lumber. Preservatively treated dimension lumber shall also be identified as required by 780 CMR 5319.1.

5502.1.2 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.

5502.1.3 End-jointed Lumber. Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5501.2 may be used interchangeably with solid-sawn members of the same species and grade.

5502.1.4 Prefabricated Wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D 5055.

5502.1.5 Structural Glued Laminated Timbers. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

5502.2 Design and Construction. Floors shall be designed and constructed in accordance with the provisions of 780 CMR 55.00, 780 CMR

Figure 5502.2 and 780 CMR 5319 and 5320 or in accordance with AF&PA/NDS.

5502.2.1 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in 780 CMR Table 5301.5 acting on the cantilevered portion of the deck *and no live load on the interior span*.

5502.3 Allowable Joist Spans. Spans for floor joists shall be in accordance with 780 CMR Tables 5502.3.1(1) and 5502.3.1(2). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists & Rafters.

5502.3.1 Sleeping Areas and Attic Joists. 780 CMR Table 5502.3.1(1) shall be utilized to determine the maximum allowable span of floor joists that support sleeping areas and attics that are accessed by means of a fixed stairway provided that the design live load does not exceed 30 psf (1.44 kN/m^2) and the design dead load does not exceed 10 psf (0.48 kN/m^2). The allowable span of ceiling joists that support attics utilized for limited storage or no storage shall be determined in accordance with 780 CMR 5802.4.

5502.3.2 Other Floor Joists. 780 CMR Table 5502.3.1(2) shall be utilized to determine the maximum allowable span of floor joists that support all areas of the building, other than sleeping and attics, provided that the design live load does not exceed 40 psf (1.92 kN/m^2) and the design dead does not exceed ten psf (0.48 kN/m^2).

5502.3.3 Floor Cantilevers. Floor cantilever spans shall not exceed the nominal depth of the wood floor joist. Floor cantilevers constructed in accordance with 780 CMR Table 5502.3.3(1) shall be permitted when supporting a

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light-frame bearing wall and roof only. Floor cantilevers supporting an exterior balcony are

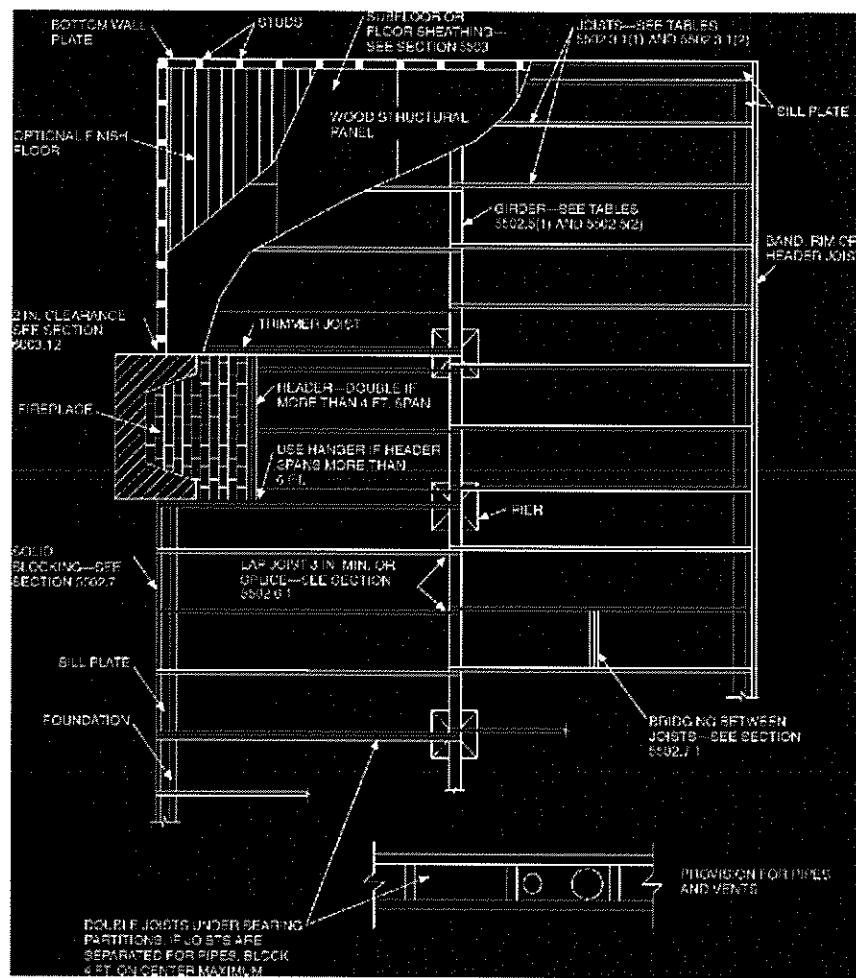
5502.4 Joists under Bearing Partitions. Joists under parallel bearing partitions shall be of adequate size to support the load. Double joists, sized to adequately support the load, that are separated to permit the installation of piping or vents shall be full depth solid blocked with lumber not less than two inches (51 mm) in nominal thickness spaced not more than four feet (1219 mm) on center. Bearing partitions perpendicular to joists shall not be offset from

permitted to be constructed in accordance with 780 CMR Table 5502.3.3(2).

supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

5502.5 Allowable Girder Spans. The allowable spans of girders fabricated of dimension lumber shall not exceed the values set forth in 780 CMR Tables 5502.5(1) and 5502.5(2).

780 CMR FIGURE 5502.2
FLOOR CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

780 CMR TABLE 5502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential Sleeping Areas, Live Load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
		2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
		Maximum floor joist spans							
12	Douglas fir-larch SS	12- 6	16- 6	21- 0	25- 7	12- 6	16- 6	21- 0	25- 7
	Douglas fir-larch #1	12- 0	15-10	20- 3	24- 8	12- 0	15- 7	19- 0	22- 0
	Douglas fir-larch #2	11-10	15- 7	19-10	23- 0	11- 6	14- 7	17- 9	20- 7
	Douglas fir-larch #3	9- 8	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
	Hem-fir SS	11-10	15- 7	19-10	24- 2	11-10	15- 7	19-10	24- 2
	Hem-fir #1	11- 7	15- 3	19- 5	23- 7	11- 7	15- 2	18- 6	21- 6
	Hem-fir #2	11- 0	14- 6	18- 6	22- 6	11- 0	14- 4	17- 6	20- 4
	Hem-fir #3	9- 8	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
	Southern pine SS	12- 3	16- 2	20- 8	25- 1	12- 3	16- 2	20- 8	25- 1
	Southern pine #1	12- 0	15-10	20- 3	24- 8	12- 0	15-10	20- 3	24- 8
	Southern pine #2	11-10	15- 7	19-10	24- 2	11-10	15- 7	18- 7	21- 9
	Southern pine #3	10- 5	13- 3	15- 8	18- 8	9- 4	11-11	14- 0	16- 8
	Spruce-pine-fir SS	11- 7	15- 3	19- 5	23- 7	11- 7	15- 3	19- 5	23- 7
	Spruce-pine-fir #1	11- 3	14-11	19- 0	23- 0	11- 3	14- 7	17- 9	20- 7
	Spruce-pine-fir #2	11- 3	14-11	19- 0	23- 0	11- 3	14- 7	17- 9	20- 7
	Spruce-pine-fir #3	9- 8	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
16	Douglas fir-larch SS	11- 4	15- 0	19- 1	23- 3	11- 4	15- 0	19- 1	23- 0
	Douglas fir-larch #1	10-11	14- 5	18- 5	21- 4	10- 8	13- 6	16- 5	19- 1
	Douglas fir-larch #2	10- 9	14- 1	17- 2	19-11	9- 11	12- 7	15- 5	17-10
	Douglas fir-larch #3	8- 5	10- 8	13- 0	15- 1	7- 6	9- 6	11- 8	13- 6
	Hem-fir SS	10- 9	14- 2	18- 0	21-11	10- 9	14- 2	18- 0	21-11
	Hem-fir #1	10- 6	13-10	17- 8	20- 9	10- 4	13- 1	16- 0	18- 7
	Hem-fir #2	10- 0	13- 2	16-10	19- 8	9- 10	12- 5	15- 2	17- 7
	Hem-fir #3	8- 5	10- 8	13- 0	15- 1	7- 6	9- 6	11- 8	13- 6
	Southern pine SS	11- 2	14- 8	18- 9	22-10	11- 2	14- 8	18- 9	22-10
	Southern pine #1	10-11	14- 5	18- 5	22- 5	10-11	14- 5	17-11	21- 4
	Southern pine #2	10- 9	14- 2	18- 0	21- 1	10- 5	13- 6	16- 1	18-10
	Southern pine #3	9- 0	11- 6	13- 7	16- 2	8- 1	10- 3	12- 2	14- 6
	Spruce-pine-fir SS	10- 6	13-10	17- 8	21- 6	10- 6	13-10	17- 8	21- 4
	Spruce-pine-fir #1	10- 3	13- 6	17- 2	19-11	9- 11	12- 7	15- 5	17-10
	Spruce-pine-fir #2	10- 3	13- 6	17- 2	19-11	9- 11	12- 7	15- 5	17-10
	Spruce-pine-fir #3	8- 5	10- 8	13- 0	15- 1	7- 6	9- 6	11- 8	13- 6
19.2	Douglas fir-larch SS	10- 8	14- 1	18- 0	21-10	10- 8	14- 1	18- 0	21- 0
	Douglas fir-larch #1	10- 4	13- 7	16- 9	19- 6	9- 8	12- 4	15- 0	17- 5
	Douglas fir-larch #2	10- 1	12-10	15- 8	18- 3	9- 1	11- 6	14- 1	16- 3
	Douglas fir-larch #3	7- 8	9- 9	11-10	13- 9	6-10	8- 8	10- 7	12- 4
	Hem-fir SS	10- 1	13- 4	17- 0	20- 8	10- 1	13- 4	17- 0	20- 7
	Hem-fir #1	9- 10	13- 0	16- 4	19- 0	9- 6	12- 0	14- 8	17- 0
	Hem-fir #2	9- 5	12- 5	15- 6	17- 1	8- 11	11- 4	13- 10	16- 1
	Hem-fir #3	7- 8	9- 9	11-10	13- 9	6-10	8- 8	10- 7	12- 4
	Southern pine SS	10- 6	13-10	17- 8	21- 6	10- 6	13-10	17- 8	21- 6
	Southern pine #1	10- 4	13- 7	17- 4	21- 1	10- 4	13- 7	16- 4	19- 6
	Southern pine #2	10- 1	13- 4	16- 5	19- 3	9- 6	12- 4	14- 8	17- 2
	Southern pine #3	8- 3	10- 6	12- 5	14- 9	7- 4	9- 5	11- 1	13- 2
	Spruce-pine-fir SS	9- 10	13- 0	16- 7	20- 2	9- 10	13- 0	16- 7	19- 6
	Spruce-pine-fir #1	9- 8	12- 9	15- 8	18- 3	9- 1	11- 6	14- 1	16- 3
	Spruce-pine-fir #2	9- 8	12- 9	15- 8	18- 3	9- 1	11- 6	14- 1	16- 3
	Spruce-pine-fir #3	7- 8	9- 9	11-10	13- 9	6-10	8- 8	10- 7	12- 4
24	Douglas fir-larch SS	9-11	13- 1	16- 8	20- 3	9-11	13- 1	16- 2	18- 9
	Douglas fir-larch #1	9- 7	12- 4	15- 0	17- 5	8- 8	11- 0	13- 5	15- 7
	Douglas fir-larch #2	9- 1	11- 6	14- 1	16- 3	8- 1	10- 3	12- 7	14- 7
	Douglas fir-larch #3	6-10	8- 8	10- 7	12- 4	6- 2	7- 9	9- 6	11- 0
	Hem-fir SS	9- 4	12- 4	15- 9	19- 2	9- 4	12- 4	15- 9	18- 5
	Hem-fir #1	9- 2	12- 0	14- 8	17- 0	8- 6	10- 9	13- 1	15- 2
	Hem-fir #2	8- 9	11- 4	13-10	16- 1	8- 0	10- 2	12- 5	14- 4
	Hem-fir #3	6-10	8- 8	10- 7	12- 4	6- 2	7- 9	9- 6	11- 0
	Southern pine SS	9- 9	12-10	16- 5	19-11	9- 9	12-10	16- 5	19-11
	Southern pine #1	9- 7	12- 7	16- 1	19- 6	9- 7	12- 4	14- 7	17- 5

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Spruce-pine-fir #2	8- 11	11- 6	14- 1	16- 3	8- 1	10- 3	12- 7	14- 7
Spruce-pine-fir #3	6- 10	8- 8	10- 7	12- 4	6- 2	7- 9	9- 6	11- 0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m². NOTE: Check sources for availability of lumber in lengths greater than 20 feet.

780 CMR TABLE 5502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/A = 360)

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
		2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
		Maximum floor joist spans							
12	Douglas fir-larch SS	11- 4	15- 0	19- 1	23- 3	11- 4	15- 0	19- 1	23- 3
	Douglas fir-larch #1	10- 11	14- 5	18- 5	22- 0	10- 11	14- 2	17- 4	20- 1
	Douglas fir-larch #2	10- 9	14- 2	17- 9	20- 7	10- 6	13- 3	16- 3	18-10
	Douglas fir-larch #3	8- 8	11- 0	13- 5	15- 7	7- 11	10- 0	12- 3	14- 3
	Hem-fir SS	10- 9	14- 2	18- 0	21-11	10- 9	14- 2	18- 0	21-11
	Hem-fir #1	10- 6	13- 10	17- 8	21- 6	10- 6	13- 10	16-11	19- 7
	Hem-fir #2	10- 0	13- 2	16-10	20- 4	10- 0	13- 1	16- 0	18- 6
	Hem-fir #3	8- 8	11- 0	13- 5	15- 7	7- 11	10- 0	12- 3	14- 3
	Southern pine SS	11- 2	14- 8	18- 9	22-10	11- 2	14- 8	18- 9	22-10
	Southern pine #1	10- 11	14- 5	18- 5	22- 5	10- 11	14- 5	18- 5	22- 5
	Southern pine #2	10- 9	14- 2	18- 0	21- 9	10- 9	14- 2	16-11	19-10
	Southern pine #3	9- 4	11- 11	14- 0	16- 8	8- 6	10- 10	12- 10	15- 3
	Spruce-pine-fir SS	10- 6	13- 10	17- 8	21- 6	10- 6	13- 10	17- 8	21- 6
	Spruce-pine-fir #1	10- 3	13- 6	17- 3	20- 7	10- 3	13- 3	16- 3	18-10
	Spruce-pine-fir #2	10- 3	13- 6	17- 3	20- 7	10- 3	13- 3	16- 3	18-10
	Spruce-pine-fir #3	8- 8	11- 0	13- 5	15- 7	7- 11	10- 0	12- 3	14- 3
16	Douglas fir-larch SS	10- 4	13- 7	17- 4	21- 1	10- 4	13- 7	17- 4	21- 0
	Douglas fir-larch #1	9- 11	13- 1	16- 5	19- 1	9- 8	12- 4	15- 0	17- 5
	Douglas fir-larch #2	9- 9	12- 7	15- 5	17-10	9- 1	11- 6	14- 1	16- 3
	Douglas fir-larch #3	7- 6	9- 6	11- 8	13- 6	6- 10	8- 8	10- 7	12- 4
	Hem-fir SS	9- 9	12- 10	16- 5	19-11	9- 9	12- 10	16- 5	19-11
	Hem-fir #1	9- 6	12- 7	16- 0	18- 7	9- 6	12- 0	14- 8	17- 0
	Hem-fir #2	9- 1	12- 0	15- 2	17- 7	8- 11	11- 4	13- 10	16- 1
	Hem-fir #3	7- 6	9- 6	11- 8	13- 6	6- 10	8- 8	10- 7	12- 4
	Southern pine SS	10- 2	13- 4	17- 0	20- 9	10- 2	13- 4	17- 0	20- 9
	Southern pine #1	9- 11	13- 1	16- 9	20- 4	9- 11	13- 1	16- 4	19- 6
	Southern pine #2	9- 9	12- 10	16- 1	18-10	9- 6	12- 4	14- 8	17- 2
	Southern pine #3	8- 1	10- 3	12- 2	14- 6	7- 4	9- 5	11- 1	13- 2
	Spruce-pine-fir SS	9- 6	12- 7	16- 0	19- 6	9- 6	12- 7	16- 0	19- 6
	Spruce-pine-fir #1	9- 4	12- 3	15- 5	17-10	9- 1	11- 6	14- 1	16- 3
	Spruce-pine-fir #2	9- 4	12- 3	15- 5	17-10	9- 1	11- 6	14- 1	16- 3
	Spruce-pine-fir #3	7- 6	9- 6	11- 8	13- 6	6- 10	8- 8	10- 7	12- 4
19.2	Douglas fir-larch SS	9- 8	12- 10	16- 4	19-10	9- 8	12- 10	16- 4	19- 2
	Douglas fir-larch #1	9- 4	12- 4	15- 0	17- 5	8- 10	11- 3	13- 8	15-11
	Douglas fir-larch #2	9- 1	11- 6	14- 1	16- 3	8- 3	10- 6	12- 10	14-10
	Douglas fir-larch #3	6- 10	8- 8	10- 7	12- 4	6- 3	7- 11	9- 8	11- 3
	Hem-fir SS	9- 2	12- 1	15- 5	18- 9	9- 2	12- 1	15- 5	18- 9
	Hem-fir #1	9- 0	11- 10	14- 8	17- 0	8- 8	10- 11	13- 4	15- 6
	Hem-fir #2	8- 7	11- 3	13- 10	16- 1	8- 2	10- 4	12- 8	14- 8
	Hem-fir #3	6- 10	8- 8	10- 7	12- 4	6- 3	7- 11	9- 8	11- 3
	Southern pine SS	9- 6	12- 7	16- 0	19- 6	9- 6	12- 7	16- 0	19- 6
	Southern pine #1	9- 4	12- 4	15- 9	19- 2	9- 4	12- 4	14-11	17- 9
	Southern pine #2	9- 2	12- 1	14- 8	17- 2	8- 8	11- 3	13- 5	15- 8
	Southern pine #3	7- 4	9- 5	11- 1	13- 2	6- 9	8- 7	10- 1	12- 1
	Spruce-pine-fir SS	9- 0	11- 10	15- 1	18- 4	9- 0	11- 10	15- 1	17- 9
	Spruce-pine-fir #1	8- 9	11- 6	14- 1	16- 3	8- 3	10- 6	12- 10	14-10
	Spruce-pine-fir #2	8- 9	11- 6	14- 1	16- 3	8- 3	10- 6	12- 10	14-10
	Spruce-pine-fir #3	6- 10	8- 8	10- 7	12- 4	6- 3	7- 11	9- 8	11- 3
24	Douglas fir-larch SS	9- 0	11- 11	15- 2	18- 5	9- 0	11- 11	14- 9	17- 1
	Douglas fir-larch #1	8- 8	11- 0	13- 5	15- 7	7- 11	10- 0	12- 3	14- 3
	Douglas fir-larch #2	8- 1	10- 3	12- 7	14- 7	7- 5	9- 5	11- 6	13- 4
	Douglas fir-larch #3	6- 2	7- 9	9- 6	11- 0	5- 7	7- 1	8- 8	10- 1
	Hem-fir SS	8- 6	11- 3	14- 4	17- 5	8- 6	11- 3	14- 4	16-10 ^a
	Hem-fir #1	8- 4	10- 9	13- 1	15- 2	7- 9	9- 9	11- 11	13- 10
	Hem-fir #2	7- 11	10- 2	12- 5	14- 4	7- 4	9- 3	11- 4	13- 1
	Hem-fir #3	6- 2	7- 9	9- 6	11- 0	5- 7	7- 1	8- 8	10- 1
24	Southern pine SS	8- 10	11- 8	14-11	18- 1	8- 10	11- 8	14-11	18- 1
	Southern pine #1	8- 8	11- 5	14- 7	17- 5	8- 8	11- 3	13- 4	15-11

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FLOORS

Southern pine	#2	8- 6	11- 0	13- 1	15- 5	7- 9	10- 0	12- 0	14- 0
Southern pine	#3	6- 7	8- 5	9- 11	11- 10	6- 0	7- 8	9- 1	10- 9
Spruce-pine-fir	SS	8- 4	11- 0	14- 0	17- 0	8- 4	11- 0	13- 8	15-11
Spruce-pine-fir	#1	8- 1	10- 3	12- 7	14- 7	7- 5	9- 5	11- 6	13- 4
Spruce-pine-fir	#2	8- 1	10- 3	12- 7	14- 7	7- 5	9- 5	11- 6	13- 4
Spruce-pine-fir	#3	6- 2	7- 9	9- 6	11- 0	5- 7	7- 1	8- 8	10- 1

NOTE: Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m². a. End bearing length shall be increased to 2 inches.

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780 CMR TABLE 5502.3.3(1) CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME

**EXTERIOR BEARING WALL AND ROOF ONLY^{a,b,c,f,g,h}
(Floor Live Load ≤ 40 psf, Roof Live Load ≤ 20 psf)**

Member & Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.) ^{d,e}											
	Ground Snow Load											
	≤20 psf			30 psf			50 psf			70 psf		
	Roof Width			Roof Width			Roof Width			Roof Width		
	24 ft.	32 ft.	40 ft.	24 ft.	32 ft.	40 ft.	24 ft.	32 ft.	40 ft.	24 ft.	32 ft.	40 ft.
2 x 8 @ 12"	20" (177)	15" (227)	—	18" (209)	—	—	—	—	—	—	—	—
2 x 10 @ 16"	29" (228)	21" (297)	16" (364)	26" (271)	18" (354)	—	20" (375)	—	—	—	—	—
2 x 10 @ 12"	36" (166)	26" (219)	20" (270)	34" (198)	22" (263)	16" (324)	26" (277)	—	—	19" (356)	—	—
2 x 12 @ 16"	—	32" (287)	25" (356)	36" (263)	29" (345)	21" (428)	29" (367)	20" (484)	—	23" (471)	—	—
2 x 12 @ 12"	—	42" (209)	31" (263)	—	37" (253)	27" (317)	36" (271)	27" (358)	17" (447)	31" (348)	19" (462)	—
2 x 12 @ 8"	—	48" (136)	45" (169)	—	48" (164)	38" (206)	—	40" (233)	26" (294)	36" (230)	29" (304)	18" (379)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- a. Tabulated values are for clear-span roof supported solely by exterior bearing walls.
- b. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine, and spruce-pine-fir for repetitive (three or more) members.
- c. Ratio of backspan to cantilever span shall be at least 3:1.
- d. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- e. Uplift force is for a backspan to cantilever span ratio of 3:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to three divided by the actual backspan ratio provided (3/backspan ratio).
- f. Reserved.
- g. A full-depth rim joist shall be provided at the cantilevered end of the joists. Solid blocking shall be provided at the cantilever support.
- h. Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

**780 CMR TABLE 5502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY^{a,b,c,f}**

Member Size	Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.) ^{c,d}		
		Ground Snow Load		
		≤30 psf	50 psf	70 psf
2 x 8	12"	42" (139)	39" (156)	34" (165)
2 x 8	16"	36" (151)	34" (171)	29" (180)
2 x 10	12"	61" (164)	57" (189)	49" (201)
2 x 10	16"	53" (180)	49" (208)	42" (220)
2 x 10	24"	43" (212)	40" (241)	34" (255)
2 x 12	16"	72" (228)	67" (260)	57" (268)
2 x 12	24"	58" (279)	54" (319)	47" (330)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- a. Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, southern pine, and spruce-pine-fir for repetitive (3 or more) members.
- b. Ratio of backspan to cantilever span shall be at least 2:1.
- c. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- d. Uplift force is for a backspan to cantilever span ratio of 2:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to two divided by the actual backspan ratio provided (2/backspan ratio).
- e. A full-depth rim joist shall be provided at the cantilevered end of the joists. Solid blocking shall be provided at the cantilevered support.
- f. Linear interpolation shall be permitted for ground snow loads other than shown.

