ARTICLE 11

MECHANICAL EQUIPMENT AND SYSTEMS

SECTION 1100.0 GENERAL

1100.1 Scope: The provisions of this article shall control the construction, inspection and maintenance of all mechanical equipment and systems in respect to structural strength, fire safety and operation. For the purposes of this article, mechanical equipment shall include solid fuel burning heating appliances.

1100.2 Mechanical code: All mechanical equipment and systems shall be constructed, installed and maintained in accordance with this code and the mechanical code listed in Appendix B.

1100.3 Commonwealth of Massachusetts requirements: All installations of gas appliances shall comply with the Massachusetts Fuel Gas Code, 248 CMR 3.00-8.00, as listed in Appendix B. The construction, installation and operation of oil burning equipment is subject to the provisions of 527 CMR 4.00. The construction, installation, testing and inspection of boilers, unfired pressure vessels, air tanks, ammonia compressor valves and refrigeration and air-conditioning systems of twenty (20) tons or more capacity are subject to the provisions of 522 CMR 2.00-12.00, and chapter 146 of the Massachusetts General Laws Annotated, as amended.

SECTION 1101.0 PLANS AND SPECIFICATIONS

1101.1 General: Plans and specifications for the installation, repair, extension or removal of any mechanical equipment or system shall be submitted in accordance with the mechanical code listed in Appendix B and a permit shall be secured prior to the commencement of any work.

1101.2 Matter covered: The plans and specifications shall show in sufficient detail all pertinent features and clearances of the appliances and systems, including: size and type of apparatus; construction of flue, stack or chimney; stack connections; type of fuel; method of operation; and the method of compliance with all regulations for the class and type of equipment installed.

1101.3 Details: An application for permit shall be accompanied by specifications and diagrammatic mechanical drawings in sufficient detail, complying with the provisions of the mechanical code listed in Appendix B, before a permit shall be issued for the mechanical equipment and system. The plans shall be drawn to a scale of not less than one-eighth (1/8) inch to the foot and shall show the location and arrangement of all equipment and distribution elements including safties and pressure controlling devices.

SECTION 1009.0 CONSTRUCTION OF METAL DUCTS AND VENTS

1009.1 Mechanical code: All metal vents, ducts and duct systems required under the provisions of this article for heating systems and equipment, and under the provisions of Article 5 for ventilating and air-conditioning systems shall be constructed and installed in accordance with the requirements of the mechanical code listed in Appendix B.

1009.2 Construction of ducts: Ducts and plenums may be constructed of approved material constructed in accordance with the requirements of the mechanical code listed in Appendix B. Non-metallic ducts shall be constructed and installed in accordance with their approval and the applicable standards listed in Appendix B. Aluminum ducts shall not be used in equipment rooms with fuel-fired equipment, encased in or under concrete slabs on grade, for kitchen or fume exhausts or in systems where air entering the duct is over two hundred fifty (250) degrees F.

1009.3 Ducts for solid or solid/liquid fueled central hearing appliances.

1009.3.1 Supply ducts: Supply ducts conveying heated conditioned air shall be fabricated of noncombustible material.

1009.3.2 Hot air ducts: Hot air ducts shall have a clearance of not less than twelve (12) inches from combustibles for the first ten (10) feet of distance from the applicance plenum/bonnet.

1009.3.3 Ducts: All ducts shall be otherwise constructed, installed, supported and insulated as required by this code.

SECTION 1010.0 SPARK ARRESTORS

1010.1 Mechanical code: All chimneys, stacks and flues, including incinerator stacks, which emit sparks shall be provided with a spark arrestor conforming to the requirements of the mechanical code listed in Appendix B.

SECTION 1102.0 INSPECTIONS AND TESTS

1102.1 Inspection: All mechanical equipment and systems requiring a permit shall be inspected in accordance with the mechanical code listed in Appendix B and shall not be placed in operation until they have been tested and approved. All solid fuel burning heating appliances shall be tested and approved according to the applicable test standards listed in Appendix B and contained in the applicable Rules and Regulations listed in Appendix Q.

Exception: Used solid fuel burning room heaters which are not labeled must be inspected and approved prior to installation by the local building official or fire official and installed in accordance to the provisions of this code.

1102.2 Concealment: It shall be unlawful for owners, contractors or workmen to lath over or in any way to conceal, any piping outlet boxes or other parts of the mechanical equipment or system requiring a permit until an inspection has been made thereof and due notice given that the work has been approved.

1102.3 Defects and repairs: Upon inspection or reinspection of a mechanical system, any defects or deficiencies which require repair to insure safe operation shall be rectified before the system is placed in use.

1102.4 Power of condemnation: When a system or any part thereof is found unsafe to life or property, it shall be condemned and such system shall not be restored to use until it has been made safe and approved.

SECTION 1103.0 EXISTING BUILDINGS

1103.1 Unsafe orders: All existing mechanical equipment and systems shall be maintained and operated in accordance with the requirements of this code and the mechanical code listed in Appendix B. Any such equipment which does not comply with the requirements, and the operation of which is deemed unsafe to the building occupants, shall be altered as ordered by the building official to secure adequate safety.

SECTION 1104.0 FEES

1104.1 General: A permit to begin work for new construction or alteration shall not be issued until the application fee and permit fee prescribed have been paid, nor shall an amendment to a permit necessitating an additional fee because of the additional work involved be issued until the additional fee shall have been paid.

SECTION 1105.0 BOILER ROOMS

1105.1 Boiler room: Every boiler or combination boiler and cooling unit shall be installed in a space which allows a minimum clearance of twenty-four (24) inches on all service sides. Such room shall be constructed of at least one (1) hour fireresistance rated construction, and the door shall be a Class C fire door or a one and three-quarter (1 3/4) inch solid wood core door. Such door shall be equipped with an automatic self-closer. Combustion air shall be provided to such room in conformance with the mechanical code listed in Appendix B. Storage or living quarters shall not be permitted in any boiler or similar heating equipment room.

Exception: One- and two-family dwellings, except for combustion air requirements as set forth in the mechanical code listed in Appendix B.

1105.2 Boiler room location: Boiler rooms shall not be located immediately below exitways; nor shall any space heater, floor furnace or other similar equipment be located in any aisle or passageway used as an element of a required means of egress from the building or structure.

SECTION 1106.0 DRYING ROOMS

1106.1 General: A drying room or dry kiln installed within a building shall be constructed entirely of approved noncombustible materials or assemblies or such materials with the required fireresistance rating based on the fire hazard of the contents and the process as regulated by the approved rules or as required in Article 4 for special uses.

1106.2 Piping clearance: All overhead heating pipes shall have a clearance of not less than two (2) inches from combustible contents of the dryer.