780 CMR TABLE 5502.5(1)
GIRDER SPANS^a AND HEADER SPANS^a FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir^b
and required number of jack studs)

GIRDERS AND HEADERSSU PPORTING	SIZE	GROUND SNOW LOAD (psf) ^c											
		30						50					
		Building width ^c (feet)											
		20		28		36		20		28		36	
Span		N.J. ^d		Span		N.J. ^d		Span		N.J. ^d		Span	
Roof and ceiling	2-2 x 4	3- 6	1	3- 2	1	2- 10	1	3- 2	1	2- 9	1	2- 6	1
	2-2 x 6	5- 5	1	4- 8	1	4- 2	1	4- 8	1	4- 0	1	3- 8	2
	2-2 x 8	6- 10	1	5- 11	2	5- 4	2	5- 11	2	5- 2	2	4- 7	2
	2-2 x 10	8- 5	2	7- 3	2	6- 6	2	7- 3	2	6- 3	2	5- 7	2
	2-2 x 12	9- 9	2	8- 5	2	7- 6	2	8- 5	2	7- 3	2	6- 6	2
	3-2 x 8	8- 4	1	7- 5	1	6- 8	1	7- 5	1	6- 5	2	5- 9	2
	3-2 x 10	10- 6	1	9- 1	2	8- 2	2	9- 1	2	7- 10	2	7- 0	2
	3-2 x 12	12- 2	2	10- 7	2	9- 5	2	10- 7	2	9- 2	2	8- 2	2
	4-2 x 8	7- 0	1	6- 1	2	5- 5	2	6- 1	2	5- 3	2	4- 8	2
	4-2 x 10	11- 8	1	10- 6	1	9- 5	2	10- 6	1	9- 1	2	8- 2	2
	4-2 x 12	14-1	1	12- 2	2	10- 11	2	12- 2	2	10- 7	2	9- 5	2
Roof, ceiling and one center-bearing floor	2-2 x 4	3- 1	1	2- 9	1	2- 5	1	2- 9	1	2- 5	1	2- 2	1
	2-2 x 6	4- 6	1	4- 0	1	3- 7	2	4- 0	1	3- 7	2	3- 3	2
	2-2 x 8	5- 9	2	5- 0	2	4- 6	2	5- 2	2	4- 6	2	4- 0	2
	2-2 x 10	7- 0	2	6- 2	2	5- 6	2	6- 4	2	5- 6	2	5- 0	2
	2-2 x 12	8- 1	2	7- 1	2	6- 5	2	7- 4	2	6- 5	2	5- 9	3
	3-2 x 8	7- 2	1	6- 3	2	5- 8	2	6- 5	2	5- 8	2	5- 1	2
	3-2 x 10	8- 9	2	7- 8	2	6- 11	2	7- 11	2	6- 11	2	6- 3	2
	3-2 x 12	10- 2	2	8- 11	2	8- 1	2	9- 2	2	8- 1	2	7- 3	2
	4-2 x 8	5- 10	2	5- 2	2	4- 8	2	5- 3	2	4- 7	2	4- 2	2
	4-2 x 10	10- 1	1	8- 10	2	8- 1	2	9- 1	2	8- 1	2	7- 2	2
	4-2 x 12	11- 9	2	10- 3	2	9- 3	2	10- 7	2	9- 3	2	8- 4	2
Roof, ceiling and one clear span floor	2-2 x 4	2- 8	1	2- 4	1	2- 1	1	2- 7	1	2- 3	1	2- 1	1
	2-2 x 6	3- 11	1	3- 5	2	3- 1	2	3- 10	2	3- 4	2	3- 1	2
	2-2 x 8	5- 0	2	4- 4	2	3- 10	2	4- 10	2	4- 2	2	3- 9	2
	2-2 x 10	6- 1	2	5- 3	2	4- 8	2	5- 11	2	5- 1	2	4- 7	3
	2-2 x 12	7- 1	2	6- 1	3	5- 5	3	6- 10	2	5- 11	3	5- 4	3
	3-2 x 8	6- 3	2	5- 5	2	4- 10	2	6- 1	2	5- 3	2	4- 8	2
	3-2 x 10	7- 7	2	6- 7	2	5- 11	2	7- 5	2	6- 5	2	5- 9	2
	3-2 x 12	8- 10	2	7- 8	2	6- 10	2	8- 7	2	7- 5	2	6- 8	2
	4-2 x 8	5- 1	2	4- 5	2	3- 11	2	4- 11	2	4- 3	2	3- 10	2
	4-2 x 10	8- 9	2	7- 7	2	6- 10	2	8- 7	2	7- 5	2	6- 7	2
	4-2 x 12	10- 2	2	8- 10	2	7- 11	2	9- 11	2	8- 7	2	7- 8	2
Roof, ceiling and two center-bearing floors	2-2 x 4	2- 7	1	2- 3	1	2- 1	1	2- 6	1	2- 2	1	1- 11	1
	2-2 x 6	3- 9	2	3- 3	2	2- 11	2	3- 8	2	3- 2	2	2- 10	2
	2-2 x 8	4- 9	2	4- 2	2	3- 9	2	4- 7	2	4- 0	2	3- 8	2
	2-2 x 10	5- 9	2	5- 1	2	4- 7	3	5- 8	2	4- 11	2	4- 5	3
	2-2 x 12	6- 8	2	5- 10	3	5- 3	3	6- 6	2	5- 9	3	5- 2	3
	3-2 x 8	5- 11	2	5- 2	2	4- 8	2	5- 9	2	5- 1	2	4- 7	2
	3-2 x 10	7- 3	2	6- 4	2	5- 8	2	7- 1	2	6- 2	2	5- 7	2
	3-2 x 12	8- 5	2	7- 4	2	6- 7	2	8- 2	2	7- 2	2	6- 5	3
	4-2 x 8	4- 10	2	4- 3	2	3- 10	2	4- 9	2	4- 2	2	3- 9	2
	4-2 x 10	8- 4	2	7- 4	2	6- 7	2	8- 2	2	7- 2	2	6- 5	2
	4-2 x 12	9- 8	2	8- 6	2	7- 8	2	9- 5	2	8- 3	2	7- 5	2
Roof, ceiling and two clear span floor	2-2 x 4	2- 7	1	1- 8	1	1- 6	2	2- 0	1	1- 8	1	1- 5	2
	2-2 x 6	3- 1	2	2- 8	2	2- 4	2	3- 0	2	2- 7	2	2- 3	2
	2-2 x 8	3- 10	2	3- 4	3	3- 0	3	3- 10	2	3- 4	2	2- 11	3
	2-2 x 10	4- 9	2	4- 1	3	3- 8	3	4- 8	2	4- 0	3	3- 7	3
	2-2 x 12	5- 6	3	4- 9	3	4- 3	3	5- 5	3	4- 8	3	4- 2	3
	3-2 x 8	4- 10	2	4- 2	2	3- 9	2	4- 9	2	4- 1	2	3- 8	2
	3-2 x 10	5- 11	2	5- 1	2	4- 7	3	5- 10	2	5- 0	2	4- 6	3
	3-2 x 12	6- 10	2	5- 11	3	5- 4	3	6- 9	2	5- 10	3	5- 3	3
	4-2 x 8	5- 7	2	4- 10	2	4- 4	2	5- 6	2	4- 9	2	4- 3	2
	4-2 x 10	6- 10	2	5- 11	2	5- 3	2	6- 9	2	5- 10	2	5- 2	2
	4-2 x 12	7- 11	2	6- 10	2	6- 2	3	7- 9	2	6- 9	2	6- 0	3

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

a. Spans are given in feet and inches.

b. Tabulated values assume #2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

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- d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
- e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

780 CMR TABLE 5502.5(2)
GIRDER SPANS^a AND HEADER SPANS^a FOR INTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir^b
and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING WIDTH ^c (feet)					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
One floor only	2-2 x 4	3- 1	1	2- 8	1	2- 5	1
	2-2 x 6	4- 6	1	3- 11	1	3- 6	1
	2-2 x 8	5- 9	1	5- 0	2	4- 5	2
	2-2 x 10	7- 0	2	6- 1	2	5- 5	2
	2-2 x 12	8- 1	2	7- 0	2	6- 3	2
	3-2 x 8	7- 2	1	6- 3	1	5- 7	2
	3-2 x 10	8- 9	1	7- 7	2	6- 9	2
	3-2 x 12	10- 2	2	8- 10	2	7- 10	2
	4-2 x 8	9- 1	1	7- 8	1	6- 9	1
	4-2 x 10	10- 1	1	8- 9	1	7- 10	2
	4-2 x 12	11- 9	1	10- 2	2	9- 1	2
	2-2 x 4	2- 2	1	1- 10	1	1- 7	1
	2-2 x 6	3- 2	2	2- 9	2	2- 5	2
	2-2 x 8	4- 0	2	3- 6	2	3- 2	2
Two floors	2-2 x 10	4- 11	2	4- 3	2	3- 10	3
	2-2 x 12	5- 9	2	5- 0	3	4- 5	3
	3-2 x 8	5- 1	2	4- 5	2	3- 11	2
	3-2 x 10	6- 2	2	5- 4	2	4- 10	2
	3-2 x 12	7- 2	2	6- 3	2	5- 7	3
	4-2 x 8	6- 1	1	5- 3	2	4- 8	2
	4-2 x 10	7- 2	2	6- 2	2	5- 6	2
	4-2 x 12	8- 4	2	7- 2	2	6- 5	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches.

b. Tabulated values assume #2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

5502.6 Bearing. The ends of each joist, beam or girder shall have not less than 1.5 inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry or concrete except where supported on a one-inch-by-four-inch (25.4 mm by 102 mm) ribbon strip and nailed to the adjacent stud or by the use of approved joist hangers.

5502.6.1 Floor Systems. Joists framing from opposite sides over a bearing support shall lap a minimum of three inches (76 mm) and shall be nailed together with a minimum three 10d face nails. A wood or metal splice with strength equal to or greater than that provided by the nailed lap is permitted.

5502.6.2 Joist Framing. Joists framing into the side of a wood girder shall be supported by approved framing anchors or on ledger strips

not less than nominal two inches by two inches (51 mm by 51 mm).

5502.7 Lateral restraint at supports. Joists shall be supported laterally at the ends and intermediate supports by full-depth solid blocking not less than two inches (51 mm) nominal in 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.

5502.7.1 Bridging. Joists exceeding a nominal 2 inches by 12 inches (51 mm by 305 mm) shall be supported laterally by solid blocking, diagonal bridging (wood or metal), or a continuous one-inch-by-three-inch (25.4 mm by 76 mm) strip nailed across the bottom of joists perpendicular to joists at intervals not exceeding eight feet (2438 mm).

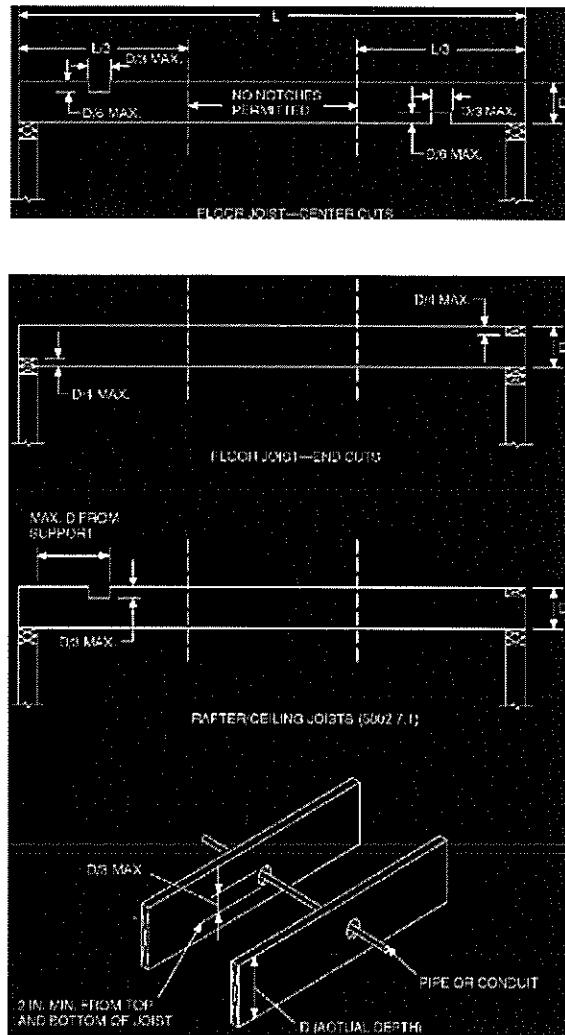
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5502.8 Drilling and Notching. Structural floor members shall not be cut, bored or notched in excess of the limitations specified in 780CMR 5502. See 780 CMR Figure 5502.8.

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780 CMR FIGURE 5502.8
CUTTING, NOTCHING AND DRILLING



For SI: 1 inch = 25.4 mm.

5502.8.1 Sawn Lumber. Notches in solid lumber joists, rafters and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member and shall not be located in the middle one-third of the span. Notches at the ends of the member shall not exceed $\frac{1}{4}$ the depth of the member. The tension side of members four inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of holes bored or cut into members shall not exceed the depth of the member. Holes shall not be closer than two inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than two inches (51 mm) to the notch.

5502.8.2 Engineered Wood Products. Cuts, notches and holes bored in trusses, laminated veneer lumber, glue-laminated members or I-joists are not permitted unless the effects of such penetrations are specifically considered in the design of the member.

5502.9 Fastening. Floor framing shall be nailed in accordance with 780 CMR Table 5602.3(1). 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.

5502.10 Framing of Openings. Openings in floor framing shall be framed with a header and trimmer joists. When the header joist span does not exceed four feet (1219 mm), the header joist may be a single member the same size as the floor joist. Single trimmer joists may be used to carry a single header joist that is located within three feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds four feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds six feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than two inches by two inches (51 mm by 51 mm).

5502.11 Wood Trusses.

5502.11.1 Design. *Wood trusses shall be designed in accordance with approved engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a Massachusetts-registered architect or registered professional engineer.*

Massachusetts-registered architect or registered professional engineer.

5502.11.2 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with the Building Component Safety Information (BCSI 1-03) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses*.

5502.11.3 Alterations to Trusses. Truss members and components shall not be cut, notched, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater, etc.), that exceed the design load for the truss, shall not be permitted without verification that the truss is capable of supporting the additional loading.

5502.11.4 Truss Design Drawings. Truss design drawings, prepared in compliance with 780 CMR 5502.11.1, shall be provided to the building official and approved prior to installation. Truss design drawing shall be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the information specified in 780 CMR 5502.11.4.1 through .12:

1. Slope or depth, span, and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.
 - 4.1. Top chord live load (including snow loads).
 - 4.2. Top chord dead load.
 - 4.3. Bottom chord live load.
 - 4.4. Bottom chord dead load.
 - 4.5. Concentrated loads and their points of application.
- 4.6. *Controlling wind loads.*
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description (e.g., size, thickness or gauge); and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:
 - 9.1. Truss-to-truss girder.

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- 9.2. Truss ply-to-ply.
- 9.3. Field splices.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss drawing or on supplemental documents.
12. Required permanent truss member bracing location.

5502.12 Draftstopping Required. When there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m^2). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

5502.12.1 Materials. Draftstopping materials shall not be less than $\frac{1}{2}$ -inch (12.7 mm) gypsum board, $\frac{1}{2}$ -inch (9.5 mm) wood structural panels, $\frac{1}{2}$ -inch (9.5 mm) Type 2-M-W particleboard or other approved materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise approved by the building official. The integrity of all draftstops shall be maintained.

5502.13 Fireblocking Required. Fireblocking shall be provided in wood-frame floor construction and floor-ceiling assemblies in accordance with 780 CMR 5602.8.

780 CMR 5503 FLOOR SHEATHING

5503.1 Lumber Sheathing. Maximum allowable spans for lumber used as floor sheathing shall conform to 780 CMR Tables 5503.1, 5503.2.1.1(1) and 5503.2.1.1(2).

780 CMR TABLE 5503.1 MINIMUM THICKNESS OF LUMBER FLOOR SHEATHING

JOIST OR BEAM SPACING (inches)	MINIMUM NET THICKNESS	
	Perpendicular to joist	Diagonal to joist
24	$\frac{11}{16}$	$\frac{3}{4}$
16	—	—
48 ^a	—	—
54 ^b	1½ T & G	N/A

10. Calculated deflection ratio and/or maximum deflection for live and total load.

60°

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa.

- a. For this support spacing, lumber sheathing shall have a minimum F_b of 675 and minimum E of 1,100,000 (see AF&PA/NDS).
- b. For this support spacing, lumber sheathing shall have a minimum F_b of 765 and minimum E of 1,400,000 (see AF&PA/NDS).
- c. For this support spacing, lumber sheathing shall have a minimum F_b of 855 and minimum E of 1,700,000 (see AF&PA/NDS).

5503.1.1 End Joints. End joints in lumber used as subflooring shall occur over supports unless end-matched lumber is used, in which case each piece shall bear on at least two joists. Subflooring may be omitted when joist spacing does not exceed 16 inches (406 mm) and a 1-inch (25.4 mm) nominal tongue-and-groove wood strip flooring is applied perpendicular to the joists.

5503.2 Wood Structural Panel Sheathing.

5503.2.1 Identification and Grade. Wood structural panel sheathing used for structural purposes shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA 0437 or CSA 0325. All panels shall be identified by a grade mark or certificate of inspection issued by an approved agency.

5503.2.1.1 Subfloor and Combined Subfloor Underlayment. Where used as subflooring or combination subfloor underlayment, wood structural panels shall be of one of the grades specified in 780 CMR Table 5503.2.1.1(1). When sanded plywood is used as combination subfloor underlayment, the grade shall be as specified in Table 5503.2.1.1(2).

5503.2.2 Allowable Spans. The maximum allowable span for wood structural panels used as subfloor or combination subfloor underlayment shall be as set forth in 780 CMR Table 5503.2.1.1(1). The maximum span for sanded plywood combination subfloor underlayment shall be as set forth in 780 CMR Table 5503.2.1.1(2).

5503.2.3 Installation. Wood structural panels used as subfloor or combination subfloor underlayment shall be attached to wood framing in accordance with 780 CMR Table 5602.3(1) and shall be attached to cold-formed steel framing in accordance with 780 CMR Table 5503.3.1(2).

5503.3 Particleboard.

FLOORS

5503.3.1 Identification and Grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency.

5503.3.2 Floor Underlayment. Particleboard floor underlayment shall conform to Type PBU

and shall not be less than $\frac{1}{4}$ inch (6.4 mm) in thickness.

5503.3.3 Installation. Particleboard underlayment shall be installed in accordance with the recommendations of the manufacturer and attached to framing in accordance with 780 CMR Table 5602.3(1).

780 CMR 5503.2.1.1(1)

ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT^{a,b,c}

SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inch)	MAXIMUM SPAN (inches)		LOAD (pounds per square foot, at maximum span)		MAXIMUM SPAN (inches)
		With edge support ^d	Without edge support	Total load	Live load	
Sheathing^e						
12/0	$\frac{5}{16}$	12	12	40	30	0
16/0	$\frac{5}{16}$	16	16	40	30	0
20/0	$\frac{5}{16}$	20	20	40	30	0
24/0		24	20 ^g	40	30	0
24/16	$\frac{7}{16}$	24	24	50	40	16
32/16	$\frac{15}{32}, \frac{1}{2}$	32	28	40	30	16 ^h
40/20	$\frac{19}{32}, -$	40	32	40	30	20 ^{h,i}
48/2	$\frac{23}{32}, \frac{3}{48}$	48	36	45	35	24
60/32		60	48	45	35	32
Underlayment, C-C plugged, single floor^e						
Roof^f						
16 o.c.	$\frac{19}{32}, -$	24	24	50	40	16 ^j
20 o.c.	$\frac{19}{32}, -$	32	32	40	30	20 ^j
24 o.c.	$\frac{23}{32}, \frac{3}{4}$	48	36	35	25	24
32 o.c.		48	40	50	40	32
48 o.c.	$1\frac{3}{32}, 1$	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- a. The allowable total loads were determined using a dead load of 10 psf. If the dead load exceeds 10 psf, then the live load shall be reduced accordingly.
- b. Panels continuous over two or more spans with long dimension perpendicular to supports. Spans shall be limited to values shown because of possible effect of concentrated loads.
- c. Applies to panels 24 inches or wider.
- d. Lumber blocking, panel edge clips (one midway between each support, except two equally spaced between supports when span is 48 inches), tongue-and-groove panel edges, or other approved type of edge support.
- e. Includes Structural 1 panels in these grades.
- f. Uniform load deflection limitation: $\frac{1}{180}$ of span under live load plus dead load, $\frac{1}{240}$ of span under live load only.
- g. Maximum span 24 inches for $\frac{15}{32}$ -and $\frac{1}{2}$ -inch panels.
- h. Maximum span 24 inches where $\frac{3}{4}$ -inch wood finish flooring is installed at right angles to joists.
- i. Maximum span 24 inches where 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor.
- j. Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum nominal $\frac{1}{4}$ -inch thick underlayment with end and edge joints offset at least two inches or 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor, or $\frac{3}{4}$ -inch wood finish flooring is installed at right angles to the supports. Allowable uniform live load at maximum span, based on deflection of $\frac{1}{360}$ of span, is 100 psf.
- k. Unsupported edges shall have tongue-and-groove joints or shall be supported by blocking unless nominal $\frac{1}{4}$ -inch-thick underlayment with end and edge joints off-set at least two inches or $\frac{3}{4}$ -inch wood finish flooring is installed at right angles to the supports. Allowable uniform live load at maximum span, based on deflection of $\frac{1}{360}$ of span, is 100 psf, except panels with a span rating of 48 on center are limited to 65 psf total uniform load at maximum span.

780 CMR TABLE 5503.2.1.1(2)
ALLOWABLE SPANS FOR SANDED PLYWOOD
COMBINATION
SUBFLOOR
UNDERLAYMENT^a

IDENTIFICATION	SPACING OF JOISTS (inches)		
	16	20	24
Species group ^b	—	—	—

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1	$\frac{1}{2}$	—	$\frac{3}{4}$
2, 3	—	$\frac{3}{4}$	—
4	$\frac{3}{4}$	—	1

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479kN/m².

- a. Plywood continuous over two or more spans and face grain perpendicular to supports. Unsupported edges shall be tongue-and-groove or blocked except where nominal $\frac{1}{4}$ -inch-thick underlayment or $\frac{3}{4}$ -inch wood finish floor is used. Allowable uniform live load at maximum span based on deflection of $\frac{1}{360}$ of span is 100 psf.
- b. Applicable to all grades of sanded exterior-type plywood.

**780 CMR 780 CMR 5504
PRESSURE PRESERVATIVELY
TREATED-WOOD FLOORS (ON GROUND)**

5504.1 General. Pressure preservatively treated-wood basement floors and floors on ground shall be designed to withstand axial forces and bending moments resulting from lateral soil pressures at the base of the exterior walls and floor live and dead loads. Floor framing shall be designed to meet joist deflection requirements in accordance with 780 CMR 5301.

5504.1.1 Unbalanced Soil Loads. Unless special provision is made to resist sliding caused by unbalanced lateral soil loads, wood basement floors shall be limited to applications where the differential depth of fill on opposite exterior foundation walls is two feet (610 mm) or less.

5504.1.2 Construction. Joists in wood basement floors shall bear tightly against the narrow face of studs in the foundation wall or directly against a band joist that bears on the studs. Plywood subfloor shall be continuous over lapped joists or over butt joints between in-line joists. Sufficient blocking shall be provided between joists to transfer lateral forces at the base of the end walls into the floor system.

5504.1.3 Uplift and Buckling. Where required, resistance to uplift or restraint against buckling shall be provided by interior bearing walls or properly designed stub walls anchored in the supporting soil below.

5504.2 Site Preparation. The area within the foundation walls shall have all vegetation, topsoil and foreign material removed, and any fill material that is added shall be free of vegetation and foreign material. The fill shall be compacted to assure uniform support of the pressure preservatively treated-wood floor sleepers.

5504.2.1 Base. A minimum four-inch-thick (102 mm) granular base of gravel having a maximum size of $\frac{3}{4}$ inch (19.1 mm) or crushed stone having a maximum size of $\frac{1}{2}$ inch (12.7 mm) shall be placed over the compacted earth.

5504.2.2 Moisture Barrier. Polyethylene sheeting of minimum six-mil (0.15 mm) thickness shall be placed over the granular base. Joints shall be lapped six inches (152 mm) and left unsealed. The polyethylene membrane shall be placed over the pressure preservatively treated-wood sleepers and shall not extend beneath the footing plates of the exterior walls.

5504.3 Materials. All framing materials, including sleepers, joists, blocking and plywood subflooring, shall be pressure preservatively treated and dried after treatment in accordance with AWPA C22.

780 CMR 5505 STEEL FLOOR FRAMING

5505.1 Cold-formed Steel Floor Framing. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel floor framing members shall comply with the requirements of 780 CMR 5505.

5505.1.1 Applicability Limits. The provisions of 780 CMR 5505 shall control the construction of steel floor framing for buildings not greater than 60 feet (18,288 mm) in length perpendicular to the joist span, not greater than 36 feet (10973 mm) in width parallel to the joist span, and not greater than two stories in height with each story not greater than ten feet (3048 mm) high. Steel floor framing constructed in accordance with the provisions of 780 CMR 5505 shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour Exposure A, B or C and a maximum ground snow load of 70 pounds per square foot (3.35 kN/m^2).

5505.1.2 In-line Framing. When supported by steel-framed walls in accordance with 780 CMR 5603, steel floor framing shall be constructed with floor joists located directly in-line with load-bearing studs located below the joists with a maximum tolerance of $\frac{3}{4}$ inch (19.1 mm) between the center lines of the joist and the stud.

5505.2 Structural Framing. Load-bearing floor framing members shall comply with 780 CMR Figure 5505.2(1) and with the dimensional and minimum thickness requirements specified in 780 CMR Tables 5505.2(1) and 5505.2(2). Tracks shall comply with 780 CMR Figure 5505.2(2) and shall have a minimum flange width of $\frac{1}{4}$ inches (32 mm). The maximum inside bend radius for members shall be the greater of $\frac{3}{32}$ inch (2.4 mm) or twice the uncoated steel thickness. Holes in joist webs shall conform to 780 CMR Figure 5505.2(3) and to the dimensional requirements specified in 780 CMR Table 5505.2(3). Holes shall be permitted only along the centerline of the web of the framing member. Holes for 800S162-33, 1000S162-43, 1200S162-43 and 1200S162-54 nominal joist sizes located less than ten inches (254 mm) from the edge of load-bearing surface shall be patched in accordance with 780 CMR 5505.3.6.

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780 CMR TABLE 5505.2(1)
COLD-FORMED STEEL JOIST SIZES

MEMBER DESIGNATION ^a	WEB DEPTH(inches)	MINIMUM FLANGE WIDTH(inches)	MAXIMUM FLANGE WIDTH(inches)	MINIMUM LIP SIZE(inches)
550S162-t	5.5	1.625	2	0.5
800S162-t	8	1.625	2	0.5
1000S162-t	10	1.625	2	0.5
1200S162-t	12	1.625	2	0.5

For SI: 1 inch = 25.4 mm.

- a. The member designation is defined by the first number representing the member depth in $\frac{1}{100}$ inches, the letter "S" representing a stud or joist member, the second number representing the flange width in $\frac{1}{100}$ inches, and the letter "t" shall be a number representing the minimum base metal thickness in mils [See 780 CMR Table 5505.2(2)].