1106.3 Insulation: When the operating temperature of the dryer is one hundred seventy-five (175) degrees F. or more, metal enclosures shall be insulated from adjacent combustible materials by not less than twelve (12) inches of air space, or the metal walls shall be lined with one-quarter (1/4) inch asbestos mill board or other approved equal insulation.

1106.4 Fire protection: Drying rooms designed for high hazard materials and processes, including dry cleaning and other special uses provided for in Article 4, shall be protected by approved automatic sprinkler or fog systems, manually controlled steam smothering systems, or other approved fire-extinguishing equipment conforming to the provisions of Article 12 and the mechanical code listed in Appendix B.

SECTION 1107.0 REFUSE CHUTES

1107.1 Chute discharge: A refuse chute shall not feed directly to the combustion chamber of an incinerator, but shall discharge into an enclosed

room or bin separated from the incinerator room by ceiling and walls of not less than two (2) hour fireresistance rating, unless otherwise approved by the building official.

1107.2 Chute enclosures: Refuse chutes shall be enclosed with walls of masonry of not less than two (2) hour fireresistance rating for interior chutes and of noncombustible (Type 2) construction for exterior chutes. All chutes shall be supported on substantial foundations complying with Article 7.

1107.3 Chute height: An interior refuse chute shall extend not less than four (4) feet above the roof and shall be covered with an approved ventilating skylight complying with Section 925.0.

1107.4 Service compartments: Service openings for chutes shall be located in separate rooms or compartments enclosed in walls, partitions, floors and ceilings which have a fireresistance rating of not less than one (1) hour and in which the openings are equipped with fire doors or other approved protectives of not less than three-quarter (3/4) hour fireresistance rating or their approved labeled equivalent.

1107.5 Opening protectives: All openings between refuse rooms, chutes and incinerator rooms shall be protected with one and one-half (1 1/2) hour fire doors or their approved labeled equivalent complying with Article 9.

SECTION 1108.0 REFUSE VAULTS

2507.1 1108.1 Refuse vault enclosures: A vault for receiving combustible refuse from an exhaust system shall be constructed of not less than three (3) hour fireresistance rated assemblies.

1108.2 Openings to boiler rooms: The opening between a vault and a boiler room shall not exceed nine (9) square feet in area and shall be located at least eight (8) feet from the firing door of the boiler, and the bottom of the opening shall be not less than six (6) inches above the boiler room floor. All openings shall be equipped with approved automatic fire doors of not less than one and one-half (1 1/2) hour fireresistance rating or the approved labeled equivalent complying with Article 9.

2507.2

1108.3 Location: When located within a building, a refuse vaults shall extend above the roof or shall be directly vented to the outer air with ducts complying with Section 1009.0.

2501.3

2507.4 1108.4 Fire protection: A vault for combustible refuse which exceeds three hundred sixty (360) cubic feet in volume shall be protected by an automatic fire suppression system conforming to Article 12 and the mechanical code listed in Appendix B.

2508.0

SECTION 1109.0 DUST, STOCK AND REFUSE CONVEYOR SYSTEMS

2508.1 1109.1 Power transmission: Power for fans located in rooms from which flammable dust is being removed shall be transmitted by means of a shaft passing through a bushed hole, or by a belt, chain or similar driving mechanism which is encased in a metal or other noncombustible dust-tight enclosure, both within and without the room.

2508.2 1109.2 Collectors and separators: Cyclone collectors and separators and their supports shall be constructed of noncombustible materials and shall be located whenever possible on the exterior of the building or structure. A collector or separator shall not be located nearer than ten (10) feet to combustible construction or to an unprotected wall or floor opening, unless the collector is provided with a metal vent pipe which extends above the highest part of any roof within a distance of thirty (30) feet.

2508.3 1109.3 Discharge pipes: Discharge pipes shall conform to all the requirements for ducts, including clearances required for high heat appliances, as contained in the mechanical code listed in Appendix B. A delivery pipe from a cyclone collector shall not convey refuse directly into the firebox of a boiler, furnace, dutch oven, refuse burner, incinerator or other appliance.

2508.4 1109.4 Vents for exhaust conveyor systems: An exhaust system shall be vented to the outside of the building either directly by flue, or indirectly through the separator, bin, or vault into which it discharges.

2508.5 1109.5 Spark protection: The outlet of an open air vent shall be protected with an approved metal or other noncombustible screen or by other equally efficient means to prevent the entry of sparks.

2508.6 1109.6 Explosion relief vents: A safety or explosion relief vent shall be provided on all systems which convey combustible refuse or stock of an explosive nature, in accordance with the requirements of Article 4.

2508.6.1 1109.6.1 Screens: When a screen is used in a safety relief vent, it shall be so attached as to permit ready release under emergency pressure.

2508.6.2 1109.6.2 Hoods: The relief vent shall be provided with an approved noncombustible cowl or hood, or with a counterbalanced relief valve or cover arranged to prevent the escape of hazardous materials, gases or liquids.

1110.0 SOLID FUEL BURNING HEATING APPLIANCES

1110.1 Installation: The installation of solid fuel burning heating appliances in new or existing buildings shall conform to the provisions of the code or the manufacturers' recommended installation procedures.

1110.1.1 Installation clearances: Clearance shall be provided from com-

bustible construction in accordance with manufacturers' recommendations following testing under the applicable standards listed in Appendix B and contained in the applicable Rules and Regulations listed in Appendix Q, or in accordance with Table 1110.1.1 (for solid fuel burning room heaters only).

INSTALLATION CLEARANCES, SOLID FUEL BURNING HEATING APPLIANCES

Type of unit	Above top of casing or appliance (inches)	From front (inches)	From back (inches)	From sides (inches)	Chimney connector (inches)
Circulating type, vented or unvented	36	24	12	12	18
Radiant or other type, vented or unvented	36	36	36	36	18

Note 1. The floor shall be of masonry or other noncombustible construction with not less than a one (1) hour fire resistance rating and shall extend twelve (12) inches beyond the appliance on all sides and at least eighteen (18) inches on the fuel and ash access side. Solid fuel heaters may be installed on a combustible floor if the appliance is listed for such installation or if the floor is protected in an approved manner.

1110.1.2 Reduced clearances: Installation clearances may be decreased according to Table 1110.1.2 when exposed construction is protected with noncombustible materials.

1110.2 Solid fuel burning room heaters installed in fireplaces: When a solid fuel burning room heater is set in front of a fireplace to use the existing chimney, the stove pipe must be connected either into the open damper through a snug fitting, noncombustible seal or through a noncombustible fireplace opening closure which seals off the fireplace. Both methods of installation must have access for cleanout.