780 CMR TABLE 5505.2(2)
MINIMUM THICKNESS OF COLD-FORMED STEEL MEMBERS

DESIGNATION(mils)	MINIMUM UNCOATED THICKNESS(inches)	REFERENCE GAGE NUMBER
33	0.033	20
43	0.043	18
54	0.054	16
68	0.068	14

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR TABLE 5505.2(3)
MAXIMUM HOLE DIMENSIONS AND SPACING IN JOIST WEBS

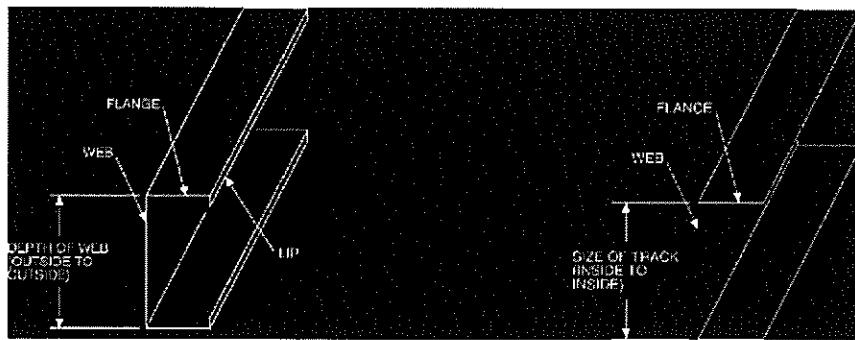
NOMINAL MEMBER SIZE	MAXIMUM HOLE DEPTH ^b (inches)	MAXIMUM HOLE LENGTH ^b (inches)	MINIMUM HOLE SPACING(inches)	MINIMUM HOLE EDGE DISTANCE ^c (inches)
550S162-33	2	5.25	16.5	10
550S162-43	2	5.25	16.5	10
550S162-54	2	5.25	16.5	10
550S162-68	2	5.25	16.5	10
800S162-33	1.5	4	24	10
800S162-43	3	6	24	10
800S162-54	3	6	24	10
800S162-68	3	6	24	10
1000S162-43	1.5	4	24	10
1000S162-54	4	6	24	10
1000S162-68	4	6	24	10
1200S162-43	1.5	4	24	10
1200S162-54	1.5	4	24	10
1200S162-68	4.75	6	24	10

For SI: 1 inch = 25.4 mm.

- a. The dimension of the hole measured across the depth of the joist web.
b. The dimension of the hole measured along the length of the joist.
c. Edge distance is measured from the edge of the hole to the edge of bearing support.

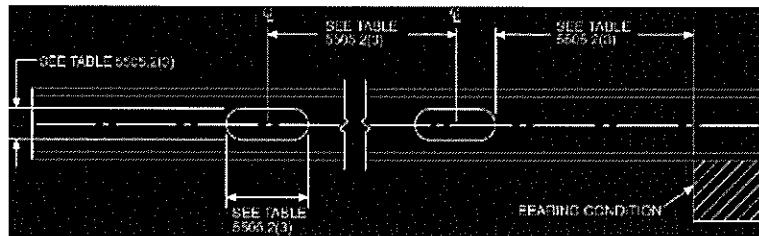
C-SECTION

780 CMR FIGURE 5505.2(2)
780 CMR FIGURE 5505.2(2)
TRACK SECTION



780 CMR FIGURE 5505.2(3) FLOOR JOIST WEB

HOLES



For SI: 1 inch = 25.4 mm.

5505.2.1 Material. Load-bearing members utilized in steel floor construction shall be cold formed to shape from structural quality sheet steel complying with the requirements of one of the following:

1. ASTM A 653: Grades 33, 37, 40 and 50 (Class 1 and 3).
2. ASTM A 792: Grades 33, 37, 40 and 50A.
3. ASTM A 875: Grades 33, 37, 40 and 50 (Class 1 and 3).
4. Steels that comply with ASTM A 653, except for tensile and elongation, shall be permitted provided the ratio of tensile strength to yield point is at least 1.08 and the total elongation is at least 10% for a two-inch (51 mm) gage length or 7% for an eight-inch (203 mm) gage length.

5505.2.2 Identification. Load-bearing steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum uncoated steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (kPa).

5505.2.3 Corrosion Protection. Load-bearing steel framing shall have a metallic coating complying with one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.
3. A minimum of GF 60 in accordance with ASTM A 875.

5505.2.4 Fastening Requirements. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of 0.5 inch (12.7 mm), shall be self-drilling tapping, and shall conform to SAE J78. Floor sheathing shall be attached to steel joists with minimum No. 8 self-drilling tapping screws that conform to SAE J78. Screws attaching floor-sheathing-to-steel joists shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of 0.375 inch (9.5 mm). Gypsum board ceilings shall be attached to steel joists with minimum No. 6 screws conforming to ASTM C 954 and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel a minimum of three exposed threads. All self-drilling tapping screws conforming to SAE J78 shall have a Type II coating in accordance with ASTMB 633.

Where No. 8 screws are specified in a steel to steel connection the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in 780 CMR Table 5505.2.4 when larger screws are used or when one of the sheets of steel being

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connected is thicker than 33 mils (0.84mm). When applying the reduction factor the resulting number of screws shall be rounded up.

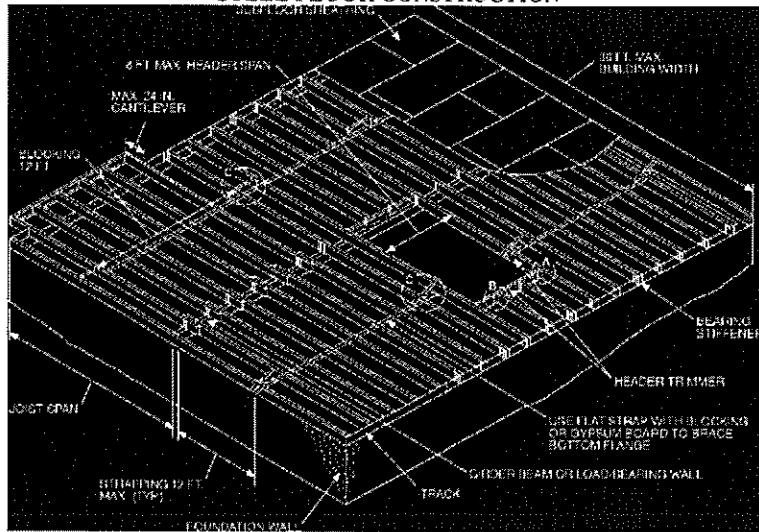
780 CMR TABLE 5505.2.4
SCREW SUBSTITUTION FACTOR

SCREW SIZE	THINNEST CONNECTED STEEL SHEET (mils)
------------	---------------------------------------

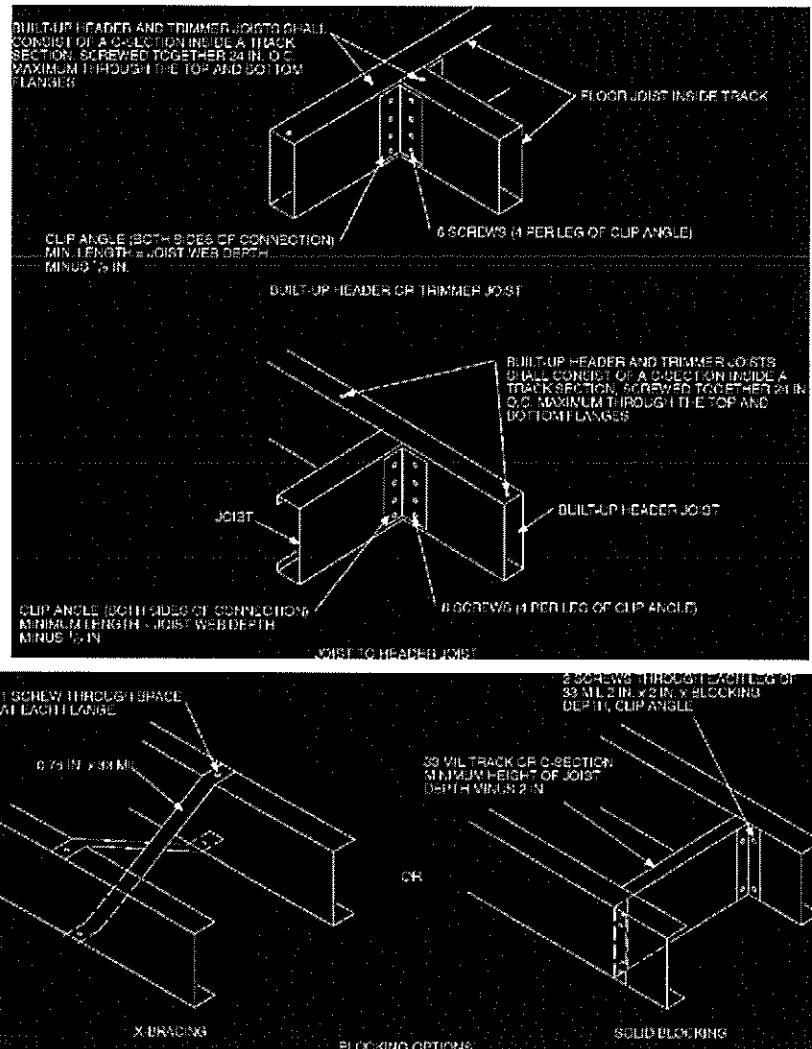
	33	43
# 8	1	0.67
# 10	0.93	0.62
# 12	0.86	0.56

For SI: 1 mil = 0.0254 mm.

**780 CMR FIGURE 5505.3
STEEL FLOOR CONSTRUCTION**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.



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For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

5505.3 Floor Construction. Cold-formed steel floors shall be constructed in accordance with 780 CMR 5505.3 and 780 CMR Figure 5505.3.

5505.3.1 Floor to Foundation or Bearing Wall Connections. Cold-formed steel floors shall be anchored to foundations, wood sills or load-bearing walls in accordance with 780 CMR Table 5505.3.1(1) and 780 CMR Figure 5505.3.1(1), 5505.3.1(2), 5505.3.1(3), 5505.3.1(4), 5505.3.1(5) or 5505.3.1(6). Continuous steel joists supported by interior load-bearing walls shall be constructed in accordance with 780 CMR Figure 5505.3.1(7). Lapped steel joists shall be constructed in accordance with 780 CMR Figure 5505.3.1(8). Fastening of steel joists to other framing members shall be in accordance with 780 CMR Table 5505.3.1(2).

5505.3.2 Allowable Joist Spans. The clear span of cold-formed steel floor joists shall not exceed the limits set forth in 780 CMR Table 5505.3.2. Floor joists shall have a minimum bearing length of 1.5 inches (38 mm). When continuous joists are used the interior bearing supports shall be located within two feet (610 mm) of mid span of the steel joists, and the individual spans shall not exceed the spans in 780 CMR Table 5505.3.2. Bearing stiffeners shall be installed at each bearing location in accordance with 780 CMR 5505.3.4 and as shown in 780 CMR Figure 5505.3.

5505.3.3 Joist Bracing. The top flanges of steel joists shall be laterally braced by the application of floor sheathing fastened to the joists in accordance with 780 CMR Table 5505.3.1(2). Floor joists with spans that exceed 12 feet (3658 mm) shall have the bottom flanges laterally braced in accordance with one of the following:

1. Gypsum board installed with minimum No. 6 screws in accordance with 780 CMR 5702.
2. Continuous steel strapping installed in accordance with 780 CMR Figure 5505.3. Steel straps shall be at least 1.5 inches (38 mm) in width and 33 mils (0.84 mm) in thickness. Straps shall be fastened to the bottom flange at each joist with at least one No. 8 screw and shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between joists in-line with straps at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joist run and at the termination of all straps.

5505.3.4 Bearing Stiffeners. Bearing stiffeners shall be installed at all bearing locations for steel floor joists. A bearing stiffener shall be fabricated from a minimum 33 mil (0.84 mm) C-section or 43 mil (1.09 mm) track section. Each stiffener shall be fastened to the web of the joist with a minimum of four No. 8 screws equally spaced as shown in Figure 5505.3.4. Stiffeners shall extend across the full depth of the web and shall be installed on either side of the web.

5505.3.5 Cutting and Notching. Flanges and lips of load-bearing steel floor framing members shall not be cut or notched.

5505.3.6 Hole Patching. Web holes for 800S162-33, 1000S162-43, 1200S162-43 and 1200S162-54 nominal joist sizes with dimensions conforming to 780 CMR 5505.2 that are closer than ten inches (305 mm) from the edge of the hole to the edge of the bearing surface shall be patched with a solid steel plate, C-section or track section in accordance with 780 CMR Figure 5505.3.6. The steel patch shall be of a minimum thickness as the receiving member and shall extend at least one inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web with No. 8 screws (minimum) spaced no greater than one inch (25.4 mm) center-to-center along the edges of the patch, with a minimum edge distance of 0.5 inch (12.7 mm).

5505.3.7 Floor Cantilevers. Floor cantilevers shall not exceed 24 inches (610 mm) as illustrated in 780 CMR Figure 5505.3. The cantilever back-span shall extend a minimum of six feet (1830 mm) within the building, and shall be fastened to a bearing condition in accordance with 780 CMR 5505.3.1. Floor cantilevers shall be permitted only on the second floor of a two-story building or the first floor of a one-story building. Floor framing that is cantilevered and supports the cantilevered floor only shall consist of single joist members in accordance with 780 CMR 5505.3.2. Floor framing that is cantilevered and supports the cantilevered floor and the roof framing load above shall consist of double joist members of the same size and material thickness as that for single joist members in accordance with 780 CMR 5505.3.2, and shall be fastened web-to-web with minimum No. 8 screws at 24 inches (610 mm) maximum on-center spacing top and bottom. Built-up floor framing consisting of a C-section inside a track section, fastened at the top and bottom flanges by minimum No. 8 screws at 24 inches (610mm) maximum on center spacing, is

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permitted in lieu of the web-to-web double joist method.

5505.3.8 Splicing. Joists and other structural members shall not be spliced. Splicing of

5505.3.9 Framing of Openings. Openings in floor framing shall be framed with header and trimmer joists. Header joist spans shall not exceed eight feet (2438 mm). Header and trimmer joists shall be fabricated from joist and track sections, which shall be of a minimum size and thickness as the adjacent floor joists and shall be installed in accordance with 780 CMR Figure 5505.3. Each header joist

tracks shall conform with 780 CMR Figure 5505.3.8.

shall be connected to trimmer joists with a minimum of four two-inch-by-two-inch (51 mm by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a steel thickness not less than that of the floor joist.

780 CMR TABLE 5505.3.1(1)
FLOOR TO FOUNDATION OR BEARING WALL CONNECTION REQUIREMENTS^{a,b}

FRAMING CONDITION	WIND SPEED (mph) AND EXPOSURE	
	Up to 110 A/B or 85 C or Seismic Design Categories A, B, C	Up to 110 C
Floor joist to wall track of exterior steel load-bearing wall per Figure 5505.3.1(1)	2-No. 8 screws	3-No. 8 screws
Floor joist track to wood sill per Figure 5505.3.1(2)	Steel plate spaced at 3" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate, spaced at 2" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails
Floor joist track to foundation per Figure 5505.3.1(3)	½" minimum diameter anchor bolt and clip angle spaced at 6" o.c. with 8-No. 8 screws	½" minimum diameter anchor bolt and clip angle spaced at 4" o.c. with 8-No. 8 screws
Joist cantilever to wall track per Figure 5505.3.1(4)	2-No. 8 screws per stiffener or bent plate	3-No. 8 screws per stiffener or bent plate
Joist cantilever to wood sill per Figure 5505.3.1(5)	Steel plate spaced at 3" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails
Joist cantilever to foundation per Figure 5505.3.1(6)	½" minimum diameter anchor bolt and clip angle spaced at 6" o.c. with 8-No. 8 screws	½" minimum diameter anchor bolt and clip angle spaced at 4" o.c. with 8-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

- a. Anchor bolts shall be located not more than 12 inches from corners or the termination of bottom tracks (e.g., at door openings). Bolts shall extend a minimum of 15 inches into masonry or seven inches into concrete.
- b. All screw sizes shown are minimum.

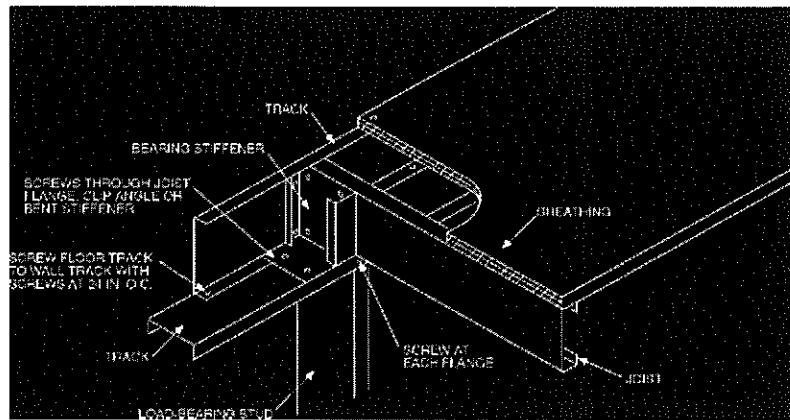
780 CMR TABLE 5505.3.1(2)
FLOOR FASTENING SCHEDULE^a

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND SIZE OF FASTENERS	SPACING OF FASTENERS
Floor joist to track of an interior load-bearing wall per Figures 5505.3.1(7) and 5505.3.1(8)	2 No. 8 screws	Each joist
Floor joist to track at end of joist	2 No. 8 screws	One per flange or two per bearing stiffener
Subfloor to floor joists	No. 8 screws	6" o.c. on edges and 10" o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

- a. All screw sizes shown are minimum.

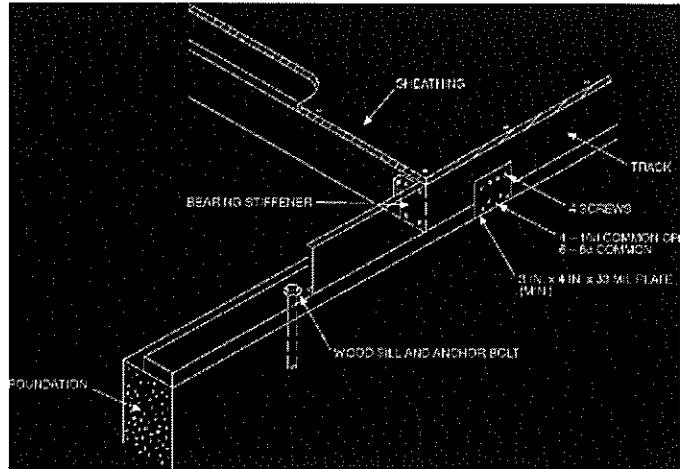
780 CMR FIGURE 5505.3.1(1)
FLOOR TO LOAD-BEARING WALL STUD CONNECTION



For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

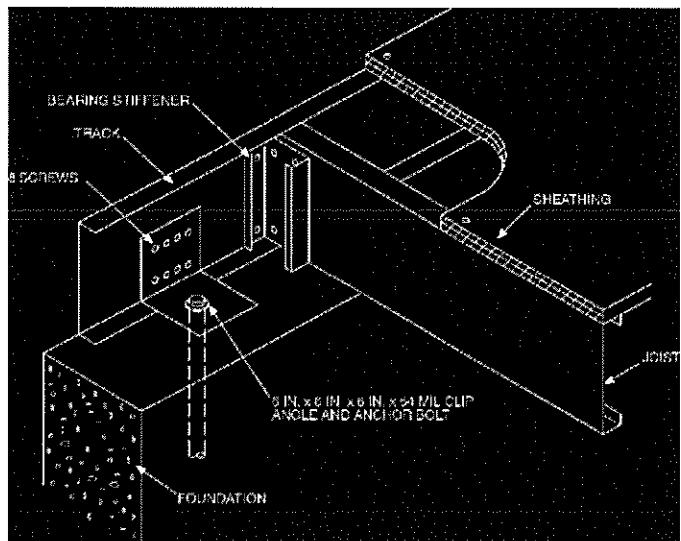
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780 CMR FIGURE 5505.3.1(2)
FLOOR TO WOOD SILL CONNECTION



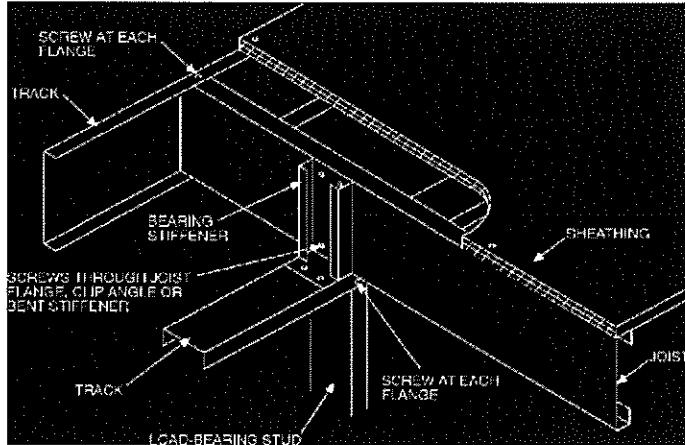
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(3)
FLOOR TO FOUNDATION CONNECTION



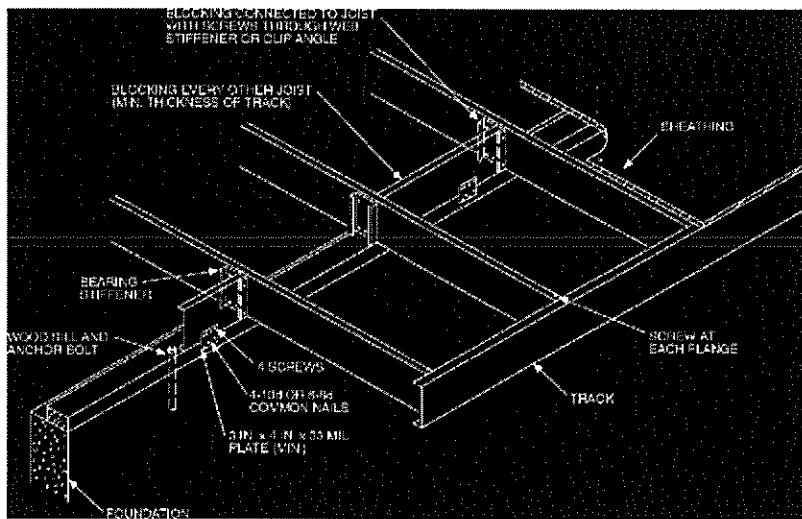
For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(4)
FLOOR CANTILEVER TO LOAD-BEARING WALL CONNECTION



For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

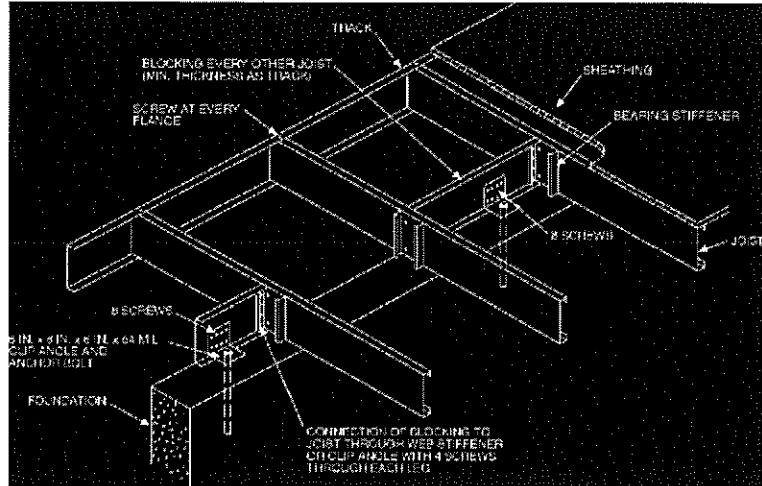
780 CMR FIGURE 5505.3.1(5)
FLOOR CANTILEVER TO WOOD SILL CONNECTION



For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

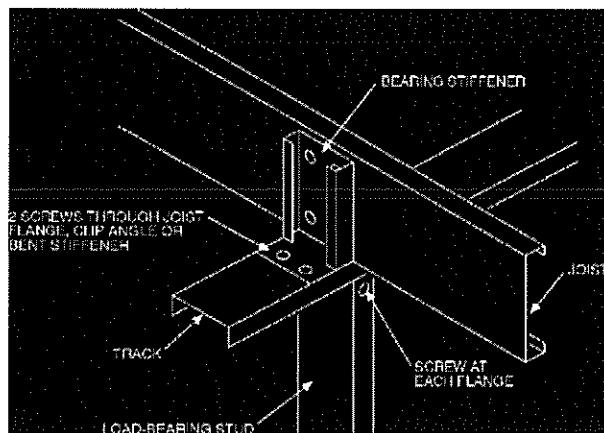
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780 CMR FIGURE 5505.3.1(6)
FLOOR CANTILEVER TO FOUNDATION CONNECTION

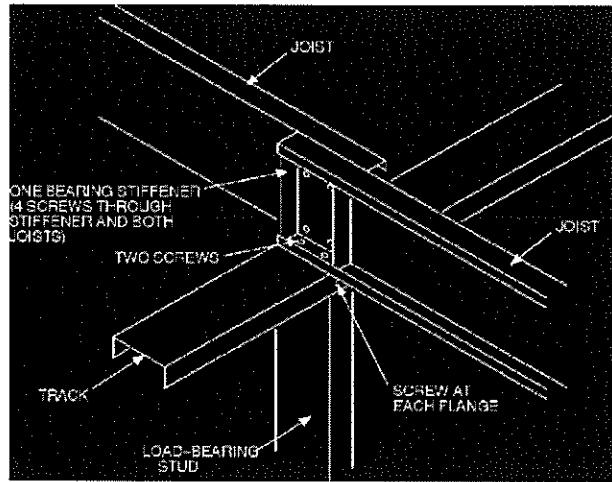


For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR FIGURE 5505.3.1(7)
CONTINUOUS JOIST SPAN SUPPORTED ON STUD



780 CMR FIGURE 5505.3.1(8)
LAPPED JOISTS SUPPORTED ON STUD



780 CMR TABLE 5505.3.2
ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS^{a,b}

NOMINAL JOIST SIZE	30 PSF LIVE LOAD		40 PSF LIVE LOAD	
	Spacing (inches)		Spacing (inches)	
	16	24	16	24
550S162-33	10'-7"	9'-1"	9'-7"	8'-1"
550S162-43	11'-6"	10'-0"	10'-5"	9'-1"
550S 162-54	12'-4"	10'-9"	11'-2"	9'-9"
550S162-68	13'-2"	11'-6"	12'-0"	10'-6"
800S162-33	13'-3"	8'-10"	10'-7"	7'-1"
800S162-43	15'-6"	13'-7"	14'-1"	12'-3"
800S162-54	16'-8"	14'-7"	15'-2"	13'-3"
800S162-68	17'-11"	15'-7"	16'-3"	14'-2"
1000S162-43	18'-8"	15'-3"	16'-8"	13'-1"
1000S162-54	20'-1"	17'-6"	18'-3"	15'-11"
1000S 162-68	21'-6"	18'-10"	19'-7"	17'- 1"
1200S162-43	20'-3"	14'-1"	16'-10"	11'-3"
1200S162-54	23'-4"	19'-7"	21'-3"	17'-6"
1200S162-68	25'-1"	21'-11"	22'-10"	19'-11"

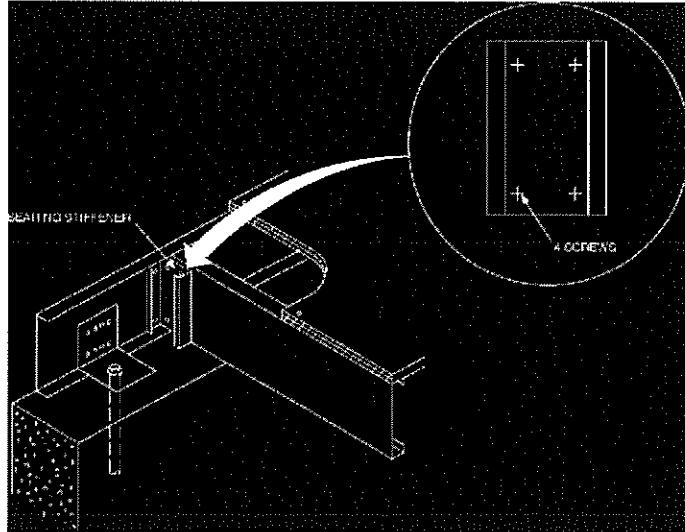
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot - 0.0479kN/m².

a. Deflection criteria: L/480 for live loads, L/360 for total loads.

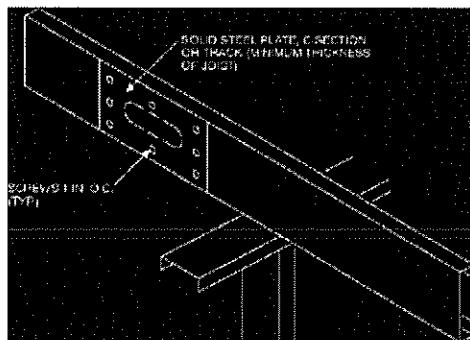
b. Floor dead load - 10 psf.

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780 CMR FIGURE 5505.3.4
BEARING STIFFENER

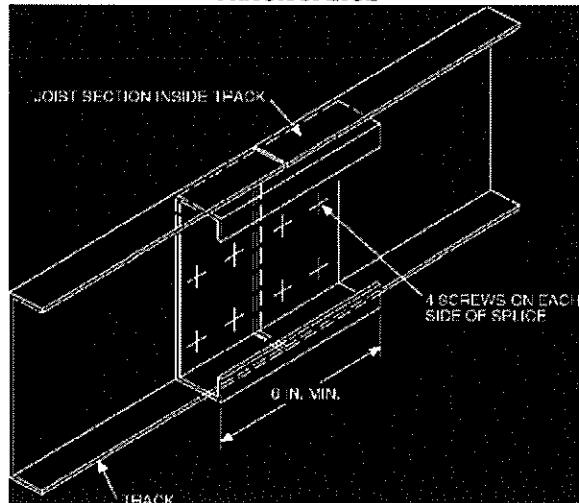


780 CMR FIGURE 5505.3.6
HOLE PATCH



For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5505.3.8
TRACK SPLICE



For SI: 1 inch = 25.4 mm.

780 CMR 5506 CONCRETE FLOORS (ON GROUND)

5506.1 General. Concrete slab-on-ground floors shall be a minimum 3.5 inches (89 mm) thick (for expansive soils, see 780 CMR 5403.1.8). The specified compressive strength of concrete shall be as set forth in 780 CMR 5402.2.

5506.1.2 Control Joints. *Slabs shall be constructed with control joints having a depth of at least one quarter of the slab thickness but not less than one inch (25 mm). Joints shall be spaced at intervals not greater than 30 feet (9144 mm) in each direction. Control joints shall be placed at locations where the slab width or length changes.*

Exception: *Control joints may be omitted when the slab is reinforced in accordance with Table 5506.1 .2. Reinforcement shall be placed at the mid-depth of the slab or two inches (51 mm) from the top of slabs greater than four inches (102 mm) in thickness.*

5506.2.3 Vapor Retarder. A six mil (0.006 inch; 152 µm) polyethylene or approved vapor retarder with joints lapped not less than six inches (152mm) shall be placed between the concrete floor slab and the base course or the prepared subgrade where no base course exists.

Exception: The vapor retarder may be omitted:

1. From garages, utility buildings and other unheated accessory structures.
2. *In accordance with the requirements of 780 CMR 61.00.*

780 CMR TABLE 5506.1.2

MAXIMUM DIMENSION OF SLAB OR DISTANCE BETWEEN CONTROL JOINTS (feet)						WWF ² WIRE SPACING (inches)	WWF ² WIRE SIZE DESIGNATION (inches)
SLAB THICKNESS (inches)							
3.5	4	4.5	5	5.5	6		
42	36	32	29	26	24	6 x 6	W1.4 x W1.4
59	52	46	42	38	35	6 x 6	W2.0 x W2.0
86	75	67	60	55	50	6 x 6	W2.9 x W2.9

5506.2 Site Preparation. The area within the foundation walls shall have all vegetation, top soil and foreign material removed.

5506.2.1 Fill. Fill material shall be free of *organic material*, vegetation and foreign material. The fill shall be compacted to assure uniform support of the slab, and except where approved, the fill depths shall not exceed 24 inches (610 mm) for clean sand or gravel.

5506.2.2 Base. A four-inch-thick (102 mm) base course consisting of clean graded sand, gravel, crushed stone or crushed blast-furnace slag passing a two-inch (51 mm) sieve shall be placed on the prepared subgrade when the slab is below grade.

Exception: A base course is not required when the concrete slab is installed on well-drained or sand-gravel mixture soils classified as Group I according to the United Soil Classification System in accordance with Table R405.1.

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NON-TEXT PAGE

780 CMR 56.00

WALL CONSTRUCTION

780 CMR 5601 GENERAL

5601.1 Application. The provisions of 780 CMR 56.00 shall control the design and construction of all walls and partitions for all buildings.

5601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

5601.2.1 Compressible Floor-covering Materials. Compressible floor-covering materials that compress more than $\frac{1}{32}$ inch (0.794 mm) when subjected to 50 pounds (23 kg) applied over one inch square (645 mm) of material and are greater than $\frac{1}{8}$ inch (3.2 mm) in thickness in the uncompressed state shall not extend beneath walls, partitions or columns, which are fastened to the floor.

780 CMR 5602 WOOD WALL FRAMING

5602.1 Identification. Load-bearing dimension lumber for studs, plates and headers shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certification of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5602 shall be accepted.

5602.1.1 End-jointed Lumber. Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5602.1 may be used interchangeably with solid-sawn members of the same species and grade.

5602.1.2 Structural Glued Laminated Timbers. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

5602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.

Exception: Bearing studs not supporting floors and nonbearing studs may be utility grade lumber, provided the studs are spaced in accordance with 780 CMR Table 5602.3(5).

5602.3 Design and Construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of 780 CMR 56.00 and 780 CMR Figures 5602.3(1) and 5602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with 780 CMR Table 5602.3(1) through 5602.3(4). Exterior walls covered with foam plastic sheathing shall be braced in accordance with 780 CMR 5602.10. Structural sheathing shall be

fastened directly to structural framing members.

5602.3.1 Stud Size, Height and Spacing. The size, height and spacing of studs shall be in accordance with 780 CMR Table 5602.3(5).

Exceptions:

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed eight feet (2438 mm) in height for exterior walls and load-bearing walls or ten feet (3048 mm) for interior nonload-bearing walls.
2. Studs more than ten feet (3048 mm) in height which are in accordance with 780 CMR Table 5602.3.1.

5602.3.2 Top Plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset at least 24 inches (610 mm). Plates shall be a nominal two inches in depth (51 mm) and have a width at least equal to the width of the studs.

Exception: A single top plate may be installed in stud walls, provided the plate is adequately tied at joints, corners and intersecting walls by a minimum three-inch-by-six-inch by a 0.036-inch-thick (76 mm by 152 mm by 0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d nails on each side, provided the rafters or joists are centered over the studs with a tolerance of no more than one inch (25.4 mm). The top plate may be omitted over lintels that are adequately tied to adjacent wall sections with steel plates or equivalent as previously described.

5602.3.3 Bearing Studs. Where joists, trusses or rafters are spaced more than 16 inches (406 mm) on center and the bearing studs below are spaced 24 inches (610 mm) on center, such members shall bear within five inches (127 mm) of the studs beneath.

Exceptions:

1. The top plates are two two-inch by six-inch (38 mm by 140 mm) or two three-inch by four-inch (64 mm by 89 mm) members.
2. A third top plate is installed.
3. Solid blocking equal in size to the studs is installed to reinforce the double top plate.

5602.3.4 Bottom (Sole) Plate. Studs shall have full bearing on a nominal two by (38 mm) or larger plate or sill having a width at least equal to the width of the studs.

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780 CMR TABLE 5602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a,b,c,d}	SPACING OF FASTENERS
Joist to sill or girder, toe nail	3-8d	—
1" x 6" subfloor or less to each joist, face nail	2-8d 2 staples, 1¾"	—
2" subfloor to joist or girder, blind and face nail	2-16d	—
Sole plate to joist or blocking, face nail	16d	16" o.c.
Top or sole plate to stud, end nail	2-16d	—
Stud to sole plate, toe nail	3-8d or 2-16d	—
Double studs, face nail	10d	24" o.c.
Double top plates, face nail	10d	24" o.c.
Sole plate to joist or blocking at braced wall panels	3-16d	16" o.c.
Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	8- 16d	—
Blocking between joists or rafters to top plate, toe nail	3-8d	—
Rim joist to top plate, toe nail	8d	6" o.c.
Top plates, laps at corners and intersections, face nail	2-10d	—
Built-up header, two pieces with ½" spacer	16d	16" o.c. along each edge
Continued header, two pieces	16d	16" o.c. along each edge
Ceiling joists to plate, toe nail	3-8d	—
Continuous header to stud, toe nail	4-8d	—
Ceiling joist, laps over partitions, face nail	3-10d	—
Ceiling joist to parallel rafters, face nail	3-10d	—
Rafter to plate, toe nail	2-16d	—
1" brace to each stud and plate, face nail	2-8d 2 staples, 1¾"	—
1" x 6" sheathing to each bearing, face nail	2-8d 2 staples, 1¾"	—
1" x 8" sheathing to each bearing, face nail	2-8d 3 staples, 1¾"	—
Wider than 1" x 8" sheathing to each bearing, face nail	3-8d 4 staples, 1¾"	—
Built-up corner studs	10d	24" o.c.
Built-up girders and beams, 2-inch lumber layers	10d	Nail each layer as follows: 32" o.c. at top and bottom and staggered. Two nails at ends and at each splice.
2" planks	2-16d	At each bearing
Roof rafters to ridge, valley or hip rafters: toe nail	4-16d	—
face nail	3-16d	—
Rafter ties to rafters, face	3-8d	—

780 CMR TABLE 5602.3(1) - continued
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER ^{b,c,d,e}	SPACING OF FASTENERS	
		Edges (inches)	Intermediate supports ^{c,f} (inches)
Wood structural panels, subfloor, roof and wall sheathing to framing, and particleboard wall sheathing to framing			
5/16" - 1/2"	6d common nail (subfloor, wall) 8d common nail (roof) ^f	6	12 ^g
19/32" - 1"	8d common nail	6	12 ^g
1 1/8" - 1 1/4"	10d common nail or 8d deformed nail	6	12
Other wall sheathing^h			
1/2" regular cellulosic fiberboard sheathing	1" galvanized roofing nail 6d common nail staple 16 ga., 1 1/2 long	3	6
1/2" structural cellulosic fiberboard sheathing	1 1/2" galvanized roofing nail 8d common nail staple 16 ga., 1 1/2 long	3	6
25/32" structural cellulosic fiberboard sheathing	1 1/4" galvanized roofing nail 8d common nail staple 16 ga., 1 1/4 long	3	6
1/2" gypsum sheathing	1 1/2" galvanized roofing nail; 6d common nail; staple galvanized, 1 1/2 long; 1 1/4 screws, Type W or S	4	8
5/8" gypsum sheathing	1 1/4" galvanized roofing nail; 8d common nail; staple galvanized, 1 1/8" long; 1 1/8" screws, Type W or S	4	8
Wood structural panels, combination subfloor underlayment to framing			
3/4" and less	6d deformed nail or 8d common nail	6	12
7/8" - 1"	8d common nail or 8d deformed nail	6	12
1 1/8" - 1 1/4"	10d common nail or 8d deformed nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h.

- a. All nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi (551 MPa) for shank diameter of 0.192 inch (20d common nail), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi (689 MPa) for shank diameters of 0.142 inch or less.
- b. Staples are 16 gage wire and have a minimum 7/16-inch on diameter crown width.
- c. Nails shall be spaced at not more than six inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot-by-eight-foot or four-foot-by-nine-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on 780 CMR Table 5602.3(2).
- f. For regions having basic wind speed of 110 mph or greater, 8d deformed nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.
- g. For regions having basic wind speed of 100 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced six inches on center. When basic wind speed is greater than 100 mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced six inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and four inches on center to gable end wall framing.
- h. Gypsum sheathing shall conform to ASTM C 79 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to either AHA 194.1 or ASTM C 208.
- i. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and at all floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof or floor sheathing panel edges perpendicular to the framing members shall not be required except at intersection of adjacent roof planes. Floor and roof perimeter shall be supported by framing members or solid blocking.

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**780 CMR TABLE 5602.3(2)
ALTERNATE ATTACHMENTS**

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a,b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof and wall sheathing to framing and particleboard wall sheathing to framing^d			
$\frac{5}{16}$	0.097 - 0.099 Nail 1½ Staple 15 ga. 1¾ Staple 16 ga. 1¾	6	12
	Staple 15 ga. 1¾	6	12
	0.097 - 0.099 Nail 1½ Staple 16 ga. 1¾	4	10
$\frac{3}{8}$	Staple 15 ga. 1½	6	12
	0.097 - 0.099 Nail 1½	3	6
	Staple 16 ga. 1¾	6	12
$\frac{15}{32}$ and $\frac{1}{2}$	Staple 15 ga. 1½	6	12
	0.097 - 0.099 Nail 1½	3	6
	Staple 16 ga. 1¾	6	12
$\frac{19}{32}$ and $\frac{5}{8}$	0.113 Nail 1¾ Staple 15 and 16 ga. 1¾	6	12
	0.097 - 0.099 Nail 1¾	3	6
	Staple 14 ga. 1¾	6	12
$\frac{23}{32}$ and $\frac{3}{4}$	Staple 15 ga. 1¾	5	10
	0.097 - 0.099 Nail 1½	3	6
	Staple 16 ga. 2	4	8
	Staple 14 ga. 2	5	10
1	0.113 Nail 2¼, Staple 15 ga. 2	4	8
	0.097 - 0.099 Nail 2¼	3	6
	Staple 14 ga. 2	5	10
Floor underlayment; plywood-hardboard-particleboard^e			
Plywood			
$\frac{1}{4}$ and $\frac{5}{16}$	1½ ring or screw shank nail—minimum 12½ ga. (0.099") shank diameter	3	6
	Staple 18 ga., $\frac{7}{8}$, $\frac{3}{16}$ crown width	2	5
$\frac{11}{32}$, $\frac{3}{8}$, $\frac{15}{32}$ and $\frac{1}{2}$	1½ ring or screw shank nail—minimum 12½ ga. (0.099) shank diameter	6	8 ^f
$\frac{19}{32}$, $\frac{5}{8}$, $\frac{23}{32}$ and $\frac{3}{4}$	1½ ring or screw shank nail—minimum 12½ ga. (0.099) shank diameter	6	12
	Staple 16 ga. 1¾	6	8
Hardboard^f			
0.200	1½ long ring-grooved underlayment nail	6	6
	4d cement-coated sinker nail	6	6
	Staple 18 ga., $\frac{7}{8}$ long (plastic coated)	3	6
Particleboard			
$\frac{1}{4}$	4d ring-grooved underlayment nail	3	6
	Staple 18 ga., $\frac{7}{8}$ long, $\frac{3}{16}$ crown	3	6
$\frac{3}{8}$	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1½ long, $\frac{3}{8}$ crown	3	6
$\frac{1}{2}$, $\frac{5}{8}$	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1½ long, $\frac{3}{8}$ crown	3	6

For SI: 1 inch = 25.4 mm.

- a. Nail is a general description and may be T-head, modified round head or round head.
- b. Staples shall have a minimum crown width of $\frac{7}{16}$ -inch on diameter except as noted.
- c. Nails or staples shall be spaced at not more than six inches on center at all supports where spans are 48 inches or greater. Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.
- d. Fasteners shall be placed in a grid pattern throughout the body of the panel.
- e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.
- f. Hardboard underlayment shall conform to ANSI/AHA A135.4.

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WALL CONSTRUCTION

780 CMR TABLE 5602.3(3)
ALLOWABLE STUD SPACING FOR WOOD STRUCTURAL PANEL WALL SHEATHING

PANEL SPAN RATING	PANEL NOMINAL THICKNESS (inch)	MAXIMUM STUD SPACING (inches)	
		Siding nailed to: ^a	
		Stud	Sheathing
12/0, 16/0, 20/0, or wall—16 o.c.	5/16, 3/8	16	16 ^b
24/0, 24/16, 32/16 or wall—24 o.c.	3/8, 7/16, 15/32, 1/2	24	24 ^c

For SI: 1 inch = 25.4 mm.

- a. Blocking of horizontal joints shall not be required.
- b. Plywood sheathing $\frac{3}{8}$ -inch thick or less shall be applied with long dimension across studs.
- c. Three-ply plywood panels shall be applied with long dimension across studs.

780 CMR TABLE 5602.3(4)
ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING*

THICKNESS (inch)	GRADE	STUD SPACING (inches)	
		When siding is nailed to studs	When siding is nailed to sheathing
3/8	M-1 Exterior glue	16	—
1/2	M-2 Exterior glue	16	16

For SI: 1 inch = 25.4 mm.

- a. Wall sheathing not exposed to the weather. If the panels are applied horizontally, the end joints of the panel shall be offset so that four panels corners will not meet. All panel edges must be supported. Leave a $\frac{1}{16}$ -inch gap between panels and nail no closer than $\frac{3}{8}$ inch from panel edges.

780 CMR TABLE 5602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS*

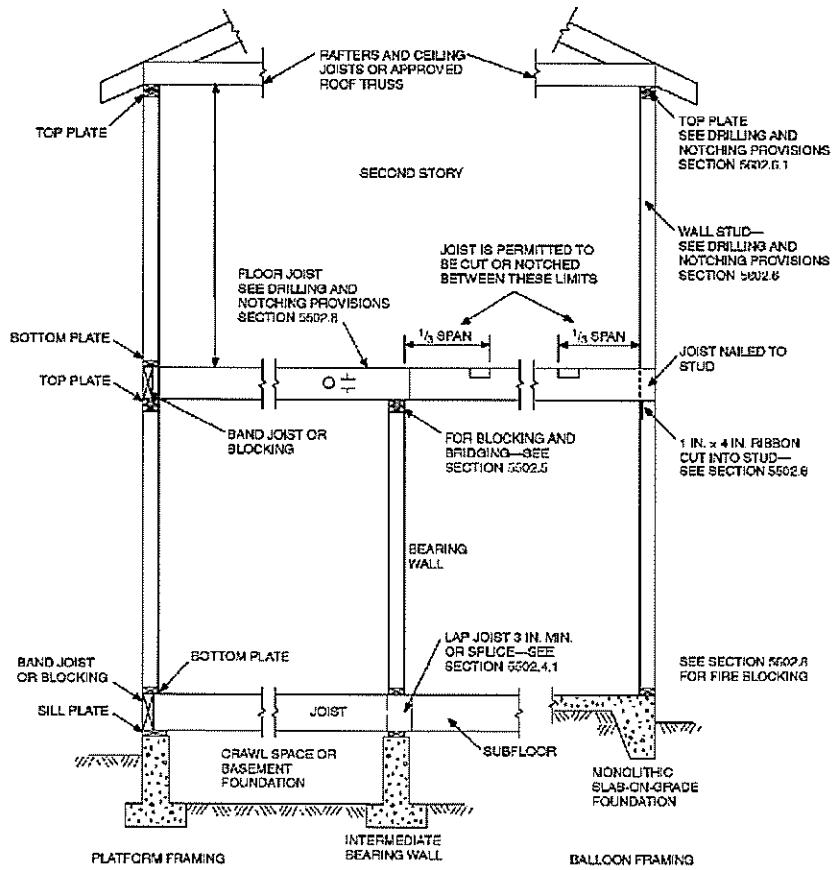
STUD SIZE (inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height ^a (feet)	Maximum spacing when supporting roof and ceiling only (inches)	Maximum spacing when supporting one floor, roof and ceiling (inches)	Maximum spacing when supporting two floors, roof and ceiling (inches)	Maximum spacing when supporting one floor only (inches)	Laterally unsupported stud height ^a (feet)	Maximum spacing (inches)
2x 3 ^b	—	—	—	—	—	10	16
2x 4	10	24	16	—	24	14	24
3x 4	10	24	24	16	24	14	24
2x 5	10	24	24	—	24	16	24
2x 6	10	24	24	16	24	20	24

For SI: 1 inch = 25.4 mm.

- a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by analysis.
- b. Shall not be used in exterior walls.

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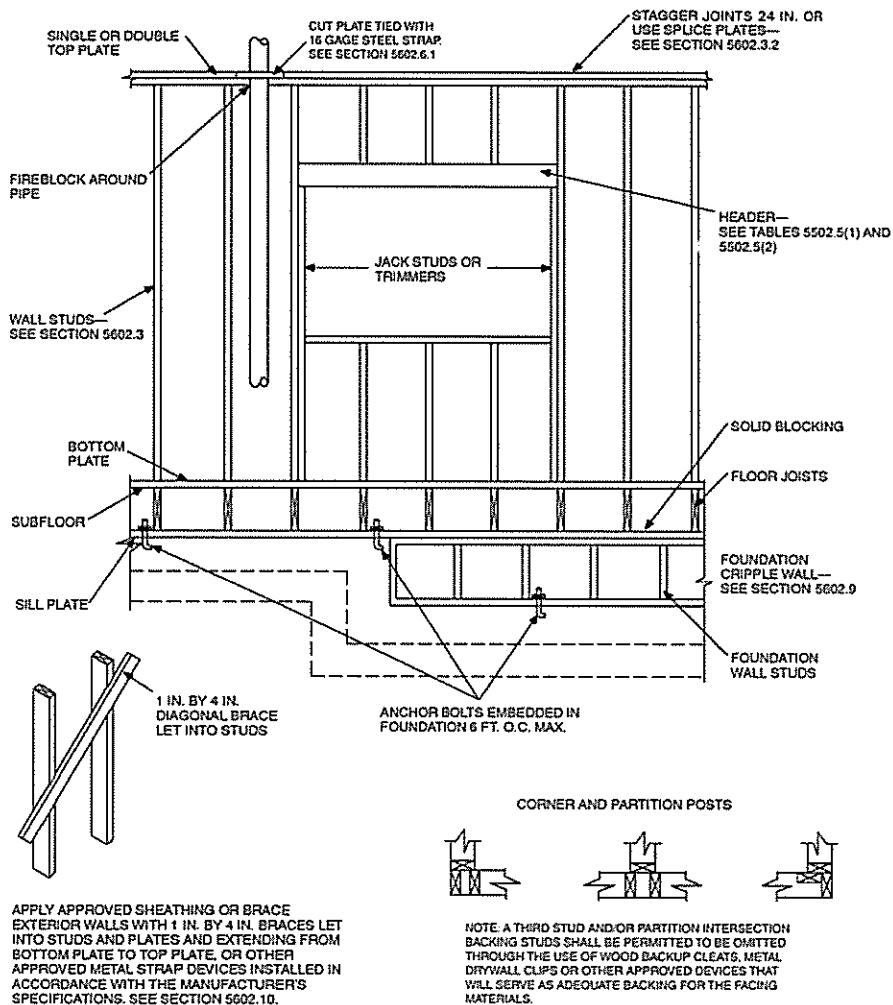
780 CMR FIGURE 5602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING



For SI: 1 inch = 25.4 mm.

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WALL CONSTRUCTION

780 CMR FIGURE 5602.3(2)
FRAMING DETAILS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

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780 CMR TABLE 5602.3.1
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO
WIND SPEEDS OF 100 MPH OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C and D₁^{b,c}

HEIGHT (feet)	ON-CENTER SPACING (inches)			
	24	16	12	8
Supporting a roof only				
>10	2 × 4	2 × 4	2 × 4	2 × 4
12	2 × 6	2 × 4	2 × 4	2 × 4
14	2 × 6	2 × 6	2 × 6	2 × 4
16	2 × 6	2 × 6	2 × 6	2 × 4
18	NA ^a	2 × 6	2 × 6	2 × 6
20	NA ^a	NA ^a	2 × 6	2 × 6
24	NA ^a	NA ^a	NA ^a	2 × 6
Supporting one floor and a roof				
>10	2 × 6	2 × 4	2 × 4	2 × 4
12	2 × 6	2 × 6	2 × 6	2 × 4
14	2 × 6	2 × 6	2 × 6	2 × 6
16	NA ^a	2 × 6	2 × 6	2 × 6
18	NA ^a	2 × 6	2 × 6	2 × 6
20	NA ^a	NA ^a	2 × 6	2 × 6
24	NA ^a	NA ^a	NA ^a	2 × 6
Supporting two floors and a roof				
>10	2 × 6	2 × 6	2 × 4	2 × 4
12	2 × 6	2 × 6	2 × 6	2 × 6
14	2 × 6	2 × 6	2 × 6	2 × 6
16	NA ^a	NA ^a	2 × 6	2 × 6
18	NA ^a	NA ^a	2 × 6	2 × 6
20	NA ^a	NA ^a	NA ^a	2 × 6
22	NA ^a	NA ^a	NA ^a	NA ^a
24	NA ^a	NA ^a	NA ^a	NA ^a

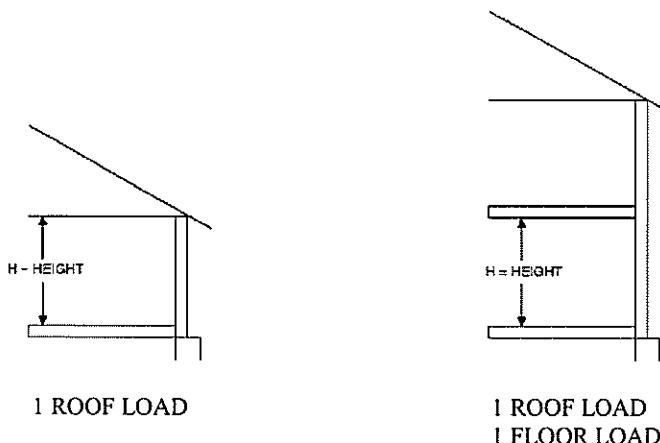
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m²,

1 pound per square inch = 6.895 kPa, 1 mile per hour = 1.609 km/h.