1110.3 Solid fuel burning room heater labeling: Every solid fuel burning room heater shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by an approved testing laboratory containing the following:

1. Manufacturer's name or trademark
2. Model and/or identification number of the appliance
3. Type of fuel(s) approved
4. Testing laboratory's name or trademark and location
5. Data tested
6. Clearance to combustibles

a. Side

b. Rear

7. Test standard

8. Label serial number

REDUCED INSTALLATION CLEARANCES WITH SPECIFIED FORMS OF PROTECTION

Table 1110.1.2

Type of protection applied to the combustible material unless otherwise specified and covering all surfaces within the distance specified as the required clearance without protection (thicknesses are minimum)	Where the required clearance without protection is:							
	36 inches			18 inches			12 inches	
	Above	Sides and rear	Chimney or vent connector	Above	Sides and rear	Chimney or vent connector	Above	Sides and rear
1. ¼″ asbestos millboard spaced out 1″	30	18	30	15	9	12	9	6
2. No. 28 Manufacturers' Standard Gage steel sheet on ¼″ asbestos millboard	24	18	24	12	9	12	9	6
3. No. 28 Manufacturers' Standard Gage steel sheet spaced out 1″	18	12	18	9	6	9	6	4
4. No. 28 Manufacturers' Standard Gage steel on ⅛″ asbestos millboard spaced out 1″	18	12	18	9	6	9	6	4
5. ¼″ asbestos millboard on 1″ mineral fiber batts reinforced with wire mesh or equivalent	18	12	18	6	6	6	4	4
6. No. 22 Manufacturers' Standard Gage steel sheet on 1″ mineral fiber batts reinforced with wire or equivalent	18	12	12	4	3	3	2	2
7. ¼″ asbestos cement board or ¼″ asbestos millboard	36	36	36	18	18	18	12	12
8. ¼″ cellular asbestos	36	36	36	18	18	18	12	12

Note 1. Except for the protection described in item 5, all clearances shall be measured from the outer surface of the appliance to the combustible material disregarding any intervening protection applied to the combustible material.
Note 2. Spacers shall be of noncombustible material.

1110.4 Central heating applicance installation: Solid or solid/liquid feuled heating (central heating) appliances istalled into an existing liquid or gas-fueled central heating system shall be positioned downstream of the existing appliance. Clearances to combustible materials shall be provided in accordance with the requirements apecified on the label affixed to the central heating applicance (see Section 2108.3.2.7).

1110.5 Central heating appliance labeling: Every solid or solid/liquid fueled boiler or warm air furnace shall bear a permanent and legible factory applied label, supplied to the manufacturer and controlled by an approved testing laboratory, containing the following information:

1. Manufacturer's name or trademark.
2. Model/identification name or number of the appliance.
3. Types of fuel(s) approved.
4. Testing laboratory's name or trademark and location.
5. Date tested.
6. Clearance to combustibles:
   a. side
   b. rear
   c. top
   d. front
7. Test standard(s).
8. Label serial number.
9. Type of appliance (boiler or warm air furnace).
10. Every boiler, pressure vessel, or pressure relief device must be stamped in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. ASME stamping shall also be required for boilers, pressure vessels and pressure relief devices produced outside the United States of America. Where required by the ASME Boiler and Pressure Vessel Code, ASME stamping may be affixed directly to the appliance in lieu of on the data plate.

Note: Additional information as required by the applicable test standard(s) may be affixed separately.

1110.5.1 Exceptions: Prior to January 1, 1981, the following exceptions shall apply:

1. ASME stamping shall not be required.

2. Solid or solid/liquid fueled central heating appliances shall be considered acceptable only if they have been tested and labeled by a laboratory accredited by the Commission to test other comfort heating applicances; or any nationally recognized laboratory.

ARTICLE 12

FIRE PROTECTION SYSTEMS

SECTION 1200.0 GENERAL

1200.1 Scope: The provisions of this article shall specify where fire protection systems are required in all buildings or structures or portions thereof.

1200.1.1 Authority: Plans submitted under Section 113.5 and Article 4 of this code relative to this article shall be reviewed by the local fire official for approval of the following items:

1. source and capacity of water supply, including size of water main;
2. location of hydrants and siamese connections;
3. access for fire fighting apparatus and rescue vehicles;
4. provisions for a fire pump, if necessary, including electrical supervisory control;
5. design and location of standpipes and/or sprinkler systems and related equipment;
6. design and location of required fire alarm systems, including detection, supervision, and all related equipment;
7. smoke control;
8. firefighter elevator key location and associated equipment;
9. location and protection of furnace rooms, boiler rooms and rooms of similar uses; and
10. fire access panels (see Section 859).

1200.2 Installation requirements: The installation methods, repair, operation and maintenance of fire protection systems shall be in accordance with this code and the fire prevention code listed in Appendix B.

1200.3 Maintenance: The owner, tenant or lessee of every building or structure shall be responsible for the care and maintenance of all fire protection systems, including equipment and devices, to insure the safety and welfare of the occupants. Fire protection systems shall not be disconnected or otherwise rendered unserviceable without first notifying the fire department. When installations of required fire protection systems are interrupted for repairs or other necessary reasons, the owner, tenant or lessee shall immediately advise the fire department and shall diligently prosecute the restoration of the protection.

1200.4 Threads: All threads provided for fire department connections to sprinkler systems, standpipe systems, yard hydrants or any other fire hose connections shall be uniform to those used by the local fire department.

1200.5 Signs: Where fire suppression control valves are located in a separate room or building, a sign shall be provided on the entrance door. The lettering for such sign shall be of a conspicuous color and shall be at least 4 inches in height, and shall read Sprinkler Control Valves or Standpipe Control Valves or indicate other types of systems (see Sections 1212.4.1 and 1214.8 for additional signs).

1200.6 Tests: Where required by this article and the standards referenced herein, all flow test connections and points of fluid discharge shall be reasonably accessible and acceptable to the administrative authority.

SECTION 1201.0 PLANS AND SPECIFICATIONS

1201.1 Required: Plans shall be submitted to indicate conformance with this code and shall be reviewed by the department prior to issuance of the permit.

Note: Since the fire department is responsible for inspection for the proper maintenance of fire protection systems in buildings, the administrative authority shall cooperate with the fire department in the discharging of responsibility to enforce this article.

1201.2 Plans: The plans and specifications submitted to the department shall contain sufficient detail to evaluate the hazard and the effectiveness of the system. The details on the hazards shall include materials involved, the location and arrangement, and the exposure to the hazard.

1201.3 Calculations: The details on the fire protection system shall include the design considerations, calculations and other information as required by this code.

SECTION 1202.0 FIRE SUPPRESSION SYSTEMS

1202.1 Where required: Fire suppression systems shall be installed and maintained in full operating condition, as specified in this code, in the locations indicated in Sections 1202.2 through 1202.21.

Exception: Buildings of Use Group R-3.

Note: Requirements for detoxification facilities (Use Group R-1) are contained in Section 439.0.