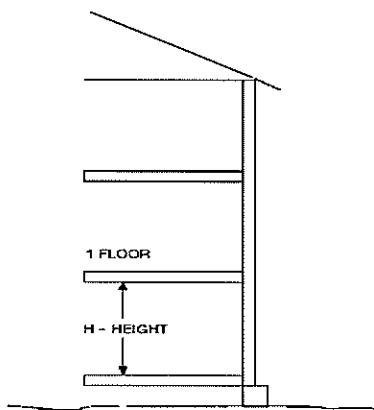
a. Design required.

b. Applicability of this table assumes the following: Snow load not exceeding 25 psf, not less than 1310 psi determined by multiplying the AF&PA NDS tabular base design value by the repetitive use factor, and by the size factor for all species except southern pine, E not less than 1.6 by 10⁶ psi, tributary dimensions for floors and roofs not exceeding six feet, maximum span for floors and roof not exceeding 12 feet, eaves not greater than two feet in dimension and exterior sheathing. Where the conditions are not within these parameters, design is required.

c. Utility, standard, stud and No. 3 grade lumber of any species are not permitted.



780 CMR TABLE 5602.3.1—continued
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO
WIND SPEEDS OF 100 MPH OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C and D₁



1 ROOF LOAD
2 FLOOR LOADS

5602.4 Interior Load-bearing Walls. Interior load-bearing walls shall be constructed, framed and fireblocked as specified for exterior walls.

5602.5 Interior Nonbearing Walls. Interior nonbearing walls shall be permitted to be constructed with two-inch-by-three-inch (51 mm by 76 mm) studs spaced 24 inches (610 mm) on center or, when not part of a braced wall line, two-inch-by-four-inch (51 mm by 102 mm) flat studs spaced at 16 inches (406 mm) on center. Interior nonbearing walls shall be capped with at least a single top plate. Interior nonbearing walls shall be fireblocked in accordance with 780 CMR 5602.8.

5602.6 Drilling and Notching—Studs. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25% of its width. Studs in nonbearing partitions may be notched to a

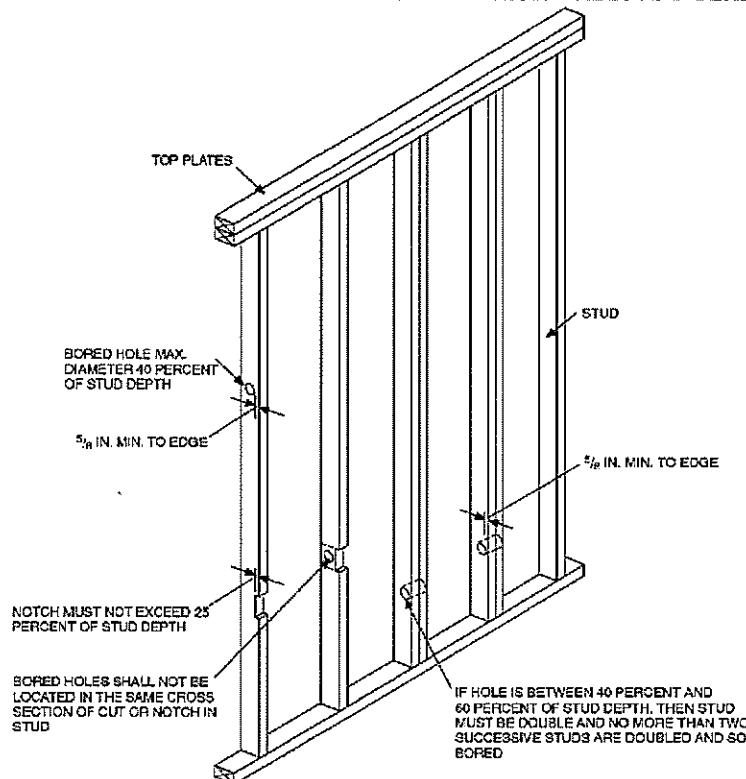
depth not to exceed 40% of a single stud width. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no greater than 40% of the stud width, the edge of the hole is no closer than $\frac{1}{8}$ inch (15.9 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. *See 780 CMR Figures 5602.6(1) and 5602.6(2).*

Exceptions:

1. A stud may be bored to a diameter not exceeding 60% of its width, provided that such studs located in exterior walls or bearing partitions are doubled and that not more than two successive studs are bored.
2. Approved stud shoes may be used when installed in accordance with the manufacturer's recommendation.

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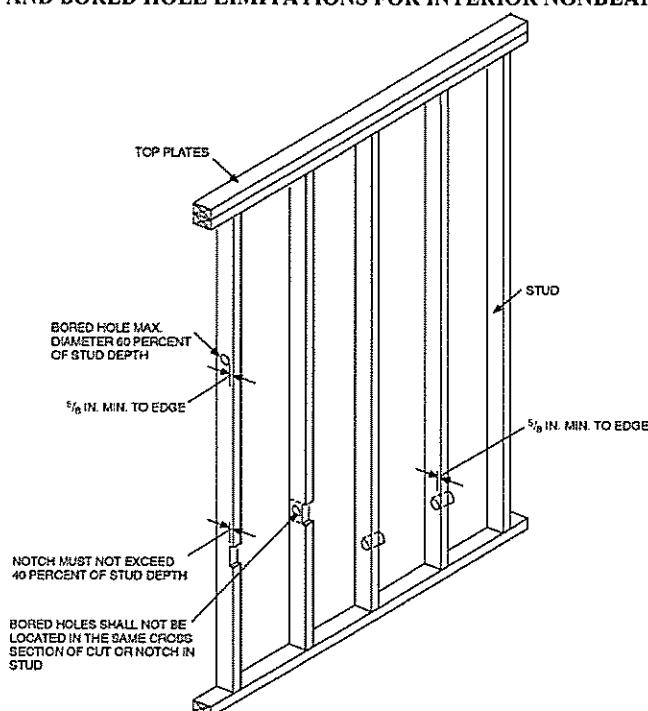
780 CMR FIGURE 5602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS



For SI: 1 inch = 25.4 mm.

NOTE: Condition for exterior and bearing walls.

780 CMR FIGURE 5602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR INTERIOR NONBEARING WALLS



For SI: 1 inch = 25.4 mm.

780 CMR 58.00

ROOF-CEILING CONSTRUCTION

780 CMR 5801 GENERAL

5801.1 Application. The provisions of 780 CMR 56.00 shall control the design and construction of the roof-ceiling system for all *one- and two-family detached dwellings and accessory buildings*.

5801.2 Requirements. Roof and ceiling construction shall be capable of accommodating all loads imposed according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

5801.3 Roof Drainage. In areas where expansive or collapsible soils are known to exist, 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 5802 WOOD ROOF FRAMING

5802.1 Identification. Load-bearing dimension lumber for rafters, trusses and ceiling joists shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5802 shall be accepted.

5802.1.1 Blocking. Blocking shall be a minimum of utility grade lumber.

5802.1.2 End-jointed Lumber. Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5802.1 may be used interchangeably with solid-sawn members of the same species and grade.

5802.1.3 Fire-retardant-treated Wood. Fire-retardant-treated wood (*FRTW*) is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

5802.1.3.1 Labeling. Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain:

1. The identification mark of an approved agency.

2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke developed rating.
6. Method drying after treatment.
7. Conformance with appropriate standards in accordance with 780 CMR 5802.1.3.2 through 5802.1.3.5.
8. For FRTW exposed to weather, damp or wet location, the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D2898).

5802.1.3.2 Strength Adjustments. Design values for untreated lumber and wood structural panels as specified in 780 CMR 5802.1, shall be adjusted for fire retardant-treated wood. Adjustments to design values shall be based upon an approved method of investigation which takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

5802.1.3.2.1 Wood Structural Panels. The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

5802.1.3.2.2 Lumber. For each species of wood treated the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with an approved method of investigation. Each manufacturer shall publish the modification factors for service at temperatures of not less

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than 80°F (26.7°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

5802.1.3.3 Exposure to Weather. Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as "Exterior" to indicate there is no increase in the listed flamespread index as defined in 780 CMR 5802.1.3 when subjected to ASTM D 2898.

5802.1.3.4 Interior Applications. Interior fire-retardant-treated wood shall have a moisture content of not over 28% when tested in accordance with ASTM D 3201 procedures at 92% relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with 780 CMR 5802.1.3.2.1 or 5802.1.3.2.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of 780 CMR 5802.

5802.1.3.5 Moisture Content. Fire-retardant-treated wood shall be dried to a moisture content of 19% or less for lumber and 15% or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in 780 CMR 5802.1.3.2.1 for plywood and 5802.1.3.2.2 for lumber.

5802.1.4 Structural Glued Laminated Timbers. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

5802.2 Design and Construction. Roof-ceilings shall be designed and constructed in accordance with the provisions of 780 CMR 56.00 and 780 CMR Figure 5606.10(1) or in accordance with AFPA/NDS. Components of roof-ceilings shall be fastened in accordance with 780 CMR Table 5602.3(1).

5802.3 Framing Details. Rafters shall be framed to ridge board or to each other with a gusset plate as a tie. Ridge board shall be at least one-inch (25.4 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. Where the roof pitch is less than three units vertical in 12 units horizontal (25% slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.

5802.3.1 Ceiling Joist and Rafter Connections.

Ceiling joists and rafters shall be nailed to each other in accordance with 780 CMR Tables 5602.3(1) and 5802.5.1(9), and the assembly shall be nailed to the top wall plate in accordance with 780 CMR Table 5602.3(1). Ceiling joists shall be continuous or securely joined where they meet over interior partitions and nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters.

Where ceiling joists are not parallel to rafters, subflooring or metal straps attached to the ends of the rafters shall be installed in a manner to provide a continuous tie across the building, or rafters shall be tied to one-inch by four-inch (25.4 mm by 102 mm) (nominal) minimum-size crossties. The connections shall be in accordance with 780 CMR Table 5602.3(1) or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top plate, the ridge formed by these rafters shall also be supported by a girder designed in accordance with accepted engineering practice.

Rafter ties shall be spaced not more than four feet (1219 mm) on center.

5802.3.2 Ceiling Joists Lapped. Ends of ceiling joists shall be lapped a minimum of three inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. When ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together in accordance with 780 CMR Table 5602.3(1) and butted joists shall be tied together in a manner to resist such thrust.

5802.4 Allowable Ceiling Joist Spans. Spans for ceiling joists shall be in accordance with 780 CMR Tables 5802.4(1) and 5802.4(2). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists and Rafters.

5802.5 Allowable Rafter Spans. Spans for rafters shall be in accordance with 780 CMR Tables 5802.5.1(1) through 5802.5.1(8). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists and Rafters. The span of each rafter shall be measured along the horizontal projection of the rafter.

5802.5.1 Purlins. Purlins are permitted to be installed to reduce the span of rafters as shown in 780 CMR Figure 5802.5.1. 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-inch by four-inch (51 mm by 102 mm) braces installed to bearing walls at a slope not less than 45 degrees from the

ROOF CEILING CONSTRUCTION

horizontal. The braces shall be spaced not more than four feet (1219 mm) on center and the unbraced length of braces shall not exceed eight feet (2438 mm).

5802.6 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 or concrete.

5802.6.1 Finished Ceiling Material. If the finished ceiling material is installed on the ceiling prior to the attachment of the ceiling to the walls, such as in construction at a factory, a compression strip of the same thickness as the finish ceiling material shall be installed directly above the top plate of bearing walls if the compressive strength of the finish ceiling material is less than the loads it will be required to withstand. The compression strip shall cover the entire length of such top plate and shall be at least ½ the width of the top plate. It shall be of material capable of transmitting the loads transferred through it.

5802.7 Cutting and Notching. Structural roof members shall not be cut, bored or notched in excess of the limitations specified in 780 CMR 5802.7.

5802.7.1 Sawn Lumber. Notches in solid lumber joists, rafters and beams shall not exceed ¼ of the depth of the member, shall not be longer than ½ of the depth of the member and shall not be located in the middle ⅓ of the span. Notches at the ends of the member shall not exceed ¼ the depth of the member. The tension side of members four inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of the holes bored or cut into members shall not exceed ⅓ the depth of the member. Holes shall not be closer than two inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than two inches (51 mm) to the notch.

Exception: Notches on cantilevered portions of rafters are permitted provided the dimension of the remaining portion of the rafter is not less than four-inch nominal (102 mm) and the length of the cantilever does not exceed 24 inches (610 mm).

5802.7.2 Engineered Wood Products. Cuts, notches and holes bored in laminated veneer lumber, glue-laminated members or I-joints are not permitted unless the effect of such penetrations are specifically considered in the design of the member.

5802.8 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.

5802.8.1 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 (25.4 mm by 76 mm) wood strip nailed across the rafters or ceiling joists at intervals not exceeding eight feet (2438 mm).

5802.9 Framing of Openings. Openings in roof and ceiling framing shall be framed with header and trimmer joists. When the header joist span does not exceed four feet (1219 mm), the header joist may be a single member the same size as the ceiling joist or rafter. Single trimmer joists may be used to carry a single header joist that is located within three feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds four feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling joists or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds six feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than two inches by two inches (51 mm by 51 mm).

5802.10 Wood Trusses.

5802.10.1 Truss Design Drawings. Truss design drawings, prepared in conformance with 780 CMR 5802.10.1, shall be provided to the building official and approved prior to installation. Truss design drawings shall include, at a minimum, the information specified below. Truss design drawing shall be provided with the shipment of trusses delivered to the jobsite.

1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.
 - 4.1. Top chord live load (including snow loads).
 - 4.2. Top chord dead load.
 - 4.3. Bottom chord live load.
 - 4.4. Bottom chord dead load.
 - 4.5. Concentrated loads and their points of application.
 - 4.6. *Controlling wind loads.*
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description (e.g., size, thickness or gauge) and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:

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- 9.1. Truss to truss girder.
- 9.2. Truss ply to ply.
- 9.3. Field splices.
10. Calculated deflection ratio and/or maximum description for live and total load.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents.
12. Required permanent truss member bracing location.

5802.10.2 Design. Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal plate connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a *Massachusetts-registered architect or registered professional engineer*.

5802.10.3 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with Building Component Safety Information (BCSI 1-03) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses*.

5802.10.4 Alterations to trusses. Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater) that exceeds the design load for the truss shall not be permitted without verification that the truss is capable of supporting such additional loading.

780 CMR TABLE 5802.4(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 5 psf			
		2 × 4	2 × 6	2 × 8	2 × 10
		Maximum ceiling joist spans			
12	Douglas fir-larch SS	13-2	20-8	Note a	Note a
	Douglas fir-larch #1	12-8	19-11	Note a	Note a
	Douglas fir-larch #2	12-5	19-6	25-8	Note a
	Douglas fir-larch #3	10-10	15-10	20-1	24-6
	Hem-fir SS	12-5	19-6	25-8	Note a
	Hem-fir #1	12-2	19-1	25-2	Note a
	Hem-fir #2	11-7	18-2	24-0	Note a
	Hem-fir #3	10-10	15-10	20-1	24-6
	Southern pine SS	12-11	20-3	Note a	Note a
	Southern pine #1	12-8	19-11	Note a	Note a
	Southern pine #2	12-5	19-6	25-8	Note a
	Southern pine #3	11-6	17-0	21-8	25-7
	Spruce-pine-fir SS	12-2	19-1	25-2	Note a
	Spruce-pine-fir #1	11-10	18-8	24-7	Note a
16	Spruce-pine-fir #2	11-10	18-8	24-7	Note a
	Spruce-pine-fir #3	10-10	15-10	20-1	24-6
	Douglas fir-larch SS	11-11	18-9	24-8	Note a
	Douglas fir-larch #1	11-6	18-1	23-10	Note a
	Douglas fir-larch #2	11-3	17-8	23-0	Note a
	Douglas fir-larch #3	9-5	13-9	17-5	21-3
	Hem-fir SS	11-3	17-8	23-4	Note a
	Hem-fir #1	11-0	17-4	22-10	Note a
	Hem-fir #2	10-6	16-6	21-9	Note a
	Hem-fir #3	9-5	13-9	17-5	21-3
	Southern pine SS	11-9	18-5	24-3	Note a
	Southern pine #1	11-6	18-1	23-1	Note a
	Southern pine #2	11-3	17-8	23-4	Note a
	Southern pine #3	10-0	14-9	18-9	22-2
19.2	Spruce-pine-fir SS	11-0	17-4	22-10	Note a
	Spruce-pine-fir #1	10-9	16-11	22-4	Note a
	Spruce-pine-fir #2	10-9	16-11	22-4	Note a
	Spruce-pine-fir #3	9-5	13-9	17-5	21-3
	Douglas fir-larch SS	11-3	17-8	23-3	Note a
	Douglas fir-larch #1	10-10	17-0	22-5	Note a
	Douglas fir-larch #2	10-7	16-7	21-0	25-8
	Douglas fir-larch #3	8-7	12-6	15-10	19-5
	Hem-fir SS	10-7	16-8	21-11	Note a
	Hem-fir #1	10-4	16-4	21-6	Note a
	Hem-fir #2	9-11	15-7	20-6	25-3
	Hem-fir #3	8-7	12-6	15-10	19-5
	Southern pine SS	11-0	17-4	22-10	Note a
	Southern pine #1	10-10	17-0	22-5	Note a
	Southern pine #2	10-7	16-8	21-11	Note a
	Southern pine #3	9-1	13-6	17-2	20-3
	Spruce-pine-fir SS	10-4	16-4	21-6	Note a
	Spruce-pine-fir #1	10-2	15-11	21-0	25-8
	Spruce-pine-fir #2	10-2	15-11	21-0	25-8
	Spruce-pine-fir #3	8-7	12-6	15-10	19-5

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780 CMR TABLE 5802.4(1) - continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 5 psf			
		2 × 4	2 × 6	2 × 8	2 × 10
		Maximum ceiling joist spans			
24	Douglas fir-larch SS	10-5	16-4	21-7	Note a
	Douglas fir-larch #1	10-10	15-9	20-1	24-6
	Douglas fir-larch #2	9-10	14-10	18-9	22-11
	Douglas fir-larch #3	7-8	11-2	14-2	17-4
	Hem-fir SS	9-10	15-6	20-5	Note a
	Hem-fir #1	9-8	15-2	19-7	23-11
	Hem-fir #2	9-2	14-5	18-6	22-7
	Hem-fir #3	7-8	11-2	14-2	17-4
	Southern pine SS	10-3	16-1	21-2	Note a
	Southern pine #1	10-0	15-9	20-10	Note a
	Southern pine #2	9-10	15-6	20-1	23-11
	Southern pine #3	8-2	12-0	15-4	18-1
	Spruce-pine-fir SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir #1	9-5	14-9	18-9	22-11
	Spruce-pine-fir #2	9-5	14-9	18-9	22-11
	Spruce-pine-fir #3	7-8	11-2	14-2	17-4

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Span exceeds 26 feet in length.

780 CMR TABLE 5802.4(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	
		Maximum ceiling joist spans				
12	Douglas fir-larch	SS	10-5	16-4	21-7	Note a
	Douglas fir-larch	#1	10-0	15-9	20-1	24-6
	Douglas fir-larch	#2	9-10	14-10	18-9	22-11
	Douglas fir-larch	#3	7-8	11-2	14-2	17-4
	Hem-fir	SS	9-10	15-6	20-5	Note a
	Hem-fir	#1	9-8	15-2	19-7	23-11
	Hem-fir	#2	9-2	14-5	18-6	22-7
	Hem-fir	#3	7-8	11-2	14-2	17-4
	Southern pine	SS	10-3	16-1	21-2	Note a
	Southern pine	#1	10-0	15-9	20-10	Note a
	Southern pine	#2	9-10	15-6	20-1	23-11
	Southern pine	#3	8-2	12-0	15-4	18-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir	#1	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#2	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#3	7-8	11-2	14-2	17-4
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0
	Douglas fir-larch	#1	9-1	13-9	17-5	21-3
	Douglas fir-larch	#2	8-9	12-10	16-3	19-10
	Douglas fir-larch	#3	6-8	9-8	12-4	15-0
	Hem-fir	SS	8-11	14-1	18-6	23-8
	Hem-fir	#1	8-9	13-5	16-10	20-8
	Hem-fir	#2	8-4	12-8	16-0	19-7
	Hem-fir	#3	6-8	9-8	12-4	15-0
	Southern pine	SS	9-4	14-7	19-3	24-7
	Southern pine	#1	9-1	14-4	18-11	23-1
	Southern pine	#2	8-11	13-6	17-5	20-9
	Southern pine	#3	7-1	10-5	13-3	15-8
	Spruce-pine-fir	SS	8-9	13-9	18-1	23-1
	Spruce-pine-fir	#1	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#2	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#3	6-8	9-8	12-4	15-0
19.2	Douglas fir-larch	SS	8-11	14-0	18-5	23-4
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5
	Douglas fir-larch	#2	8-0	11-9	14-10	18-2
	Douglas fir-larch	#3	6-1	8-10	11-3	13-8
	Hem-fir	SS	8-5	13-3	17-5	22-3
	Hem-fir	#1	8-3	12-3	15-6	18-11
	Hem-fir	#2	7-10	11-7	14-8	17-10
	Hem-fir	#3	6-1	8-10	11-3	13-8
	Southern pine	SS	8-9	13-9	18-1	23-1
	Southern pine	#1	8-7	13-6	17-9	21-1
	Southern pine	#2	8-5	12-3	15-10	18-11
	Southern pine	#3	6-5	9-6	12-1	14-4
	Spruce-pine-fir	SS	8-3	12-11	17-1	21-8
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8

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780 CMR TABLE 5802.4(2) - continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	
		Maximum ceiling joist spans				
24	Douglas fir-larch	SS #1 #2 #3 SS #1 #2 #3	8-3 7-8 7-2 5-5 7-10 7-6 7-1 5-5	13-0 11-2 10-6 7-11 12-3 10-11 10-4 7-11	17-1 14-2 13-3 10-0 16-2 13-10 13-1 10-0	20-11 17-4 16-3 12-3 20-6 16-11 16-0 12-3
	Southern pine	SS #1 #2 #3 SS #1 #2 #3	8-1 8-0 7-8 5-9 7-8 7-2 7-2 5-5	12-9 12-6 11-0 8-6 12-0 10-6 10-6 7-11	16-10 15-10 14-2 10-10 15-10 13-3 13-3 10-0	21-6 18-10 16-11 12-10 19-5 16-3 16-3 12-3

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load=20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf				DEAD LOAD = 20 psf					
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	
		Maximum rafter spans ^a									
12	Douglas fir-larch SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-5	Note b	Note b
	Douglas fir-larch #1	11-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas fir-larch #2	10-10	16-7	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas fir-larch #3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-fir SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-fir #1	10-7	16-8	21-10	Note b	Note b	10-3	14-11	18-11	23-2	Note b
	Hem-fir #2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-fir #3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
	Southern pine #1	11-1	17-4	22-11	Note b	Note b	11-1	17-3	21-9	25-10	Note b
	Southern pine #2	10-10	17-0	22-5	Note b	Note b	10-6	15-1	19-5	23-2	Note b
	Southern pine #3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-pine-fir SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-pine-fir #1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir #2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir #3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas fir-larch SS	10-5	16-4	21-7	Note b	Note b	10-5	16-0	20-3	24-9	Note b
	Douglas fir-larch #1	10-0	15-4	19-5	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch #2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas fir-larch #3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-fir SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-11	24-4	Note b
	Hem-fir #1	9-8	14-11	18-11	23-2	Note b	8-10	12-11	16-5	20-0	23-3
	Hem-fir #2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-fir #3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern pine #1	10-0	15-9	20-10	25-10	Note b	10-0	15-0	18-10	22-4	Note b
	Southern pine #2	9-10	15-1	19-5	23-2	Note b	9-1	13-0	16-10	20-1	23-7
	Southern pine #3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-pine-fir SS	9-8	15-2	19-11	25-5	Note b	9-8	14-10	18-10	23-0	Note b
	Spruce-pine-fir #1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir #2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir #3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
19.2	Douglas fir-larch SS	9-10	15-5	20-4	25-11	Note b	9-10	14-7	18-6	22-7	Note b
	Douglas fir-larch #1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch #2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas fir-larch #3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-fir SS	9-3	14-7	19-2	24-6	Note b	9-3	14-4	18-2	22-3	25-9
	Hem-fir #1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-fir #2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir #3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Southern pine #1	9-5	14-10	19-7	23-7	Note b	9-3	13-8	17-2	20-5	24-4
	Southern pine #2	9-3	13-9	17-9	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern pine #3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-pine-fir SS	9-1	14-3	18-9	23-11	Note b	9-1	13-7	17-2	21-0	24-4
	Spruce-pine-fir #1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir #2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir #3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5

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780 CMR TABLE 5802.5.1(1)- continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load=20 psf, ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans*									
24	Douglas fir-larch SS	9-1	14-4	18-10	23-4	Note b	8-11	13-1	16-7	20-3	23-5
	Douglas fir-larch #1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas fir-larch #2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas fir-larch #3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-fir SS	8-7	13-6	17-10	22-9	Note b	8-7	12-10	16-3	19-10	23-0
	Hem-fir #1	8-4	12-6	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-fir #2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-fir #3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern pine SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	22-11	Note b
	Southern pine #1	8-9	13-9	17-9	21-1	25-2	8-3	12-3	15-4	18-3	21-9
	Southern pine #2	8-7	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern pine #3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-pine-fir SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-pine-fir #1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir #2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir #3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulate rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load=20 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum rafter spans ^a									
12	Douglas fir-larch SS	10-5	16-4	21-7	Note b	Note b	10-5	16-4	21-7	Note b	Note b
	Douglas fir-larch #1	10-0	15-9	20-10	Note b	Note b	10-0	15-4	19-5	23-9	Note b
	Douglas fir-larch #2	9-10	15-6	20-5	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas fir-larch #3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-fir SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Hem-fir #1	9-8	15-2	19-11	25-5	Note b	9-8	14-11	18-11	23-2	Note b
	Hem-fir #2	9-2	14-5	19-0	24-3	Note b	9-2	14-2	17-11	21-11	25-5
	Hem-fir #3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern pine #1	10-0	15-9	20-10	Note b	Note b	10-0	15-9	20-10	25-10	Note b
	Southern pine #2	9-10	15-6	20-5	Note b	Note b	9-10	15-1	19-5	23-2	Note b
	Southern pine #3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-pine-fir SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Spruce-pine-fir #1	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-pine-fir #2	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-pine-fir #3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas fir-larch SS	9-6	14-11	19-7	25-0	Note b	9-6	14-11	19-7	24-9	Note b
	Douglas fir-larch #1	9-1	14-4	18-11	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch #2	8-11	14-1	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas fir-larch #3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-fir SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Hem-fir #1	8-9	13-9	18-1	23-1	Note b	8-9	12-11	16-5	20-0	23-3
	Hem-fir #2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-fir #3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine SS	9-4	14-7	19-3	24-7	Note b	9-4	14-7	19-3	24-7	Note b
	Southern pine #1	9-1	14-4	18-11	24-1	Note b	9-1	14-4	18-10	22-4	Note b
	Southern pine #2	8-11	14-1	18-6	23-2	Note b	8-11	13-0	16-10	20-1	23-7
	Southern pine #3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-pine-fir SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-0	Note b
	Spruce-pine-fir #1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir #2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir #3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
19.2	Douglas fir-larch SS	8-11	14-0	18-5	23-7	Note b	8-11	14-0	18-5	22-7	Note b
	Douglas fir-larch #1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch #2	8-5	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas fir-larch #3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-fir SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	25-9
	Hem-fir #1	8-3	12-11	17-1	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-fir #2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir #3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-1	Note b
	Southern pine #1	8-7	13-6	17-9	22-8	Note b	8-7	13-6	17-2	20-5	24-4
	Southern pine #2	8-5	13-3	17-5	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern pine #3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-pine-fir SS	8-3	12-11	17-1	21-9	Note b	8-3	12-11	17-1	21-0	24-4
	Spruce-pine-fir #1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir #2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir #3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5

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780 CMR TABLE 5802.5.1(2) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load=20 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans*									
24	Douglas fir-larch SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	16-7	20-3	23-5
	Douglas fir-larch #1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas fir-larch #2	7-10	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas fir-larch #3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-fir SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0
	Hem-fir #1	7-8	12-0	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-fir #2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-fir #3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern pine SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	Note b
	Southern pine #1	8-0	12-6	16-6	21-1	25-2	8-0	12-3	15-4	18-3	21-9
	Southern pine #2	7-10	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern pine #3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-pine-fir SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9
	Spruce-pine-fir #1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir #2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir #3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_R	Rafters Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(3)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=30 psf, ceiling not attached to rafters, L/Δ= 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum rafter spans ^a									
12	Douglas fir-larch SS	10-0	15-9	20-9	Note b	Note b	10-0	15-9	20-1	24-6	Note b
	Douglas fir-larch #1	9-8	14-9	18-8	22-9	Note b	9-0	13-2	16-8	20-4	23-7
	Douglas fir-larch #2	9-5	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas fir-larch #3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-fir SS	9-6	14-10	19-7	25-0	Note b	9-6	14-10	19-7	24-1	Note b
	Hem-fir #1	9-3	14-4	18-2	22-2	25-9	8-9	12-10	16-3	19-10	23-0
	Hem-fir #2	8-10	13-7	17-2	21-0	24-4	8-4	12-2	15-4	18-9	21-9
	Hem-fir #3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern pine SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Southern pine #1	9-8	15-2	20-0	24-9	Note b	9-8	14-10	18-8	22-2	Note b
	Southern pine #2	9-6	14-5	18-8	22-3	Note b	9-0	12-11	16-8	19-11	23-4
	Southern pine #3	7-7	11-2	14-3	16-10	20-0	6-9	10-0	12-9	15-1	17-11
	Spruce-pine-fir SS	9-3	14-7	19-2	24-6	Note b	9-3	14-7	18-8	22-9	Note b
	Spruce-pine-fir #1	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-pine-fir #2	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-pine-fir #3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas fir-larch SS	9-1	14-4	18-10	23-9	Note b	9-1	13-9	17-5	21-3	24-8
	Douglas fir-larch #1	8-9	12-9	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch #2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas fir-larch #3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-fir SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-1	20-10	24-2
	Hem-fir #1	8-5	12-5	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-fir #2	8-0	11-9	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-fir #3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern pine SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern pine #1	8-9	13-9	18-1	21-5	25-7	8-8	12-10	16-2	19-2	22-10
	Southern pine #2	8-7	12-6	16-2	19-3	22-7	7-10	11-2	14-5	17-3	20-2
	Southern pine #3	6-7	9-8	12-4	14-7	17-4	5-10	8-8	11-0	13-0	15-6
	Spruce-pine-fir SS	8-5	13-3	17-5	22-1	25-7	8-5	12-9	16-2	19-9	22-10
	Spruce-pine-fir #1	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir #2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir #3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
19.2	Douglas fir-larch SS	8-7	13-6	17-9	21-8	25-2	8-7	12-6	15-10	19-5	22-6
	Douglas fir-larch #1	7-11	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch #2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas fir-larch #3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-fir SS	8-1	12-9	16-9	21-4	24-8	8-1	12-4	15-7	19-1	22-1
	Hem-fir #1	7-9	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-fir #2	7-4	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir #3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-0	25-9
	Southern pine #1	8-3	13-0	16-6	19-7	23-4	7-11	11-9	14-9	17-6	20-11
	Southern pine #2	7-11	11-5	14-9	17-7	20-7	7-1	10-2	13-2	15-9	18-5
	Southern pine #3	6-0	8-10	11-3	13-4	15-10	5-4	7-11	10-1	11-11	14-2
	Spruce-pine-fir SS	7-11	12-5	16-5	20-2	23-4	7-11	11-8	14-9	18-0	20-11
	Spruce-pine-fir #1	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir #2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir #3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2

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780 CMR TABLE 5802.5.1(3) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=30 psf, ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans*									
24	Douglas fir-larch SS	7-11	12-6	15-10	19-5	22-6	7-8	11-3	14-2	17-4	20-1
	Douglas fir-larch #1	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch #2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas fir-larch #3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-fir SS	7-6	11-10	15-7	19-1	22-1	7-6	11-0	13-11	17-0	19-9
	Hem-fir #1	6-11	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-fir #2	6-7	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-fir #3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern pine SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-8	23-0
	Southern pine #1	7-8	11-9	14-9	17-6	20-11	7-1	10-6	13-2	15-8	18-8
	Southern pine #2	7-1	10-2	13-2	15-9	18-5	6-4	9-2	11-9	14-1	16-6
	Southern pine #3	5-4	7-11	10-1	11-11	14-2	4-9	7-1	9-0	10-8	12-8
	Spruce-pine-fir SS	7-4	11-7	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir #1	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir #2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir #3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(4)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=50 psf, ceiling not attached to rafters, L/Δ= 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum rafter spans ^a									
12	Douglas fir-larch SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	17-0	20-9	24-0
	Douglas fir-larch #1	8-2	12-0	15-3	18-7	21-7	7-7	11-2	14-1	17-3	20-0
	Douglas fir-larch #2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch #3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-fir SS	8-0	12-6	16-6	21-1	25-6	8-0	12-6	16-6	20-4	23-7
	Hem-fir #1	7-10	11-9	14-10	18-1	21-0	7-5	10-10	13-9	16-9	19-5
	Hem-fir #2	7-5	11-1	14-0	17-2	19-11	7-0	10-3	13-0	15-10	18-5
	Hem-fir #3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern pine SS	8-4	13-0	17-2	21-11	Note b		8-4	13-0	17-2	21-11
	Southern pine #1	8-2	12-10	16-10	20-3	24-1	8-2	12-6	15-9	18-9	22-4
	Southern pine #2	8-0	11-9	15-3	18-2	21-3	7-7	10-11	14-1	16-10	19-9
	Southern pine #3	6-2	9-2	11-8	13-9	16-4	5-9	8-5	10-9	12-9	15-2
	Spruce-pine-fir SS	7-10	12-3	16-2	20-8	24-1	7-10	12-3	15-9	19-3	22-4
	Spruce-pine-fir #1	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir #2	7-8	11-3	14-3	17-5	15-2	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir #3	5-10	8-6	10-9	13-2	20-3	5-5	7-10	10-0	12-2	14-1
16	Douglas fir-larch SS	7-8	12-1	15-10	19-5	22-6	7-8	11-7	14-8	17-11	20-10
	Douglas fir-larch #1	7-1	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch #2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas fir-larch #3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-fir SS	7-3	11-5	15-0	19-1	22-1	7-3	11-5	14-5	17-8	20-5
	Hem-fir #1	6-11	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-fir #2	6-7	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-fir #3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern pine SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	23-10
	Southern pine #1	7-5	11-7	14-9	17-6	20-11	7-4	10-10	13-8	16-2	19-4
	Southern pine #2	7-1	10-2	13-2	15-9	18-5	6-7	9-5	12-2	14-7	17-1
	Southern pine #3	5-4	7-11	10-1	11-11	14-2	4-11	7-4	9-4	11-0	13-1
	Spruce-pine-fir SS	7-1	11-2	14-8	18-0	20-11	7-1	10-9	13-8	15-11	19-4
	Spruce-pine-fir #1	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir #2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir #3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
19.2	Douglas fir-larch SS	7-3	11-4	14-6	17-8	20-6	7-3	10-7	13-5	16-5	19-0
	Douglas fir-larch #1	6-6	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas fir-larch #2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas fir-larch #3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-fir SS	6-10	10-9	14-2	17-5	20-2	6-10	10-5	13-2	16-1	18-8
	Hem-fir #1	6-4	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-fir #2	6-0	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-fir #3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern pine SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-7	21-9
	Southern pine #1	7-0	10-8	13-5	16-0	19-1	6-8	9-11	12-5	14-10	17-8
	Southern pine #2	6-6	9-4	12-0	14-4	16-10	6-0	8-8	11-2	13-4	15-7
	Southern pine #3	4-11	7-3	9-2	10-10	12-11	4-6	6-8	8-6	10-1	12-0
	Spruce-pine-fir SS	6-8	10-6	13-5	16-5	19-1	6-8	9-10	12-5	15-3	17-8
	Spruce-pine-fir #1	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir #2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir #3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2

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780 CMR TABLE 5802.5.1(4) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=50 psf, ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans ^a									
24	Douglas fir-larch SS	6-8	10-5	13-0	15-10	18-4	6-6	9-6	12-0	14-8	17-0
	Douglas fir-larch #1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas fir-larch #2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas fir-larch #3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-fir SS	6-4	9-11	12-9	15-7	18-0	6-4	9-4	11-9	14-5	16-8
	Hem-fir #1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-fir #2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-fir #3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern pine SS	6-7	10-4	13-8	17-5	21-0	6-7	10-4	13-8	16-7	19-5
	Southern pine #1	6-5	9-7	12-0	14-4	17-1	6-0	8-10	11-2	13-3	15-9
	Southern pine #2	5-10	8-4	10-9	12-10	15-1	5-5	7-9	10-0	11-11	13-11
	Southern pine #3	4-4	6-5	8-3	9-9	11-7	4-1	6-0	7-7	9-0	10-8
	Spruce-pine-fir SS	6-2	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Spruce-pine-fir #1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir #2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir #3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_r	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_r = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
ROOF CEILING CONSTRUCTION

780 CMR TABLE 5802.5.1(5)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=30 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum rafter spans ^a									
12	Douglas fir-larch SS	9-1	14-4	18-10	24-1	Note b	9-1	14-4	18-10	24-1	Note b
	Douglas fir-larch #1	8-9	13-9	18-2	22-9	Note b	8-9	13-2	16-8	20-4	23-7
	Douglas fir-larch #2	8-7	13-6	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas fir-larch #3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-fir SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-10	22-9	Note b
	Hem-fir #1	8-5	13-3	17-5	22-2	25-9	8-5	12-10	16-3	19-10	23-0
	Hem-fir #2	8-0	12-7	16-7	21-0	24-4	8-0	12-2	15-4	18-9	21-9
	Hem-fir #3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern pine SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern pine #1	8-9	13-9	18-2	23-2	Note b	8-9	13-9	18-2	22-2	Note b
	Southern pine #2	8-7	13-6	17-10	22-3	Note b	8-7	12-11	16-8	19-11	23-4
	Southern pine #3	7-7	11-2	14-3	16-10	20-0	6-9	10-0	12-9	15-1	17-11
	Spruce-pine-fir SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	Note b
	Spruce-pine-fir #1	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-pine-fir #2	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-pine-fir #3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas fir-larch SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	17-2	21-3	24-8
	Douglas fir-larch #1	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch #2	7-10	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas fir-larch #3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-fir SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	20-8	24-2
	Hem-fir #1	7-8	12-0	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-fir #2	7-3	11-5	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-fir #3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern pine SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	Note b
	Southern pine #1	8-0	12-6	16-6	21-1	25-7	8-0	12-6	16-2	19-2	22-10
	Southern pine #2	7-10	12-3	16-2	19-3	22-7	7-10	11-2	14-5	17-3	20-2
	Southern pine #3	6-7	9-8	12-4	14-7	17-4	5-10	8-8	11-0	13-0	15-6
	Spruce-pine-fir SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	19-9	22-10
	Spruce-pine-fir #1	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir #2	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir #3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
19.2	Douglas fir-larch SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	15-10	19-5	22-6
	Douglas fir-larch #1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch #2	7-4	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas fir-larch #3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-fir SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-fir #1	7-2	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-fir #2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir #3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-2	24-7
	Southern pine #1	7-6	11-9	15-6	19-7	23-4	7-6	11-9	14-9	17-6	20-11
	Southern pine #2	7-4	11-5	14-9	17-7	20-7	7-1	10-2	13-2	15-9	18-5
	Southern pine #3	6-0	8-10	11-3	13-4	15-10	5-4	7-11	10-1	11-11	14-2
	Spruce-pine-fir SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-pine-fir #1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir #2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir #3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
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780 CMR TABLE 5802.5.1(5) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=30 psf, ceiling attached to rafters, L/A = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans*									
24	Douglas fir-larch SS	7-3	11-4	15-0	19-1	22-6	7-3	11-3	14-2	17-4	20-1
	Douglas fir-larch #1	7-0	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch #2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas fir-larch #3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-fir SS	6-10	10-9	14-2	18-0	21-11	6-10	10-9	13-11	17-0	19-9
	Hem-fir #1	6-8	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-fir #2	6-4	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-fir #3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern pine SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-10
	Southern pine #1	7-0	10-11	14-5	17-6	20-11	7-0	10-6	13-2	15-8	18-8
	Southern pine #2	6-10	10-2	13-2	15-9	18-5	6-4	9-2	11-9	14-1	16-6
	Southern pine #3	5-4	7-11	10-1	11-11	14-2	4-9	7-1	9-0	10-8	12-8
	Spruce-pine-fir SS	6-8	10-6	13-10	17-8	20-11	6-8	10-5	13-2	16-1	18-8
	Spruce-pine-fir #1	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-10	13-6	15-7
	Spruce-pine-fir #2	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-10	13-6	15-7
	Spruce-pine-fir #3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_r	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_r = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(6)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum rafter spans ^a									
12	Douglas fir-larch SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-11	20-3	24-0
	Douglas fir-larch #1	7-5	11-7	15-3	18-7	21-7	7-5	11-2	14-1	17-3	20-0
	Douglas fir-larch #2	7-3	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch #3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-fir SS	7-3	11-5	15-0	19-2	23-4	7-3	11-5	15-0	19-2	23-4
	Hem-fir #1	7-1	11-2	14-8	18-1	21-0	7-1	10-10	13-9	16-9	19-5
	Hem-fir #2	6-9	10-8	14-0	17-2	19-11	6-9	10-3	13-0	15-10	18-5
	Hem-fir #3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern pine SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	24-3
	Southern pine #1	7-5	11-7	15-4	19-7	23-9	7-5	11-7	15-4	18-9	22-4
	Southern pine #2	7-3	11-5	15-0	18-2	21-3	7-3	10-11	14-1	16-10	19-9
	Southern pine #3	6-2	9-2	11-8	13-9	16-4	5-9	8-5	10-9	12-9	15-2
	Spruce-pine-fir SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-4
	Spruce-pine-fir #1	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-pine-fir #2	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-pine-fir #3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas fir-larch SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	17-11	20-10
	Douglas fir-larch #1	6-9	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch #2	6-7	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas fir-larch #3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-fir SS	6-7	10-4	13-8	17-5	21-2	6-7	10-4	13-8	17-5	20-5
	Hem-fir #1	6-5	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-fir #2	6-2	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-fir #3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern pine SS	6-10	10-9	14-2	18-1	22-0	6-10	10-9	14-2	18-1	22-0
	Southern pine #1	6-9	10-7	13-11	17-6	20-11	6-9	10-7	13-8	16-2	19-4
	Southern pine #2	6-7	10-2	13-2	15-9	18-5	6-7	9-5	12-2	14-7	17-1
	Southern pine #3	5-4	7-11	10-1	11-11	14-2	4-11	7-4	9-4	11-0	13-1
	Spruce-pine-fir SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-8	19-4
	Spruce-pine-fir #1	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir #2	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir #3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
19.2	Douglas fir-larch SS	6-7	10-4	13-7	17-4	20-6	6-7	10-4	13-5	16-5	19-0
	Douglas fir-larch #1	6-4	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas fir-larch #2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas fir-larch #3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-fir SS	6-2	9-9	12-10	16-5	19-11	6-2	9-9	12-10	16-1	18-8
	Hem-fir #1	6-1	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-fir #2	5-9	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-fir #3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern pine SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	17-0	20-9
	Southern pine #1	6-4	9-11	13-1	16-0	19-1	6-4	9-11	12-5	14-10	17-8
	Southern pine #2	6-2	9-4	12-0	14-4	16-10	6-0	8-8	11-2	13-4	15-7
	Southern pine #3	4-11	7-3	9-2	10-10	12-11	4-6	6-8	8-6	10-1	12-0
	Spruce-pine-fir SS	6-1	9-6	12-7	16-0	19-1	6-1	9-6	12-5	15-3	17-8
	Spruce-pine-fir #1	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir #2	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir #3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5802.5.1(6) - continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Ground snow load=50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans*									
24	Douglas fir-larch SS	6-1	9-7	12-7	15-10	18-4	6-1	9-6	12-0	14-8	17-0
	Douglas fir-larch #1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas fir-larch #2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas fir-larch #3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-fir SS	5-9	9-1	11-11	15-2	18-0	5-9	9-1	11-9	14-5	15-11
	Hem-fir #1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-fir #2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-fir #3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern pine SS	6-0	9-5	12-5	15-10	19-3	6-0	9-5	12-5	15-10	19-3
	Southern pine #1	5-10	9-3	12-0	14-4	17-1	5-10	8-10	11-2	13-0	15-9
	Southern pine #2	5-9	8-4	10-9	12-10	15-1	5-5	7-9	10-0	11-11	13-11
	Southern pine #3	4-4	6-5	8-3	9-9	11-7	4-1	6-0	7-7	9-0	10-8
	Spruce-pine-fir SS	5-8	8-10	11-8	14-8	17-1	5-8	8-10	11-2	13-7	15-9
	Spruce-pine-fir #1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir #2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir #3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR TABLE 5802.5.1(7)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf						DEAD LOAD = 20 psf					
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12		
		Maximum Rafter Spans*											
12	Douglas fir-larch	SS 7-7	11-10	15-8	19-5	22-6	7-7	11-10	15-0	18-3	21-2		
	Douglas fir-larch	#1 7-1	10-5	13-2	16-1	18-8	6-8	9-10	12-5	15-2	17-7		
	Douglas fir-larch	#2 6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6		
	Douglas fir-larch	#3 5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5		
	Hem-fir	SS 7-2	11-3	14-9	18-10	22-1	7-2	11-3	14-8	18-0	20-10		
	Hem-fir	#1 6-11	10-2	12-10	15-8	18-2	6-6	9-7	12-1	14-10	17-2		
	Hem-fir	#2 6-7	9-7	12-2	14-10	17-3	6-2	9-1	11-5	14-0	16-3		
	Hem-fir	#3 5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5		
	Southern pine	SS 7-5	11-8	15-4	19-7	23-10	7-5	11-8	15-4	19-7	23-10		
	Southern pine	#1 7-3	11-5	14-9	17-6	20-11	7-3	11-1	13-11	16-6	19-8		
	Southern pine	#2 7-1	10-2	13-2	15-9	18-5	6-8	9-7	12-5	14-10	17-5		
	Southern pine	#3 5-4	7-11	10-1	11-11	14-2	5-1	7-5	9-6	11-3	13-4		
	Spruce-pine-fir	SS 7-0	11-0	14-6	18-0	20-11	7-0	11-10	13-11	17-0	19-8		
16	Spruce-pine-fir	#1 6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6		
	Spruce-pine-fir	#2 6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6		
	Spruce-pine-fir	#3 5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5		
	Douglas fir-larch	SS 6-10	10-9	13-9	16-10	19-6	6-10	10-3	13-0	15-10	18-4		
	Douglas fir-larch	#1 6-2	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3		
	Douglas fir-larch	#2 5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3		
	Douglas fir-larch	#3 4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9		
	Hem-fir	SS 6-6	10-2	13-5	16-6	19-2	6-6	10-1	12-9	15-7	18-0		
	Hem-fir	#1 6-0	8-9	11-2	13-7	15-9	5-8	8-3	10-6	12-10	14-10		
	Hem-fir	#2 5-8	8-4	10-6	12-10	14-11	5-4	7-10	9-11	12-1	14-1		
	Hem-fir	#3 4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9		
	Southern pine	SS 6-9	10-7	14-0	17-10	21-8	6-9	10-7	14-0	17-10	21-0		
	Southern pine	#1 6-7	10-2	12-9	15-2	18-1	6-5	9-7	12-0	14-4	17-1		
	Southern pine	#2 6-2	8-10	11-5	13-7	16-0	5-10	8-4	10-9	12-10	15-1		
	Southern pine	#3 4-8	6-10	8-9	10-4	12-3	4-4	6-5	8-3	9-9	11-7		
19.2	Spruce-pine-fir	SS 6-4	10-0	12-9	15-7	18-1	6-4	9-6	12-0	14-8	17-1		
	Spruce-pine-fir	#1 5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3		
	Spruce-pine-fir	#2 5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3		
	Spruce-pine-fir	#3 4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9		
	Douglas fir-larch	SS 6-5	9-11	12-7	15-4	17-9	6-5	9-4	11-10	14-5	16-9		
	Douglas fir-larch	#1 5-7	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	13-11		
	Douglas fir-larch	#2 5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0		
	Douglas fir-larch	#3 4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10		
	Hem-fir	SS 6-1	9-7	12-4	15-1	17-4	6-1	9-2	11-8	14-2	15-5		
	Hem-fir	#1 5-6	8-0	10-2	12-5	14-5	5-2	7-7	9-7	11-8	13-7		
	Hem-fir	#2 5-2	7-7	9-7	11-9	13-7	4-11	7-2	9-1	11-1	12-10		
	Hem-fir	#3 4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10		
	Southern pine	SS 6-4	10-0	13-2	16-9	20-4	6-4	10-0	13-2	16-5	19-2		
	Southern pine	#1 6-3	9-3	11-8	13-10	16-6	5-11	8-9	11-0	13-1	15-7		
	Southern pine	#2 5-7	8-1	10-5	12-5	14-7	5-4	7-7	9-10	11-9	13-9		
	Southern pine	#3 4-3	6-3	8-0	9-5	11-2	4-0	5-11	7-6	8-10	10-7		
	Spruce-pine-fir	SS 6-0	9-2	11-8	14-3	16-6	5-11	8-8	11-10	13-5	15-7		
	Spruce-pine-fir	#1 5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0		
	Spruce-pine-fir	#2 5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0		
	Spruce-pine-fir	#3 4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10		

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THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5802.5.1(7) - continued
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum Rafter Spans*									
24	Douglas fir-larch	SS 6-0	8-10	11-3	13-9	15-11	5-9	8-4	10-7	12-11	15-0
	Douglas fir-larch	#1 5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Douglas fir-larch	#2 4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Douglas fir-larch	#3 3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Hem-fir	SS 5-8	8-8	11-10	13-6	13-11	5-7	8-3	10-5	12-4	12-4
	Hem-fir	#1 4-11	7-2	9-1	11-1	12-10	4-7	6-9	8-7	10-6	12-2
	Hem-fir	#2 4-8	6-9	8-7	10-6	12-2	4-4	6-5	8-1	9-11	11-6
	Hem-fir	#3 3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Southern pine	SS 5-11	9-3	12-2	15-7	18-2	5-11	9-3	12-2	14-8	17-2
	Southern pine	#1 5-7	8-3	10-5	12-5	14-9	5-3	7-10	9-10	11-8	13-11
	Southern pine	#2 5-0	7-3	9-4	11-1	13-0	4-9	6-10	8-9	10-6	12-4
	Southern pine	#3 3-9	5-7	7-1	8-5	10-0	3-7	5-3	6-9	7-11	9-5
	Spruce-pine-fir	SS 5-6	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	12-11
	Spruce-pine-fir	#1 4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#2 4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#3 3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_R	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
ROOF CEILING CONSTRUCTION