1202.2 Use Group A-1: In all buildings or structures or portions thereof of Use Group A-1.

1202.3 Use Group A-2: In all buildings or structures or portions thereof of Use Group A-2:

1. When more than 5,000 square feet in area; or
2. When more than one story in height.

1202.4 Use Group A-3: In all buildings or structures or portions thereof of Use Group A-3 when more than 12,000 square feet in area.

1202.5 Stages and enclosed platforms: Stages under the roof and gridiron, in the tie and fly galleries, and in all places behind the proscenium wall of the stage; over and within enclosed platforms in excess of 500 square feet in area; and in dressing rooms, lounges, workshops and storerooms accessory to such stages or enclosed platforms.

Exceptions:

1. Stages or enclosed platforms open to the auditorium room on three or more sides.

2. Altars, pulpits or similar platforms and their accessory rooms.
3. Stage gridirons when sidewall sprinklers with 135 degrees F. rated heads with heat-baffle plates are installed around the perimeter of the stage except for the proscenium opening at points not more than 30 inches below the gridiron nor more than 6 inches below the baffle plate.
4. Under stage or under enclosed platform areas less than 4 feet in clear height used exclusively for chair or table storage and lined on the inside with materials approved for 1-hour fireresistance rated construction.

1202.6 High-rise buildings: In all high-rise buildings exceeding seventy (70) feet in height, as required by Chapter 148, Section 26A of the Massachusetts General Laws, as amended.

1202.7 Use Group H: In all buildings or structures or portions thereof of Use Group H.

1202.8 Use Group I: In all buildings or structures or portions thereof of Use Group I.

Exceptions:
1. Use Group I-2 hospitals of Type 1 construction not over five stories and 75 feet, hospitals of Type 2A construction not over 3 stories and 45 feet, and hospitals of Type 2B construction not over one story in height.
2. Use Group I-2 nursing homes of Types 1, 2A or 2B construction, not over one story in height.
3. Use Group I-2 day care centers not over one story in height which accommodate 100 children or less with each room having an exit directly to the outside.
4. Buildings of Use Group I-1 two stories or less in height and having an occupant load of less than 20.
5. Buildings of Use Group I-1 having an occupant load of less than six.

1202.9 Use Groups M, S-1 and F-1: In all buildings or structures or portions thereof of Use Groups M, S-1 and F-1:
1. When more than 12,000 square feet in area; or
2. When more than 24,000 square feet in total area on all floors; or
3. When more than three stories in height.

1202.10 Public garages (Group 1): In all Group 1 public garages:
1. When more than 10,000 square feet in area.
2. When more than 7,500 square feet in area and more than one story in height.
3. When more than 5,000 square feet in area and more than two stories in height.
4. When more than three stories in height.
5. When located in buildings where the upper stories are designed for other uses.
6. When located in any story that is more than 50 percent below grade.
7. In fuel dispensing areas.

1202.11 Public garages (Group 2): In all Group 2 public garages:
1. When more than 10,000 square feet in area and more than one story in height.

2. When more than two stories in height.
3. When located in buildings where the upper stories are designed for other uses.

Exception: Open parking structures or portions of buildings classified as open parking structures according to the definition in Section 201.0.

1202.12 Bus garages: In all bus garages:

1. When required by Section 1202.10.
2. When used as passenger terminals for four or more buses.
3. When used for storage or loading of four or more buses.

1202.13 Unlimited area buildings: In unlimited area buildings as required by Section 307.0.

1202.14 Storage and workshop areas: In all portions of Use Groups A, B, I, R-1 and R-2 occupied for storage, workshop or similar purposes.

Exceptions:

1. Individual storage or workshop areas located entirely within unsprinklered dwelling units.
2. Storage and workshop rooms less than 24 square feet in area.

1202.15 Windowless story: In every story or basement of all buildings where there is not provided at least one of the following types of openings:

1. An exterior stairway meeting Section 619.0, or outside ramp meeting Section 615.0, leading directly to grade in each fifty (50) lineal feet or fraction thereof of exterior wall in the story or basement, on at least one side of the building.
2. Twenty (20) square feet of opening above the adjoining ground level in each fifty (50) lineal feet or fraction thereof of exterior wall in the story or basement, on at least one side of the building. Openings shall have minimum dimensions of not less than twenty-two (22) inches.. Such openings shall be accessible to the fire department from the exterior and shall be unobstructed to allow firefighting and rescue operations from the exterior.

When openings in a story are provided on only one side and the opposite wall of such story is more than seventy-five (75) feet from such openings, the story shall be provided with an approved automatic fire suppression system, or openings as specified above shall be provided on at least two sides of the exterior walls of the story. If any portion of a basement is located more than seventy-five (75) feet from openings required in this section, the basement shall be provided with an approved automatic fire suppression system.

1202.16 Painting rooms: In spray painting rooms or shops where painting, brushing, dipping or mixing is regularly conducted using flammable materials.

1202.17 Trash rooms and chutes: In rooms or areas used for incineration, trash and laundry collection or similar uses; and at alternate floor levels and at the top of all chutes used in conjunction with these rooms or areas.

1202.18 Furnace rooms: In furnace rooms, boiler rooms and rooms for similar uses. Exception: Such a room located entirely within and serving a single dwelling unit.

1202.19 Unenclosed vertical openings: In unenclosed vertical openings between floors as required by Section 437.3.1.

1202.20 Kitchen exhaust systems: In commercial kitchen exhaust systems when such systems are required by the mechanical code listed in Appendix B.

1202.21 Hazardous exhaust systems: In duct systems exhausting hazardous material in accordance with the mechanical code listed in Appendix B.

1202.22 Alternative protection: In special use areas of buildings or structures, an automatic fire detection system shall be installed in lieu of a fire suppression system where such fire suppression system installation would be detrimental or dangerous to the specific use or occupancy, as approved by the code official and the fire prevention code official.

1202.22.1 Telephone central office equipment buildings: Within telephone central office equipment buildings, the automatic fire suppression system is not required in the following rooms or areas when such rooms or areas are protected with an approved automatic fire alarm system.

1. Generator and transformer rooms.
2. Communication equipment areas when such areas are separated from the remainder of the building by 1-hour fireresistance rated wall and 2-hour fireresistance rated floor/ceiling assemblies, and are used exclusively for such equipment.

SECTION 1203.0 SUPPRESSION SYSTEM SELECTION

1203.1 General: To guide the administrative authority with the selection of the proper type of fixed fire suppression system, the extinguishing agents for each type of hazard or fire are classified as follows.

Class A: Fires involving ordinary combustible materials (such as wood, cloth, paper, rubber and many plastics) requiring the heat-absorbing (cooling) effects of water, water solutions, or the coating effects of certain dry chemicals which retard combustion.

Class B: Fires involving flammable or combustible liquids, flammable gases, greases and similar materials where extinguishment is most readily secured by excluding air (oxygen), inhibiting the release of combustible vapors, or interrupting the combustion chain reaction.

Class C: Fires involving energized electrical equipment where safety to the operator requires the use of electrically nonconductive extinguishing agents.

Note: Portable Class A or B extinguishers and hand-held solid stream nozzles are inappropriate for fighting electrical fires. However, fixed water spray systems are appropriate for fighting fires in energized electrical systems.

1203.2 Special hazards: In rooms or buildings containing combustibles such as aluminum powder, calcium carbide, calcium phosphide, metallic sodium and potassium, quick-lime, magnesium powder or sodium peroxide, which are incompatible with the use of water as an extinguishing agent, other extinguishing agents shall be used.

1203.3 Types: Where a fire suppression system is required in this code, Table 1203 provides the code official with information to assist in the determination of the type of suppression system suitable for the hazard involved, if not otherwise specified in this code.

Table 1203
GUIDE FOR SUPPRESSION SYSTEM SELECTION

Hazard	Water sprinklers or spray 1204.0 to 1206.0	Foam 1207.0	Carbon dioxide or halogenated 1208.0 to 1209.0	Dry chemical 1210.0	Wet chemical 1211.0
Class A fire potential	X	X	X	X	X
Class B fire potential	X	X	X	X	X
Class C fire potential	X		X		
SPECIAL FIRE HAZARD AREAS[A]					
Aircraft hangars	X	X	X	X	
Alcohol storage	X	X	X	X	
Ammunition loading	X				
Ammunition magazines	X				
Asphalt impregnating	X	X			
Battery rooms			X		
Carburetor overhaul shops	X	X	X	X	
Cleaning plant equipment	X	X	X	X	
Computer rooms	X		X		
Dowtherm	X				
Drying ovens	X		X	X	X
Elevator equipment rooms with open-type mechanical relays			X		
Engine test cells	X	X	X		
Escalator, stair wells	X				
Explosives: Manufacturing, storage	X				
Flammable liquids storage	X	X	X		
Flammable solids storage	X				
Fuel oil storage	X	X			
Hangar decks	X	X			
High piled storage in excess of 15 feet in height	X	X			

Table 1203 (continued)

GUIDE FOR SUPPRESSION SYSTEM SELECTION

Hazard	Water sprinklers or spray 1204.0 to 1206.0	Foam 1207.0	Carbon dioxide or halogenated 1208.0 to 1209.0	Dry chemical 1210.0	Wet chemical 1211.0
HPM use facility:					
Fabrication areas (Ordinary Hazard Group 3)	X				
Service passages (Ordinary Hazard Group 3)	X				
Separate inside HPM storage rooms without dispensing (Ordinary Hazard Group 3)	X				
Separate inside HPM storage rooms with dispensing (Extra Hazard Group 2)	X				
Egress Corridors (Ordinary Hazard Group 3)	X				
Hydraulic oil, lubricating oil	X		X		
Hydroturbine generators	X		X		
Jet engine test cells	X	X	X		
Library stacks	X		X		
Lignite storage and handling	X				
Liquefied petroleum gas storage	X				
Oil quenching bath	X	X	X	X	
Paints: manufacturing, storage	X	X	X	X	
Paint spray booths	X		X	X	
Petrochemical storage	X	X	X		
Petroleum testing laboratories	X	X	X		
Printing presses	X		X		
Rack and palletized storage in excess of 12 feet (3658 mm) in height	X	X			
Range hoods	X		X	X	X
Reactor and fractionating towers	X				
Record vaults			X		
Rubber mixing and heat treating	X				
Service stations (inside buildings)	X		X		
Shipboard storage	X		X		
Solvent cleaning tanks		X	X	X	
Solvent thinned coatings		X	X	X	
Transformers, circuit breakers (outdoors)	X				
Transformers, circuit breakers (indoors)	X		X		
Turbine lubricating oil	X	X	X	X	
Vegetable oil, solvent extraction	X	X			

Note a. Within buildings or areas, so classified, as to require a suppression system.

SECTION 1204.0 WATER SPRINKLER SYSTEMS

1204.1 General: Water sprinkler extinguishing systems shall be of an approved type and installed in accordance with the provisions of this code and NFiPA 13 listed in Appendix I.

1204.2 Occupancy sprinkler system: Within a building of mixed occupancies and where an occupancy is required by this code to be sprinklered with more than 20 sprinklers, the use group requiring sprinklers shall be separated from other uses by fire separation walls and floor/ceiling assemblies having a fireresistance rating corresponding to the highest fire grading prescribed in Table 902 for the separate uses and equipped throughout with a complete automatic sprinkler system.

1204.3 Design: The details of the system supplied with the plans and specifications shall include information and the calculations of the sprinkler spacing and arrangement with water supply and discharge requirements, size and equivalent lengths of pipe and fittings and water supply source. Sufficient information shall be included to identify the apparatus and devices used. The design of the sprinkler system for a HPM use facility shall be in accordance with NFiPA 13 listed in Appendix I, and not less than that required for the special fire hazard areas shown in Table 1203.

1204.4 Actuation: Water sprinkler extinguishing systems shall be automatically actuated unless otherwise specifically provided in this code.

1204.5 Sprinkler alarms: Approved audible or visual alarm devices shall be connected to every water sprinkler system. Such alarm devices shall be activated by water flow and shall be located in an approved location.

Exception: Alarms and alarm attachments shall not be required for limited area sprinkler systems (see Section 1205.5).

1204.5.1 Additional alarms: At least one additional audible or visual alarm device shall be installed within the building.

1204.6 Water control valve tags: Identification tags shall be provided in accordance with NFiPA 26 listed in Appendix I.

1204.7 Sprinkler riser: A sprinkler system riser which also serves as the wet standpipe riser in buildings required to have or having both systems shall conform to Section 1212.4.1.

1204.8 Tests: All sprinkler systems shall be tested in accordance with the fire prevention code listed in Appendix B.

SECTION 1205.0 LIMITED AREA SPRINKLER SYSTEMS

1205.1 General: A limited area sprinkler system shall be of an approved type and installed in accordance with the provisions of this section.

1205.2 Installation: Where the provisions of this code require a limited number of sprinklers, a limited area sprinkler system is permitted to be installed to comply with these requirements.

1205.3 Design: The details of the system supplied with the plans and specifications shall include information and the calculations of the sprinkler spacing and arrangement with water supply and discharge requirements, size and equivalent lengths of pipe and fittings and water supply source. Sufficient information shall be included to identify the apparatus and devices used.

1205.4 Actuation: A limited area sprinkler system shall be automatically actuated.

1205.5 Sprinkler alarms: Alarms and alarm attachments shall not be required.

1205.6 Standpipe connection: The water supply for the limited area sprinkler system shall be from the building standpipe system when the building is equipped with a standpipe system that is sized for 500 gallons per minute minimum flow and has an automatic water supply (see Section 1212.4.1).