780 CMR TABLE 5802.5.1(8)
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
		Maximum rafter spans*									
12	Douglas fir-larch SS	6-10	10-9	14-3	18-2	22-1	6-10	10-9	14-3	18-2	21-2
	Douglas fir-larch #1	6-7	10-5	13-2	16-1	18-8	6-7	9-10	12-5	15-2	17-7
	Douglas fir-larch #2	6-6	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Douglas fir-larch #3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Hem-fir SS	6-6	10-2	13-5	17-2	20-10	6-6	10-2	13-5	17-2	20-10
	Hem-fir #1	6-4	10-0	12-10	15-8	18-2	6-4	9-7	12-1	14-10	17-2
	Hem-fir #2	6-1	9-6	12-2	14-10	17-3	6-1	9-1	11-5	14-0	16-3
	Hem-fir #3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Southern pine SS	6-9	10-7	14-0	17-10	21-8	6-9	10-7	14-0	17-10	21-8
	Southern pine #1	6-7	10-5	13-8	17-6	20-11	6-7	10-5	13-8	16-6	19-8
	Southern pine #2	6-6	10-2	13-2	15-9	18-5	6-6	9-7	12-5	14-10	17-5
	Southern pine #3	5-4	7-11	10-1	11-11	14-2	5-1	7-5	9-6	11-3	13-4
	Spruce-pine-fir SS	6-4	10-0	13-2	16-9	20-5	6-4	10-0	13-2	16-9	19-8
	Spruce-pine-fir #1	6-2	9-9	12-4	15-1	17-6	6-2	9-2	11-8	14-2	16-6
	Spruce-pine-fir #2	6-2	9-9	12-4	15-1	17-6	6-2	9-2	11-8	14-2	16-6
	Spruce-pine-fir #3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
16	Douglas fir-larch SS	6-3	9-10	12-11	16-6	19-6	6-3	9-10	12-11	15-10	18-4
	Douglas fir-larch #1	6-0	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3
	Douglas fir-larch #2	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Douglas fir-larch #3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Hem-fir SS	5-11	9-3	12-2	15-7	18-11	5-11	9-3	12-2	15-7	18-0
	Hem-fir #1	5-9	8-9	11-2	13-7	15-9	5-8	8-3	10-6	12-10	14-10
	Hem-fir #2	5-6	8-4	10-6	12-10	14-11	5-4	7-10	9-11	12-1	14-1
	Hem-fir #3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Southern pine SS	6-1	9-7	12-8	16-2	19-8	6-1	9-7	12-8	16-2	19-8
	Southern pine #1	6-0	9-5	12-5	15-2	18-1	6-0	9-5	12-0	14-4	17-1
	Southern pine #2	5-11	8-10	11-5	13-7	16-0	5-10	8-4	10-9	12-10	15-1
	Southern pine #3	4-8	6-10	8-9	10-4	12-3	4-4	6-5	8-3	9-9	11-7
	Spruce-pine-fir SS	5-9	9-1	11-11	15-3	18-1	5-9	9-1	11-11	14-8	17-1
	Spruce-pine-fir #1	5-8	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir #2	5-8	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir #3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
19.2	Douglas fir-larch SS	5-10	9-3	12-2	15-4	17-9	5-10	9-3	11-10	14-5	16-9
	Douglas fir-larch #1	5-7	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	13-11
	Douglas fir-larch #2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Douglas fir-larch #3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Hem-fir SS	5-6	8-8	11-6	14-8	17-4	5-6	8-8	11-6	14-2	15-5
	Hem-fir #1	5-5	8-0	10-2	12-5	14-5	5-2	7-7	9-7	11-8	13-7
	Hem-fir #2	5-2	7-7	9-7	11-9	13-7	4-11	7-2	9-1	11-1	12-10
	Hem-fir #3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Southern pine SS	5-9	9-1	11-11	15-3	18-6	5-9	9-1	11-11	15-3	18-6
	Southern pine #1	5-8	8-11	11-8	13-10	16-6	5-8	8-9	11-0	13-1	15-7
	Southern pine #2	5-6	8-1	10-5	12-5	14-7	5-4	7-7	9-10	11-9	13-9
	Southern pine #3	4-3	6-3	8-0	9-5	11-2	4-0	5-11	7-6	8-10	10-7
	Spruce-pine-fir SS	5-5	8-6	11-3	14-3	16-6	5-5	8-6	11-0	13-5	15-7
	Spruce-pine-fir #1	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir #2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir #3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10

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THE MASSACHUSETTS STATE BUILDING CODE

780 CMR TABLE 5802.5.1(8) - continued
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD
(Ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
		2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
		Maximum rafter spans ^a									
24	Douglas fir-larch SS	5-5	8-7	11-3	13-9	15-11	5-5	8-4	10-7	12-11	15-0
	Douglas fir-larch #1	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Douglas fir-larch #2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Douglas fir-larch #3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Hem-fir SS	5-2	8-1	10-8	13-6	13-11	5-2	8-1	10-5	12-4	12-4
	Hem-fir #1	4-11	7-2	9-1	11-1	12-10	4-7	6-9	8-7	10-6	12-2
	Hem-fir #2	4-8	6-9	8-7	10-6	12-2	4-4	6-5	8-1	9-11	11-6
	Hem-fir #3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Southern pine SS	5-4	8-5	11-1	14-2	17-2	5-4	8-5	11-1	14-2	17-2
	Southern pine #1	5-3	8-3	10-5	12-5	14-9	5-3	7-10	9-10	11-8	13-11
20	Southern pine #2	5-0	7-3	9-4	11-1	13-0	4-9	6-10	8-9	10-6	12-4
	Southern pine #3	3-9	5-7	7-1	8-5	10-0	3-7	5-3	6-9	7-11	9-5
	Spruce-pine-fir SS	5-0	7-11	10-5	12-9	14-9	5-0	7-9	9-10	12-0	12-11
	Spruce-pine-fir #1	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir #2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir #3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_c/H_r	Rafter Span Adjustment Factor
2/3 or greater	0.50
1/2	0.58
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 and less	1.00

where: H_c = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls. H_r = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
ROOF CEILING CONSTRUCTION

780 CMR TABLE 5802.5.1(9)
Rafter/Ceiling Joist Heel Joint Connections^{a,b,c,d,e,f}

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)																		
		30				50				70										
		Roof span (feet)																		
Required number of 16d common nails ^{a,b} per heel joint splices ^{c,d,f}																				
		12	20	28	36	12	20	28	36	12	20	28	36							
3:12	12	4	6	8	11	5	8	12	15	6	11	15	20							
	16	5	8	11	14	6	11	15	20	8	14	20	26							
	24	7	11	16	21	9	16	23	30	12	21	30	39							
4:12	12	3	5	6	8	4	6	9	11	5	8	12	15							
	16	4	6	8	11	5	8	12	15	6	11	15	20							
	24	5	9	12	16	7	12	17	22	9	16	23	29							
5:12	12	3	4	5	7	3	5	7	9	4	7	9	12							
	16	3	5	7	9	4	7	9	12	5	9	12	16							
	24	4	7	10	13	6	10	14	18	7	13	18	23							
7:12	12	3	3	4	5	3	4	5	7	3	5	7	9							
	16	3	4	5	6	3	5	7	9	4	6	9	11							
	24	3	5	7	9	4	7	10	13	5	9	13	17							
9:12	12	3	3	3	4	3	3	4	5	3	4	5	7							
	16	3	3	4	5	3	4	5	7	3	5	7	9							
	24	3	4	6	7	3	6	8	10	4	7	10	13							
12:12	12	3	3	3	3	3	3	3	4	3	3	4	5							
	16	3	3	3	4	3	3	4	5	3	4	5	7							
	24	3	3	4	6	3	4	6	8	3	6	8	10							

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. 40d box nails shall be permitted to be substituted for 16d common nails.

b. Nailing requirements shall be permitted to be reduced 25% if nails are clinched.

c. Heel joint connections are not required when the ridge is supported by a load-bearing wall, header or ridge beam.

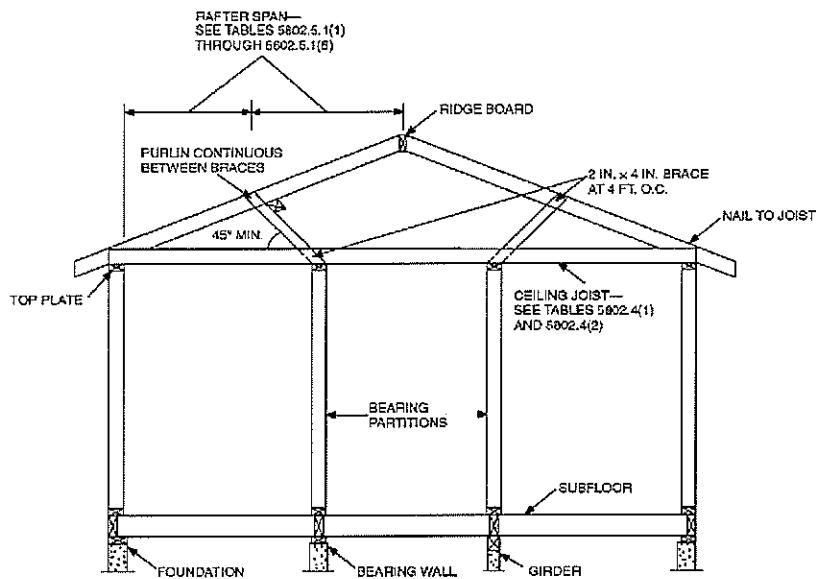
d. When intermediate support of the rafter is provided by vertical struts or purlins to a load bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

e. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

f. When rafter ties are substituted for ceiling joists, the heel joint connection requirement shall be taken as the tabulated heel joint connection requirement for $\frac{1}{3}$ of the actual rafter-slope.

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**780 CMR FIGURE 5802.5.1
BRACED RAFTER CONSTRUCTION**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.018 rad.

NOTE: Where ceiling joints run perpendicular to the rafters, rafter ties shall be nailed to the rafter near the plate line and spaced not more than four feet on center.

**780CMR TABLE 5802.11
REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS
TO RESIST WIND UPLIFT FORCES^{a,b,c,e,f}
(Pounds per connection)**

BASIC WIND SPEED (3-second gust)	ROOF SPAN (feet)							OVERHANGS ^d (pounds/feet)
	12	20	24	28	32	36	40	
85	-72	-120	-145	-169	-193	-217	-241	-38.55
90	-91	-151	-181	-212	-242	-272	-302	-43.22
100	-131	-218	-262	-305	-349	-393	-436	-53.36
110	-175	-292	-351	-409	-467	-526	-584	-64.56

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 1.61 km/hr, 1 pound/foot = 14.5939 N/m, 1 pound = 0.454 kg.

a. The uplift connection requirements are based on a 30 foot mean roof height located in Exposure B. For Exposures C and D and for other mean roof heights, multiply the above loads by the Adjustment Coefficients in 780 CMR Table 5301.2(3).

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for ten pounds of dead load.

d. The uplift connection requirements do not account for the effects of overhangs. The magnitude of the above loads shall be increased by adding the overhang loads found in the table. The overhang loads are also based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.

e. The uplift connection requirements are based upon wind loading on end zones as defined in Section M1609.6 of the *International Building Code*. Connection loads for connections located a distance of 20% of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 600-pound rated connector is used on the roof framing, a 500-pound rated connector is permitted at the next floor level down.)

ROOF CEILING CONSTRUCTION

5802.10.5 Truss to Wall Connection. Trusses shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 175 pounds (79.45 kg.) and shall be installed in accordance with the manufacturer's specifications. For roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m^2) or greater, as established in 780 CMR Table 5301.2(2), adjusted for height and exposure per 780 CMR Table 5301.2(3), *see* 780 CMR 5802.11.

5802.11 Roof tie-down.

5802.11.1 Uplift Resistance. Roof assemblies which are subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m^2) or greater shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in 780 CMR Table 5802.11. Wind uplift pressures shall be determined using an effective wind area of 100 square feet (9.3 m^2) and *the applicable wind zone* in 780 CMR Table 5301.2(2), as adjusted for height and exposure per 780 CMR Table 5301.2(3).

A continuous load path shall be provided to transmit the uplift forces from the rafter or truss ties to the foundation.

780 CMR 5803 ROOF SHEATHING

5803.1 Lumber Sheathing. Allowable spans for lumber used as roof sheathing shall conform to 780 CMR Table 5803.1. Spaced lumber sheathing for wood shingle and shake roofing shall conform to the requirements of 780 CMR 5905.7 and 5905.8.

**780 CMR TABLE 5803.1
MINIMUM THICKNESS OF
LUMBER ROOF SHEATHING**

RAFTER OR BEAM SPACING (inches)	MINIMUM NET THICKNESS (inches)
24	5/8
48 ^a	
60 ^b	1 1/2 T & G
72 ^c	

For SI: 1 inch = 25.4 mm.

- a. Minimum $270 F_b$, 340,000 E.
- b. Minimum $420 F_b$, 660,000 E.
- c. Minimum $600 F_b$, 1,150,000 E.

5803.2 Wood Structural Panel Sheathing.

5803.2.1 Identification and Grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA 0437, and shall be identified by grade mark or certificate of inspection issued by an approved agency. Wood structural panels shall comply with the grades specified in 780 CMR Table 5503.2.1.1(1).

5803.2.1.1 Exposure Durability. All wood structural panels, when designed to be permanently exposed in outdoor applications,

shall be of an exterior exposure durability. Wood structural panel roof sheathing exposed to the underside may be of interior type bonded with exterior glue, identified as Exposure 1.

5803.2.1.2 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 that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an approved agency.

5803.2.2 Allowable Spans. The maximum allowable spans for wood structural panel roof sheathing shall not exceed the values set forth in 780 CMR Table 5503.2.1.1(1).

5803.2.3 Installation. Wood structural panel used as roof sheathing shall be installed with joints staggered or nonstaggered in accordance with 780 CMR Table 5602.3(1), or APA E30 for wood roof framing or with 780 CMR Table 5804.3 for steel roof framing.

780 CMR 5804 STEEL ROOF FRAMING

5804.1 General. Elements shall be straight and free of any defects that would significantly affect their structural performance. Cold-formed steel roof framing members shall comply with the requirements of 780 CMR 5804.1.

5804.1.1 Applicability Limits. The provisions of 780 CMR 5804.1 shall control the construction of steel roof framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist span or truss, not greater than two stories in height with each story not greater than ten feet (3048 mm) high, and roof slopes not smaller than 3:12 (25% slope) or greater than 12:12 (100% slope). Steel roof framing constructed in accordance with the provisions of 780 CMR 5804.1 shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour (209 km/h) Exposure A, B or C and a maximum ground snow load of 70 psf (3.35 kN/m^2).

5804.1.2 In-line Framing. Steel roof framing constructed in accordance with 780 CMR 5804 shall be located directly in-line with load-bearing studs below with a maximum tolerance of $\frac{3}{4}$ inch (19.1 mm) between the centerline of the stud and roof joist/rafter.

5804.1.3 Roof trusses. The design, quality assurance, installation and testing of cold-formed steel trusses shall be in accordance with the AISI Standard for Cold-formed Steel Framing-Truss Design (COFS/Truss).

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5804.2 Structural Framing. Load-bearing steel roof framing members shall comply with 780 CMR Figure 5804.2(1) and the dimensional and minimum thickness requirements specified in 780 CMR Tables 5804.2(1) and 5804.2(2). Tracks shall comply with 780 CMR Figure 5804.2(2) and shall have a minimum flange width of 1½ inches (32 mm). The maximum inside bend radius for load-bearing members shall be the greater of $\frac{1}{32}$ inch (2.4 mm) or twice the uncoated steel thickness. Holes in roof framing members shall not exceed 1.5 inches (38 mm) in width or four inches (102 mm) in length as shown in 780 CMR Figure 5804.2(3). Holes shall be permitted only along the centerline of the web of the framing member. Holes shall not be less than 24 inches (610 mm) center-to-center and shall not be located less than ten inches (254 mm) from the edge of the hole to the edge of the bearing surface or support unless patched in accordance with 780 CMR 5804.3.6.

5804.2.1 Material. Load-bearing steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of one of the following:

1. ASTM A 653; Grades 33, 37, 40 and 50 (Classes 1 and 3).
2. ASTM A 792; Grades 33, 37, 40 and 50A.
3. ASTM A 875; Grades 33, 37, 40 and 50 (Classes 1 and 3).
4. Steels that comply with ASTM A 653, except for tensile and elongation, shall be permitted provided the ratio of tensile strength to yield point is at least 1.08 and the total elongation is at least 10% for a two-inch (51

mm) gage length or 7% for an 8-inch (203 mm) gage length.

5804.2.2 Identification. Load-bearing steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum uncoated steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi).

5804.2.3 Fastening Requirements. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $\frac{1}{2}$ inch (12.7 mm), shall be self-drilling tapping, and shall conform to SAE J78. Structural sheathing shall be attached to roof rafters with minimum No. 8 self-drilling tapping screws that conform to SAE J78. Screws for attaching structural sheathing to steel roof framing shall have a minimum head diameter of 0.292 inch (7.4mm) with countersunk heads and shall be installed with a minimum edge distance of $\frac{3}{8}$ inch (9.5 mm). Gypsum board ceilings shall be attached to steel joists with minimum No. 6 screws conforming to ASTM C 954 and shall be installed in accordance with 780 CMR 5805. For all connections, screws shall extend through the steel a minimum of three exposed threads. All self-drilling tapping screws conforming to SAE J78 shall have a minimum Type II coating in accordance with ASTM B 633.

780 CMR TABLE 5804.2(1)
LOAD-BEARING COLD-FORMED STEEL MEMBER SIZES

NOMINAL MEMBER SIZE MEMBER DESIGNATION*	WEB DEPTH (inches)	MINIMUM FLANGE WIDTH (inches)	MAXIMUM FLANGE WIDTH (inches)	MINIMUM LIP SIZE (inches)
350S162-t	3.5	1.625	2	0.5
550S162-t	5.5	1.625	2	0.5
800S162-t	8	1.625	2	0.5
1000S162-t	10	1.625	2	0.5
1200S162-t	12	1.625	2	0.5

For SI: 1 inch = 25.4 mm.

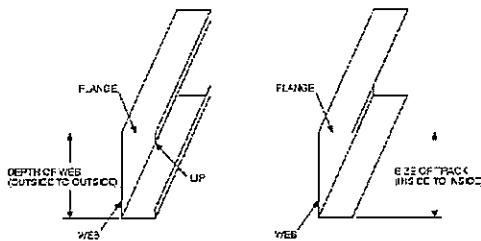
- a. The member designation is defined by the first number representing the member depth in $\frac{1}{100}$ inch, the letter "s" representing a stud or joist member, the second number representing the flange width in $\frac{1}{100}$ inch, and the letter "t" shall be a number representing the minimum base metal thickness in mils [see 780CMR Table 5804.2(2)].

780 CMR TABLE 5804.2(2)
MINIMUM THICKNESS OF COLD-FORMED STEEL ROOF FRAMING MEMBERS

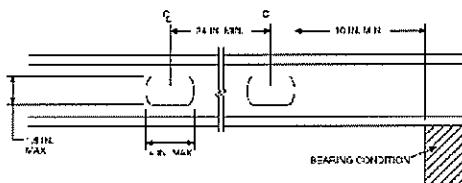
DESIGNATION (mils)	MINIMUM UNCOATED THICKNESS (inches)	REFERENCED GAGE NUMBER
33	0.033	20
43	0.043	18
54	0.054	16
68	0.068	14

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR
FIGURE 5804.2(1) C-SECTION
FIGURE 5804.2(2) TRACK SECTION



780 CMR FIGURE 5804.2(3)
WEB HOLES



For SI: 1 inch = 25.4 mm.

Where No. 8 screws are specified in a steel-to-steel connection, the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in 780 CMR Table 5804.2.3 when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84mm). When applying the reduction factor, the resulting number of screws shall be rounded up.

780 CMR TABLE 5804.2.3
SCREW SUBSTITUTION FACTOR

SCREW SIZE	THINNEST CONNECTED STEEL SHEET (mils)	
	33	43
#8	1	0.67
#10	0.93	0.62
#12	0.86	0.56

For SI: 1 mil = 0.0254 mm.

5804.3 Roof Construction. Steel roof systems constructed in accordance with the provisions of 780 CMR 5804.3 shall consist of both ceiling joists and rafters in accordance with 780 CMR Figure 5804.3 and fastened in accordance with 780 CMR Table 5804.3.

5804.3.1 Allowable Ceiling Joist Spans. The clear span of cold-formed steel ceiling joists shall not exceed the limits set forth in 780CMR Table

5804.3.1(1) or 5804.3.1(2). Ceiling joists shall have a minimum bearing length of 1.5 inches (38 mm) and shall be connected to rafters (heel joint) in accordance with 780 CMR Figure 5804.3.1(1) and 780CMR Table 5804.3.1(3). When continuous joists are framed across interior bearing supports, the interior bearing supports shall be located within 24 inches (610 mm) of midspan of the ceiling joist, and the individual spans shall not exceed the applicable spans in 780 CMR Table 5804.3.1(1) or 5804.3.1(2). Where required in 780 CMR Table 5804.3.1(1) or 5804.3.1(2), bearing stiffeners shall be installed at each bearing location in accordance with 780 CMR 5804.3.8 and 780 CMR Figure 5804.3.8. When the attic is to be used as an occupied space, the ceiling joists shall be designed in accordance with 780 CMR 5505.

5804.3.2 Ceiling Joist Bracing. The bottom flanges of steel ceiling joists shall be laterally braced in accordance with 780 CMR 5702. The top flanges of steel ceiling joists shall be laterally braced with a minimum of 33 mil (0.84 mm) C-section, 33 mil (0.84mm) track section, or 1½ inch by 33 mil (38 mm by 0.84 mm) continuous steel strapping as required in 780 CMR Table 5804.3.1(1) or 5804.3.1(2). Lateral bracing shall be installed in accordance with 780 CMR Figure

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5804.3. C-section, tracks or straps shall be fastened to the top flange at each joist with at least one No. 8 screw and shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between joists in-line with strap bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joists, and at the termination of all straps. The third point bracing span values from 780 CMR Table 5804.3.1(1) or 5804.3.1(2) shall be used for straps installed at closer spacings than third point bracing, or when sheathing is applied to the top of the ceiling joists.

5804.3.3 Allowable Rafter Spans. The horizontal projection of the rafter span, as shown in 780 CMR Figure 5804.3, shall not exceed the limits set forth in 780 CMR Table 5804.3.3(1). Wind speeds shall be converted to equivalent ground snow loads in accordance with 780 CMR Table 5804.3.3(2). Rafter spans shall be selected based on the higher of the ground snow load or the equivalent snow load converted from the wind speed. When required, a rafter support brace shall be a minimum of 350S162-33 C-section with maximum length of eight feet (2438 mm) and shall be connected to a ceiling joist and rafter with four No. 10 screws at each end.

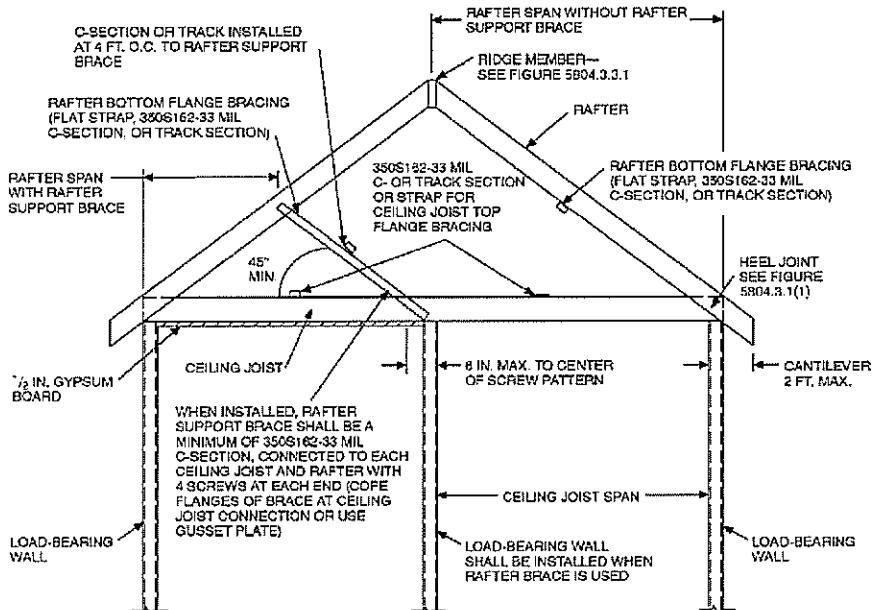
780 CMR TABLE 5804.3
ROOF FRAMING FASTENING SCHEDULE^{a,b}

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND SIZE OF FASTENERS	SPACING OF FASTENERS
Ceiling joist to top track of load-bearing wall	2 No. 10 screws	Each joist
Roof sheathing (oriented strand board or plywood) to rafter	No. 8 screws	6" o.c. on edges and 12" o.c. at interior supports. 6" o.c. at gable end truss
Truss to bearing wall ^a	2 No. 10 screws	Each truss
Gable end truss to endwall top track	No. 10 screws	12" o.c.
Rafter to ceiling joist	Minimum No. 10 screws, per 780 CMR Table 5804.3.1(3)	Evenly spaced, less than $\frac{1}{2}$ " from all edges.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m², 1 mil = 0.0254 mm.

- a. Screws shall be applied through the flanges of the truss or ceiling joist or a 54 mil clip angle shall be used with two No.10 screws in each leg. See 780 CMR 5804.4 for additional requirements to resist uplift forces.
- b. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof sheathing panel edges perpendicular to the framing members shall not be required except at the intersection of adjacent roof planes. Roof perimeter shall be supported by framing members or cold-formed blocking of the same depth and gauge as the floor members.