1205.6.1 Domestic supply: Where limited area sprinklers are supplied from the domestic water system, the domestic water system shall be designed to adequately support the design flow of the largest number of sprinklers in any one of the enclosed areas. When supplied by the domestic water system, the maximum number of sprinklers in any one enclosed room or area shall not exceed 20, and the sprinklers shall be capable of totally protecting the room or area.

Note: See Section 439.16 for requirements for limited area sprinkler systems in detoxification facilities (Use Group R-1).

1205.6.2 Fire department connections: A fire department connection is not required for limited area sprinkler systems supplied from the domestic water system.

1205.6.3 Cross connection: There shall not be a cross connection between the domestic water system and the standpipe system.

1205.6.4 Domestic connection: A check valve shall be provided at the point where the suppression system piping is connected to the domestic water piping to prevent contamination of the domestic water supply. Shutoff valves shall not be permitted in the suppression system piping. Water supply shall be controlled by the riser control valve to the domestic water piping.

1205.7 Use: Limited area sprinklers shall be used only in rooms or areas enclosed with construction assemblies as required by this code.

1205.8 Tests: All limited area sprinkler systems shall be tested in accordance with the fire prevention code listed in Appendix B.

SECTION 1206.0 WATER-SPRAY FIXED SYSTEMS

1206.1 General: Water-spray extinguishing systems shall be of an approved type and installed in accordance with the provisions of this code and NFiPA 15 listed in Appendix I.

1206.2 Design: The details of the system supplied with the plans and specifications shall include information and the calculations of the sprinkler spacing and arrangement with water supply and discharge requirements, size and equivalent lengths of pipe and fittings and water supply source. Sufficient information shall be included to identify the apparatus and devices used.

1206.3 Actuation: Water-spray extinguishing systems shall be automatically actuated with supplementary manual tripping capability.

1206.4 Tests: All new system piping shall be hydrostatically tested in accordance with the provisions of NFiPA 15 listed in Appendix I.

SECTION 1207.0 FOAM EXTINGUISHING SYSTEMS

1207.1 General: Foam extinguishing systems shall be of an approved type and installed in accordance with the provisions of this code and NFiPA 11, 11A and 16 listed in Appendix I.

1207.2 Design: The details of the system supplied with the plans and specifications shall include complete computations showing pressure drop in all system piping, friction loss calculations of liquid lines and a detailed layout of the entire hazard area to be protected. Hydraulic characteristics of foam proportioners and foam makers as determined by tests shall be supplied by the manufacturer to the department (including the range of operating conditions required for the proposed installation) to permit determination of the adequacy of the hydraulics of the proposed protection.

1207.3 Actuation: A foam extinguishing system shall be automatically actuated with supplementary manual tripping capability.

1207.4 Tests: All piping, except that piping which handles expanded foam, shall be subjected to a two (2) hour hydrostatic pressure test of 200 psi or 50 psi in excess of the maximum pressure anticipated, whichever is greater, without leakage. The system shall be subjected to a flow test to ensure that the hazard area is fully protected in conformance with the design specifications, and to determine the flow pressures, actual discharge capacity, foam quality, consumption rate of foam-producing materials, manpower requirements and other operating characteristics.

SECTION 1208.0 CARBON DIOXIDE EXTINGUISHING SYSTEMS

1208.1 General: Carbon dioxide extinguishing systems shall be of an approved type and installed in accordance with the provisions of this code and NFiPA 12 listed in Appendix I.

1208.2 Design: The details of the system supplied with the plans and specifications shall include information and calculations of the amount of carbon dioxide, the location and flow rate of each nozzle including equivalent orifice area and the location, size and the carbon dioxide storage facility. Information shall be submitted pertaining to the location and function of the detection devices,

operating devices, auxiliary equipment and electrical circuitry, if used. Sufficient information shall be indicated to identify properly the apparatus and devices used. Any special features shall be adequately explained.

1208.3 Actuation: Carbon dioxide extinguishing systems shall be automatically actuated with supplementary manual tripping capability.

1208.4 Safety requirements: In any proposed use of a carbon dioxide system where there is a possibility that persons will enter or be trapped in atmospheres made hazardous by a carbon dioxide discharge, warning signs, discharge alarms and breathing apparatus shall be provided to ensure prompt evacuation of and to prevent entry into such atmospheres, and also to provide means for prompt rescue of any trapped personnel.

1208.5 Tests: A completed system shall be tested for tightness up to the selector valve, and for continuity of piping with free unobstructed flow beyond the selector valve. The labeling of devices with proper designations and instructions shall be checked. Operational tests shall be conducted on all devices except cylinder valves in multi-cylinder high pressure systems. Where conditions prevail that make it difficult to determine adequately the system requirements or design, a suitable discharge test and concentration analysis test shall be made. All tests are to be conducted as indicated in NFiPA 12 listed in Appendix I.

1208.6 Range hoods: In addition to the requirements of this section, Section 1202.20 and the mechanical code listed in Appendix B, range hood CO_2 systems shall bear the label of an approved agency. The system shall be installed in accordance with the manufacturer's installation instructions.

SECTION 1209.0 HALOGENATED FIRE EXTINGUISHING SYSTEMS

1209.1 General: Halogenated fire extinguishing systems shall be of an approved type and installed in accordance with the provisions of this code and NFiPA 12A and 12B listed in Appendix I.

1209.2 Design: The details of the system supplied with the plans and specifications shall include information and calculations of the amount of extinguishing agent; container storage pressure; the location and flow rate of each nozzle including equivalent orifice area; the location, size and equivalent lengths of pipe, fittings and hose; and the location and size of the storage facility. Information shall be submitted pertaining to the location and function of the detection devices, auxiliary equipment and electrical circuitry, if used. Sufficient information shall be indicated to identify properly the apparatus and devices used. Any special features shall be adequately explained.

1209.3 Actuation: Halogenated fire extinguishing systems shall be automatically actuated with supplementary manual tripping capability.

1209.4 Safety requirements: In any proposed use of a halogenated fire extinguishing system where there is a possibility that persons will enter or be trapped in atmospheres made hazardous by a discharge, warning signs,

discharge alarms and breathing apparatus shall be provided to ensure prompt evacuation of and to prevent entry into such atmospheres, and also to provide means for prompt rescue of any trapped personnel.

1209.5 Tests: A completed system shall be tested for tightness up to the selector valve, and for continuity of piping with free unobstructed flow beyond the selector valve. The labeling of devices with proper designations and instructions shall be checked. Operational tests shall be conducted on all devices except cylinder valves in multi-cylinder systems. Where conditions prevail that make it difficult to determine adequately the system requirements or design, a suitable discharge test and concentration analysis shall be made. All tests are to be conducted as indicated in NFiPA 12A and 12B listed in Appendix I.