780 CMR FIGURE 5804.3
STEEL ROOF CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

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ROOF CEILING CONSTRUCTION

780 CMR TABLE 5804.3.1(1)
ALLOWABLE SPANS FOR COLD-FORMED STEEL CEILING JOISTS^{a,b,c}
10 psf live load (no attic storage)

NOMINAL JOIST SIZE	LATERAL SUPPORT OF TOP (COMPRESSION) FLANGE					
	Unbraced		Mid-span bracing		Third-point bracing	
	Spacing (inches)	16	24	16	24	16
350S162-33	9'-2"	8'-3"	11'-9"	10'-1"	11'-9"	10'-4"
350S162-43	9'-11"	8'-10"	12'-10"	11'-2"	12'-10"	11'-2"
350S162-54	10'-8"	9'-6"	13'-9"	12'-0"	13'-9"	12'-0"
350S162-68	11'-7"	10'-4"	14'-8"	12'-10"	14'-8"	12'-10"
550S162-33	10'-5"	9'-5"	14'-5"	12'-8" ^c	16'-4"	13'-10" ^c
550S162-43	11'-2"	10'-1"	15'-7"	13'-10"	18'-0"	15'-5"
550S162-54	12'-0"	10'-9"	16'-7"	14'-9"	19'-5"	16'-8"
550S162-68	12'-11"	11'-7"	17'-8"	15'-10"	20'-11"	18'-1"
800S162-33	11'-8" ^c	10'-6" ^c	16'-5" ^c	14'-9" ^c	19'-5" ^c	16'-7" ^c
800S162-43	12'-6"	11'-3"	17'-6"	15'-10"	21'-2"	18'-7"
800S162-54	13'-4"	11'-11"	18'-7"	16'-9"	22'-7"	20'-0"
800S162-68	14'-3"	12'-9"	19'-8"	17'-8"	23'-11"	21'-4"
1000S162-43	13'-4" ^c	12'-1" ^c	18'-9" ^c	16'-11" ^c	22'-11" ^c	20'-6" ^c
1000S162-54	14'-2"	12'-9"	19'-10"	17'-10"	24'-2"	21'-9"
1000S162-68	15'-2"	13'-7"	21'-0"	18'-11"	25'-6"	23'-0"
1200S162-43	14'-1" ^c	12'-8" ^c	19'-10" ^c	17'-11" ^c	24'-3" ^c	21'-6" ^c
1200S162-54	15'-0" ^c	13'-5" ^c	20'-11" ^c	18'-11" ^c	25'-7" ^c	23'-1" ^c
1200S162-68	15'-11"	14'-4"	22'-2"	19'-11"	27'-0"	24'-4"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Deflection criteria: 1/240 for total loads.

b. Ceiling dead load = 5 psf.

c. Bearing stiffeners are required at all bearing points and concentrated load locations.

TABLE 5804.3.1(2)
ALLOWABLE SPANS FOR COLD-FORMED STEEL CEILING JOISTS^{a,b,c}
20 psf live load (Limited attic storage where development of future rooms is not possible)

NOMINAL JOIST SIZE	LATERAL SUPPORT OF TOP FLANGE					
	Unbraced		Mid-span bracing		Third-point bracing	
	Spacing (inches)	16	24	16	24	16
350S 162-33	8'-0"	6'-0"	9'-8"	6'-0"	9'-0"	6'-0"
350S162-43	8'-8"	7'-8"	10'-9"	9'-1"	10'-10"	9'-5"
350S162-54	9'-3"	8'-3"	11'-7"	9'-11"	11'-7"	10'-1"
350S162-68	10'-0"	8'-11"	12'-5"	10'-10"	12'-5"	10'-10"
550S162-33	9'-2"	6'-0"	12'-2" ^c	10'-5" ^c	13'-3"	11'-0" ^c
550S162-43	9'-10"	8'-10"	13'-4"	11'-6"	14'-9"	12'-5"
550S162-54	10'-5"	9'-5"	14'-4"	12'-6"	16'-1"	13'-7"
550S162-68	11'-3"	10'-0"	15'-4"	13'-5"	17'-5"	14'-10"
800S162-33	10'-3" ^c	9'-3" ^c	14'-4" ^c	12'-5" ^c	15'-11" ^c	13'-4" ^c
800S162-43	10'-11"	9'-10"	15'-5"	13'-8" ^c	17'-11" ^c	15'-5" ^c
800S162-54	11'-8"	10'-6"	16'-3"	14'-7"	19'-3"	16'-8"
800S162-68	12'-5"	11'-2"	17'-3"	15'-6"	20'-7"	18'-0"
1000S162-43	11'-9"	10'-7" ^c	16'-6" ^c	14'-10" ^c	19'-10" ^c	17'-1" ^c
1000S162-54	12'-5"	11'-2"	17'-5"	15'-8"	21'-1"	18'-7"
1000S162-68	13'-3"	11'-10"	18'-5"	16'-7"	22'-4"	19'-11"
1200S162-43	12'-5" ^c	11'-2" ^c	17'-5" ^c	15'-8" ^c	20'-9" ^c	18'-0" ^c
1200S162-54	13'-1" ^c	11'-9" ^c	18'-5" ^c	16'-7" ^c	22'-5" ^c	20'-1" ^c
1200S162-68	13'-11"	12'-6"	19'-5"	17'-6"	23'-8"	21'-3"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Deflection criteria: 1/240 for total loads.

b. Ceiling dead load = 5 psf.

c. Bearing stiffeners are required at all bearing points and concentrated load locations.

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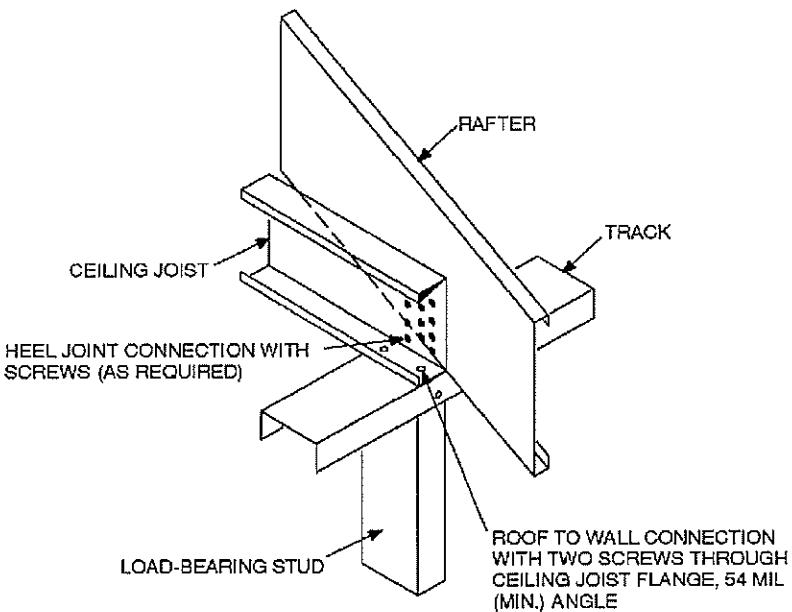
780 CMR TABLE 5804.3.1(3)
NUMBER OF SCREWS REQUIRED FOR CEILING JOIST TO RAFTER CONNECTION*

ROOF SLOPE	BUILDING WIDTH (feet)															
	24				28				32				36			
	Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)				Ground snow load (psf)			
	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
3:12	5	6	9	12	6	7	10	13	7	8	12	15	8	9	13	17
4:12	4	5	7	9	5	6	8	10	6	6	9	12	6	7	10	13
5:12	4	4	6	7	4	5	7	9	5	5	8	10	5	6	9	11
6:12	3	4	5	7	4	4	6	8	4	5	7	9	4	5	7	10
7:12	3	3	5	6	3	4	5	7	4	4	6	8	4	5	7	9
8:12	3	3	4	5	3	3	5	6	3	4	5	7	4	4	6	8
9:12	2	3	4	5	3	3	4	6	3	4	5	6	3	4	6	7
10:12	2	3	4	5	3	3	4	5	3	3	5	6	3	4	5	7
11:12	2	3	4	4	3	3	4	5	3	3	5	6	3	4	5	6
12:12	2	3	3	4	2	3	4	5	3	3	4	6	3	4	5	6

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Screws shall be No. 10 minimum.

780 CMR FIGURE 5804.3.1(1)
JOIST TO RAFTER CONNECTION



For SI: 1 mil = 0.0254 mm.

780 CMR TABLE 5804.3.3(1)
ALLOWABLE HORIZONTAL RAFTER SPANS^{a,b}

NOMINAL RAFTER SIZE	GROUND SNOW LOAD							
	20 psf		30 psf		50 psf		70 psf	
	Spacing (inches-feet)	16	Spacing (inches-feet)	16	Spacing (inches-feet)	16	Spacing (inches-feet)	16
550S162-33	12'-8"	10'-4"	11'-9"	9'-7"	9'-11"	8'-1"	8'-10"	7'-2"
550S162-43	15'-5"	12'-7"	14'-3"	11'-8"	12'-1"	9'-10"	10'-8"	8'-9"
550S162-54	13'-0"	14'-2"	16'-1"	13'-1"	13'-8"	11'-2"	12'-1"	9'-10"
550S162-68	18'-1"	15'-10"	17'-3"	14'-9"	15'-4"	12'-6"	13'-6"	11'-1"
800S162-33	15'-5"	11'-5"	14'-4"	9'-10"	10'-7"	7'-1"	8'-3"	5'-6"
800S162-43	19'-1"	15'-7"	17'-9"	14'-6"	15'-1"	12'-3"	13'-3"	10'-9"
800S162-54	22'-7"	18'-5"	21'-0"	17'-1"	17'-9"	14'-6"	15'-9"	12'-10"
800S162-68	24'-7"	20'-9"	23'-4"	19'-3"	20'-0"	16'-4"	17'-8"	14'-5"
1000S162-43	21'-2"	17'-3"	19'-8"	16'-0"	16'-8"	13'-1"	14'-9"	10'-3"
1000S162-54	25'-1"	20'-6"	23'-3"	19'-0"	19'-9"	16'-1"	17'-5"	14'-3"
1000S162-68	29'-6"	24'-6"	27'-9"	22'-9"	23'-8"	19'-3"	21'-0"	17'-1"
1200S162-43	23'-0"	18'-2"	21'-4"	15'-7"	16'-9"	11'-3"	13'-2"	8'-9"
1200S162-54	27'-3"	22'-3"	25'-3"	20'-7"	21'-5"	17'-6"	18'-11"	15'-5"
1200S162-68	32'-1"	26'-2"	29'-9"	24'-3"	25'-3"	20'-7"	22'-4"	18'-2"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m².

a. Deflection criteria: 1/240 for live loads and 1/180 for total loads.

b. Roof dead load = 12 pounds per square foot.

780 CMR TABLE 5804.3.3(2)
BASIC WIND SPEED TO EQUIVALENT SNOW LOAD CONVERSION

BASIC WIND SPEED AND EXPOSURE	Exp. A/B	Exp. C	EQUIVALENT GROUND SNOW LOAD (psf)								
			Roof slope								
85 mph	—	20	20	20	20	20	30	30	30	30	30
100 mph	85 mph	20	20	20	20	30	30	30	30	50	50
110 mph	100 mph	20	20	20	20	30	50	50	50	50	50
—	110 mph	30	30	30	50	50	50	70	70	70	—

For SI: 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kN/m².

5804.3.3.1 Rafter Framing. Rafters shall be connected to a parallel ceiling joist to form a continuous tie between exterior walls in accordance with 780 CMR Figures 5804.3 and 5804.3.1(1) and 780 CMR Table 5804.3.1(3). Rafters shall be connected to a ridge member with a minimum two-inch by two-inch (51 mm by 51 mm) clip angle fastened with minimum No. 10 screws to the ridge member in accordance with 780 CMR Figure 5804.3.3.1 and 780 CMR Table 5804.3.3.1. The clip angle shall have a minimum steel thickness as the rafter member and shall extend the full depth of the rafter member. The ridge member shall be fabricated from a C-section and a track section, which shall be of a minimum size and steel thickness as the adjacent rafters and shall be installed in accordance with 780 CMR Figure 5804.3.3.1.

5804.3.3.2 Roof Cantilevers. Roof cantilevers shall not exceed 24 inches (610 mm) in accordance with 780 CMR Figure 5804.3. Roof cantilevers shall be supported by a header in accordance with 780 CMR 5603.6 or shall be supported by the floor framing in accordance with 780 CMR 5505.3.7.

5804.3.4 Rafter Bottom Flange Bracing. The bottom flanges of steel rafters shall be continuously braced with a minimum 33-mil (0.84 mm) C-section, 33-mil (0.84 mm) track section, or a 1½-inch by 33-mil (38 mm by 0.84mm) steel strapping at a maximum spacing of eight feet (2438 mm) as measured parallel to the rafters. Bracing shall be installed in accordance with 780 CMR Figure 5804.3. The C-section, track section, or straps shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between rafters in-line with the continuous bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the rafters and at the termination of all straps. The ends of continuous bracing shall be fastened to blocking with at least two No. 8 screws.

5804.3.5 Cutting and Notching. Flanges and lips of load-bearing steel roof framing members shall not be cut or notched. Holes in webs shall be in accordance with 780 CMR 5804.2.

5804.3.6 Hole Patching. Holes in ceiling joist and rafters with dimensions conforming to 780 CMR 5804.2 that are closer than ten inches (254 mm) from the edge of the hole to the edge of

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bearing surface shall be patched with a solid steel plate, C-section or track section in accordance with 780 CMR Figure 5804.3.6. The steel patch shall be of a minimum thickness as the receiving member and shall extend at least one inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web with No. 8 screws (minimum) spaced no greater than one inch (25.4 mm) center-to-center along the edges of the patch, with a minimum edge distance of $\frac{1}{2}$ inch (12.7 mm).

5804.3.7 Splicing. Rafters and other structural members, except ceiling joists, shall not be spliced. Splices in ceiling joists shall only be permitted at interior bearing points and shall be constructed in accordance with 780 CMR Figure 5804.3.7(1). Spliced ceiling joists shall be connected with the same number and size of screws on connection. Splicing of tracks shall conform with 780 CMR Figure 5804.3.7(2).

5804.3.8 Bearing Stiffener. A bearing stiffener shall be fabricated from a minimum 33-mil (0.84 mm) C-section or track section. Each stiffener shall be fastened to the web of the ceiling joist with a minimum of four No. 8 screws equally spaced as shown in 780 CMR Figure 5804.3.8. Stiffeners shall extend across the full depth of the web and shall be installed on either side of the web.

5804.3.9 Headers. Roof-ceiling framing above wall openings shall be supported on headers. The allowable spans for headers in bearing walls shall not exceed the values set forth in 780 CMR Table 5603.6(1).

5804.3.10 Framing of Opening. Openings in roof and ceiling framing shall be framed with headers and trimmers between ceiling joists or rafters. Header joist spans shall not exceed four feet (1219 mm). Header and trimmer joists shall be fabricated from joist and track sections, which shall be of a minimum size and thickness in accordance with 780 CMR Figures 5804.3.10(1) and 5804.3.10(2). Each header joist shall be connected to trimmer joist with a minimum of four two-inch by two-inch (51mm by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a steel thickness not less than that of the floor joist.

5804.4 Roof Tie-down. Roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.96 kN/m^2) or greater, as established in 780 CMR Table 5301.2(2), shall have rafter-to-bearing wall ties provided in accordance with 780 CMR Table 5802.11.

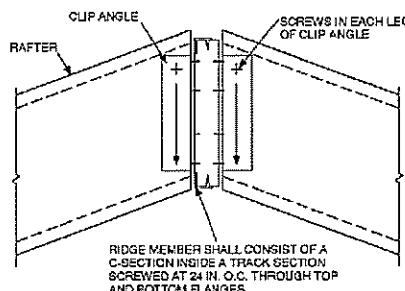
780 CMR TABLE 5804.3.3.1
NUMBER OF SCREWS REQUIRED AT EACH LEG OF CLIP ANGLE FOR RAFTER
TO RIDGE MEMBER CONNECTION*

BUILDING WIDTH (feet)	GROUND SNOW LOAD (psf)			
	0 to 20	21 to 30	31 to 50	51 to 70
24	2	3	4	4
28	2	3	4	5
32	3	3	4	5
36	3	4	5	6

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. Screws shall be No. 10 minimum.

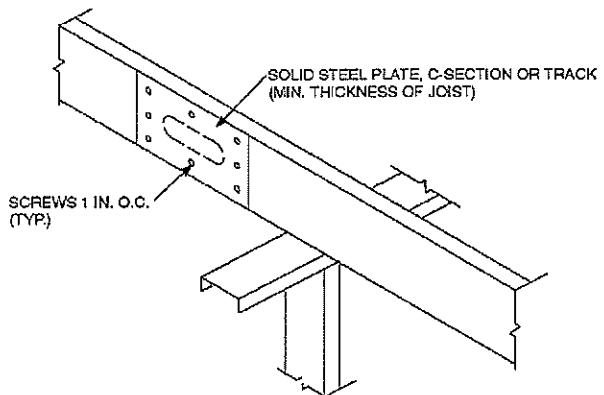
780 CMR FIGURE 5804.3.3.1
RIDGE BOARD CONNECTION



For SI: 1 inch = 25.4 mm.

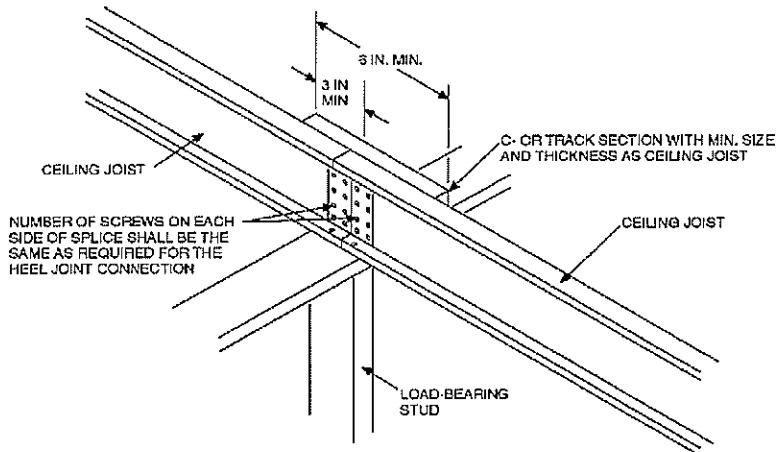
780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS
ROOF CEILING CONSTRUCTION

780 CMR FIGURE 5804.3.6
HOLE PATCHING



For SI: 1 inch = 25.4 mm.

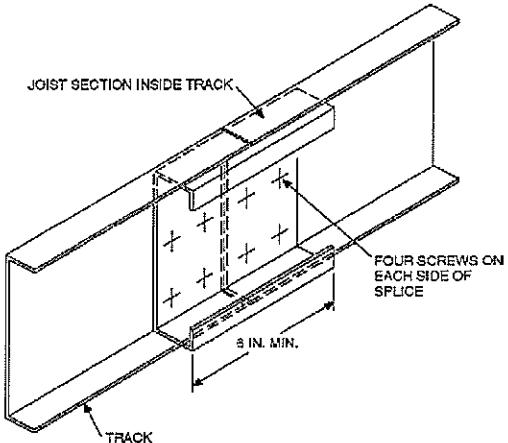
FIGURE 5804.3.7(1)
SPliced CEILING JOISTS



For SI: 1 inch = 25.4 mm.

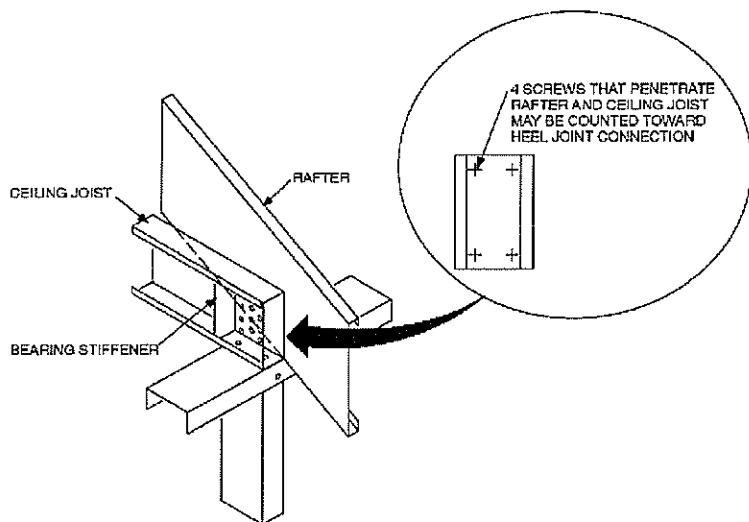
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780 CMR FIGURE 5804.3.7(2)
TRACK SPLICE



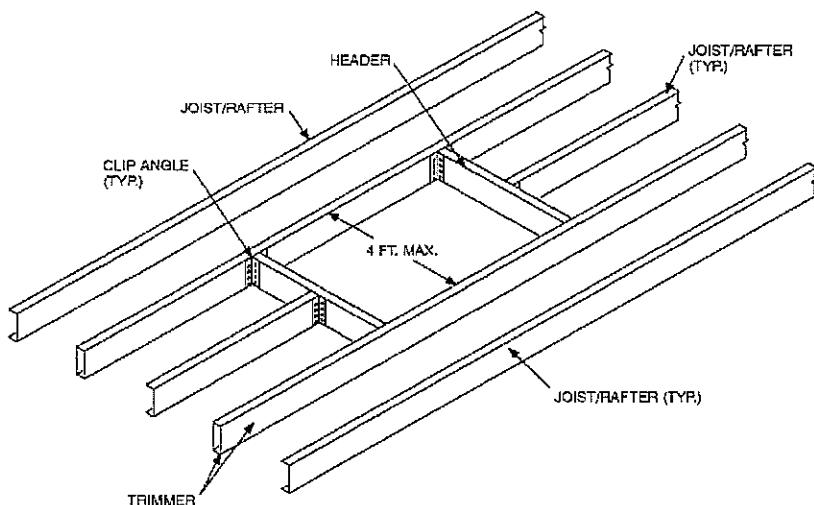
For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5804.3.8
BEARING STIFFENER



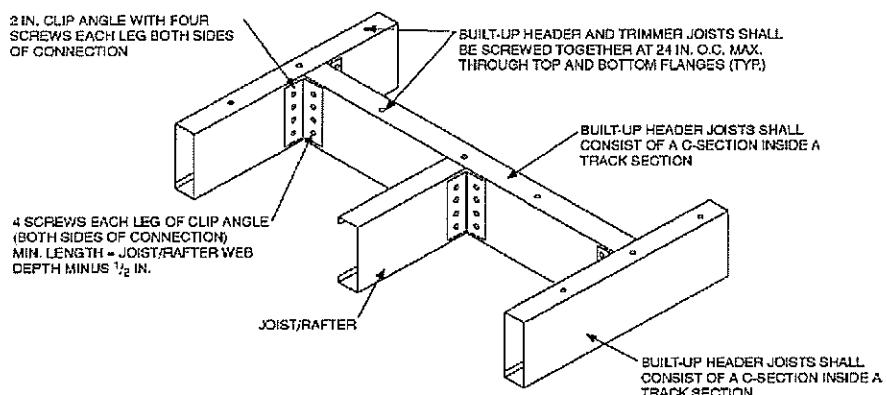
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 ROOF CEILING CONSTRUCTION

780 CMR FIGURE 5804.3.10(1)
ROOF OPENING



For SI: 1 foot = 304.8 mm.

780 CMR FIGURE 5804.3.10(2)
HEADER TO TRIMMER CONNECTION



For SI: 1 inch = 25.4 mm.

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780 CMR 5805 CEILING FINISHES

5805.1 Ceiling installation. Ceilings shall be installed in accordance with the requirements for interior wall finishes as provided in 780 CMR 5702.

780 CMR 5806 ROOF VENTILATION

5806.1 Ventilation Required. 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 ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with $\frac{1}{8}$ inch (3.2 mm) minimum to $\frac{1}{4}$ inch (6.4 mm) maximum openings.

Exceptions:

1. *Roof assemblies where an expanding spray foam insulation material, providing at least 40% of the total R-value of the required insulation, is in direct contact with the underside of the roof deck and adjacent framing members. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.*
2. *Roof assemblies where a board foam plastic insulation material, providing at least 40% of the total R-value of the required insulation, is placed on top of the roof deck. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.*

When either of the above exceptions is taken, the following conditions must also be satisfied:

1. *The roof assembly, including the wall-to-eave-to-roof-deck connection must be made air tight, per 780 CMR J4.3.3 or 780 CMR I304.3, as possible.*
2. *Thermal barrier requirements, if any, shall be per 780 CMR 2603.4, as applicable.*
3. *The roof assembly must meet the fire-resistance-rating requirements of 780 CMR, when and as applicable.*
4. *Roofing material must be listed/warranted by its manufacturer for use in an unvented roof system.*

5806.2 Minimum Area. The total net free ventilating area shall not be less than one to 150 of the area of the space ventilated except that the total

area is permitted to be reduced to one to 300, provided 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. As an alternative, the net free cross-ventilation area may be reduced to one to 300 when a vapor barrier having a transmission rate not exceeding one perm (57.4 mg/s \cdot m² Pa) is installed on the warm side of the ceiling.

5806.3 Vent Clearance. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a one-inch (25.4 mm) space shall be provided between the insulation and the roof sheathing at the location of the vent.

780 CMR 5807 ATTIC ACCESS

5807.1 Attic Access. An attic access opening shall be provided to attic areas that exceed 30 square feet (2.8 m²) and have a vertical height of 30 inches (762 mm) or greater.

The rough-framed opening shall not be less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other readily accessible location. A 30-inch (762 mm) minimum unobstructed headroom in the attic space shall be provided at some point above the access opening. See 780 CMR 6305.1.3 for access requirements where mechanical equipment is located in attics.

All attic access doors, trap doors, etc., separating conditioned from unconditioned space shall be fitted with suitable gaskets, weather strips, etc., and fit and close tightly to ensure minimal air leakage between conditioned and unconditioned space (also see 780 CMR 61.00).

780 CMR 5808 INSULATION CLEARANCE

5808.1 Combustible Insulation. Combustible insulation shall be separated a minimum of three inches (76 mm) from recessed lighting fixtures, fan motors and other heat-producing devices.

Exception: When heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed lighting fixtures installed in the building thermal envelope shall meet the requirements of 780 CMR 61.00.