SECTION 1210.0 DRY CHEMICAL EXTINGUISHING SYSTEMS

1210.1 General: Dry chemical extinguishing systems shall be of an approved type and installed in accordance with the provisions of this code and NFiPA 17 listed in Appendix I.

1210.2 Design: The details of the system supplied with the plans and specifications shall include sufficient information and calculations of the amount of dry chemical; the size, length, and arrangement of connected piping, or piping and hose; description and location of nozzles so that the adequacy of the system can be determined. Information shall be submitted pertaining to the location and function of detection devices, operating devices, auxiliary equipment and electrical circuitry, if used. Sufficient information shall be indicated to identify properly the apparatus and devices used. Any special features shall be adequately explained.

1210.3 Actuation: Dry chemical extinguishing systems shall be automatically actuated with supplementary manual tripping capability.

1210.4 Safety requirements: Where there is a possibility that personnel will be exposed to a dry chemical discharge, warning signs, discharge alarms and breathing apparatus shall be provided to ensure prompt evacuation of such locations, and also to provide means for prompt rescue for any trapped personnel.

1210.5 Tests: A completed system shall be tested by a discharge of expellant gas through the piping and nozzles. Observations for gas leakage and for continuity of piping with free unobstructed flow shall be made. Observations shall be made of the flow of expellant gas through all nozzles. The labeling of devices with proper designations and instructions shall be checked. After testing, all piping and nozzles are to be blown clean, using compressed air or nitrogen and the system properly charged and placed in the normal "set" condition. All tests are to be conducted as indicated in NFiPA 17 listed in Appendix I.

1210.6 Range hoods: In addition to the requirements of this section, Section 1202.20 and the mechanical code listed in Appendix B, range hood dry chemical systems shall bear the label of an approved agency. The system shall be installed in accordance with the manufacturer's installation instructions. The dry chemical agent of the system shall be nontoxic.

SECTION 1211.0 WET CHEMICAL RANGE HOOD EXTINGUISHING SYSTEMS

1211.1 General: Wet chemical extinguishing systems shall be installed in accordance with the provisions of this section, the mechanical code listed in Appendix B, and NFiPA 17A listed in Appendix I. The system shall bear the label of an approved agency and be installed in accordance with the manufacturer's installation instructions. Wet chemical is defined as a solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof which forms the extinguishing agent.

1211.2 Tests: A completed system shall be tested by a discharge of wet chemical in sufficient amounts to verify that the system is properly installed and functional. Tests shall include a check of the detection systems, alarms, and releasing devices, including manual stations, fuel and power shutoff devices and other associated equipment. All tests are to be conducted as indicated in NFiPA 17A listed in Appendix I.

SECTION 1212.0 STANDPIPE SYSTEMS

1212.1 General: Standpipe systems shall be of an approved type and installed and maintained in accordance with the provisions of this code, the fire prevention code listed in Appendix B, and NFiPA 14 listed in Appendix I.

1212.2 Where required: Standpipe systems shall be installed in the locations prescribed in Sections 1212.2.1 through 1212.2.10.

1212.2.1 Use Group A: In all buildings or structures or portions thereof of Use Group A when:

1. Two or more stories in height of Use Group A-1, A-2, or A-3, and having an occupant load of more than 300; or
2. Three or more stories in height regardless of the area per floor; or
3. Having an auditorium seating over 500. Standpipes shall be located one on each side of the auditorium in each tier, one in each mezzanine, one in each tier of dressing rooms, and protecting each property, store and work room.
4. Having a stage. Standpipes shall be located on each side of the stage. Such standpipes shall be not less than 2 1/2-inch diameter, equipped with 1 1/2-inch hose and 3/8-inch nozzles.

1212.2.2 Use Group B: In all buildings or structures or portions thereof of Use Group B when:

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

1212.2.3 Use Group F: In all buildings or structures or portions thereof of Use Group F when:

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

1212.2.4 Use Group H: In all buildings or structures or portions thereof of Use Group H when:

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

1212.2.5 Use Group I: In all buildings or structures or portions thereof of Use Group I three or more stories in height regardless of the area per floor.

1212.2.6 Use Group M: In all buildings or structures or portions thereof of Use Group M when:

1. Three stories or more in height, and more than 3,000 square feet in area per floor; or
2. Four or more stories in height regardless of the area per floor; or
3. Classified as a covered mall building within the mall portions (see Section 432.10).

1212.2.7 Use Group R: In all buildings or structures or portions thereof of Use Group R when:

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

1212.2.8 Use Group S: In all buildings or structures or portions thereof of Use Group S, other than public garages which shall conform to Section 1212.2.10. when:

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

1212.2.9 Use Group T: In all buildings or structures or portions thereof of Use Group T when:

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

1212.2.10 Public garages: In all Group I and II public garages when:

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

Note: Open parking structures are not public garages (see Section 429.0).

1212.3 Standpipe system piping sizes: The riser piping, supply piping, and the water service piping shall be sized to maintain a residual pressure of at least 65 psi at the topmost outlet of each riser while flowing the minimum quantities of water specified in Sections 1212.3.1 and 1212.3.2 of this code.

Exception: The 65 psi residual pressure is not required to be maintained in buildings less than 70 feet in height which are equipped throughout with an approved automatic fire suppression system.

1212.3.1 Riser sizing: The vertical water pipe(s) within a building to which fire hose outlets and valves are attached shall be sized for a minimum flow of 500 gpm.

Exceptions:

1. Where only 1 1/2-inch valves are required or are provided, the riser(s) shall be sized to provide a minimum flow of 100 gpm. The minimum size shall be 2 1/2 inches.
2. In buildings where limited area sprinkler systems are supplied water from a common standpipe riser, the riser shall be sized to satisfy total demand.
3. In buildings equipped throughout with an approved automatic fire suppression system where both the suppression system and standpipe fire hose outlets are supplied water from a common riser, the minimum riser diameter shall be adequate for the suppression system or the standpipe system, whichever is greater. The minimum riser diameter shall be not less than that based on hydraulic calculations.
4. In buildings which are not equipped throughout with an approved automatic fire suppression system wherein the minimum diameter of the common riser is based on hydraulic calculations, all risers shall have a minimum diameter as described in Table 1212.
5. In buildings of Use Groups B, R-1, R-2, and I equipped throughout with an approved automatic fire suppression system, each vertical standpipe riser shall be sized for a minimum flow of 250 gpm.
6. Standpipe systems in covered mall buildings as provided in Section 432.10.

Table 1212
BUILDING HEIGHT AND STANDPIPE RISER SIZE

Maximum building height	Minimum riser size
4 stories or 50 feet	2 1/2 inches
6 stories or 75 feet	4 inches
76 feet to 250 feet	6 inches
over 250 feet	8 inches

1212.3.2 Supply pipe sizing: The supply piping, including the horizontal or common feeder lines within a building and the water service line outside of the building, shall be sized for a minimum flow of 500 gpm. When more than one standpipe riser is required or provided, all common supply piping shall be sized for a minimum flow of 500 gpm for the first riser plus 250 gpm for each additional riser, and the total need not exceed 2,500 gpm.

Exceptions:

1. Where only 1 1/2-inch valves are required or are provided, the supply piping shall be sized for a minimum flow of 100 gpm for each riser, and the total need not exceed 500 gpm. The minimum size shall be 2 1/2 inches.
2. In buildings where limited area sprinkler systems are supplied water from a common standpipe riser, the supply piping shall be sized for a minimum flow of 500 gpm plus the sprinkler demand for the first riser, plus 250 gpm for each additional riser, and the total need not exceed 2,500 gpm.
3. In buildings of Use Groups B, I, R-1 and R-2 equipped throughout with an approved automatic fire suppression system, all common supply piping shall be sized for a minimum flow of 250 gpm for the first riser plus 250 gpm for each additional riser, and the total need not exceed 1,500 gpm.

1212.4 Number of risers: The number of standpipe risers shall be such that all parts of every floor area can be reached by a thirty (30) foot hose stream from a nozzle attached to not more than 100 feet of hose connected to a riser outlet. In those buildings equipped with an interior smokeproof enclosure vestibule, at least one standpipe hose connection shall be located in the vestibule. In covered mall buildings, outlets shall be located in accordance with Section 432.10.

1212.4.1 Combination: Where a standpipe system riser also serves as the water sprinkler system riser in buildings required to have both systems or in buildings having both systems, control valves shall be installed where sprinklers are connected to the riser so that sprinklers are under the control of a separate floor control valve(s) to allow standpipes to remain operational while the sprinkler system is in a closed position. If control valves are located in a separate room or building, a sign shall be provided on the entrance door. The lettering of such sign shall be of a conspicuous color and shall be at least 4 inches in height and shall read Standpipe Control Valve or indicate other types of systems.

1212.4.2 High-rise buildings: All buildings seventy (70) feet in height or greater shall have each floor supplied by a minimum of two (2) combination risers.

1212.5 Outlets: Standpipe system outlets shall comply with the provisions of Sections 1212.5.1 through 1212.5.4.

1212.5.1 Hose connections: At each floor level, and not more than five (5) feet above the floor, there shall be connected to each standpipe a 2 1/2-inch hose connection capped with a reducing coupling to a 1 1/2-inch hose connection which shall also be capped.

1212.5.2 Roof hydrants: Where standpipes are installed in buildings more than six stories or 75 feet in height, at least one riser shall extend through the roof and terminate in a two-way, 2 1/2-inch hose connection. The main control valve on a roof hydrant or manifolded hose connection shall be located in an area not subject to freezing, as close to the roof access as practical and plainly marked (see Section 1214.8).

1212.5.3 Pressure reducers: When the residual pressure at any standpipe fire hose outlet exceeds 100 psi, approved pressure reducing devices or discs shall be installed at the outlets to reduce the pressure to 100 psi while the required quantity

of water per minute is flowing. Any standpipe riser over 250 feet in height shall be equipped with an approved pressure regulating device on each hose outlet, which controls discharge pressures under both flow (residual) and no-flow (static) conditions.

1212.5.4 Test gauges: An approved water pressure gauge shall be attached to the top of each standpipe riser for inspection and test purposes. Shutoff valves, with provisions for bleeding pressure from the gauge, shall be installed between the gauge and the top of the riser. Gauges shall be accessible and located in spaces not subject to freezing.

1212.6 Materials: All standpipes shall be constructed of approved materials. All pipe, fittings and valves shall be of extra heavy pattern when the normal working pressure will exceed 175 psi.

1212.7 Tests: All standpipe systems shall be flow tested and hydrostatically tested in accordance with the fire prevention code listed in Appendix B.

SECTION 1213.0 STANDPIPES FOR BUILDINGS UNDER CONSTRUCTION OR DEMOLITION

1213.1 General: Standpipes required by this section are to be either temporary or permanent in nature, with or without a water supply, provided, however, that such standpipes conform to the requirements of Section 1212.0 as to number of risers, capacity, outlets and materials.

1213.2 Where required: Temporary or permanent standpipes shall be installed, as the work of the building progresses, beginning at the fourth story or at forty (40) feet in height.

1213.3 Height: The standpipe systems shall be carried up with each floor and shall be installed and ready for use as each floor progresses. Standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.

1213.4 Outlets: Hose outlets shall be provided with caps and attachment chains. The 1 1/2-inch hose and nozzle shall not be required during construction.

1213.5 Fire department connections: At the street level there shall be provided for each temporary or permanent standpipe installation one or more two-way fire department inlet connections. Fire department inlet connections shall be prominently marked and readily and easily accessible at all times (see Section 1214.8).

1213.6 Buildings under demolition: Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be more than one floor below the floor above being demolished.

SECTION 1214.0 FIRE DEPARTMENT CONNECTIONS
(See Section 1213.5 for temporary standpipes)

1214.1 Required: All water sprinkler and standpipe systems shall be provided with at least one two-way fire department connection. Each inlet of the fire department connection shall be at least 2 1/2 inches in diameter. The pipe from the standpipe system and the pipe from the water sprinkler system to the fire department connection shall not be smaller than four (4) inches. Single fire department connections shall not be installed unless approved by the fire official.

Exceptions:

1. A fire department connection shall not be required for limited area sprinkler systems (see Section 1205.6.2).
2. On standpipe or sprinkler systems where the supply pipe to the system is less than four (4) inches, the pipe from the system to the fire department connection shall not be smaller than 2 1/2-inches.

1214.2 Connections: Fire department connections shall be arranged in such a manner that the use of any one water sprinkler connection will serve all the sprinklers, and the use of any one standpipe connection will serve all the standpipes within the building.

1214.3 Location: Fire department connections shall be located and be visible on a street front or in a location approved by the department. Such connections shall be located so that immediate access can be made by the fire department. Obstructions such as fences, bushes, trees, walls or any other similar object, shall not be permitted for new or existing installations.

1214.4 Height: Fire department connections shall not be less than 18 inches and not more than 42 inches in elevation, measured from the ground level to the center line of the inlets.

1214.5 Projection: Where the fire department connection would project beyond the property line or into the public way, a flush-type fire department connection shall be provided.

1214.6 Hose thread: Hose thread in the fire department connection shall be uniform with that used by the local fire department.

1214.7 Fittings: Fire department inlet connections shall be fitted with check valves, ball drip valves and plugs with chains or frangible caps.

1214.8 Signs: A metal sign with raised letters at least one (1) inch in height shall be mounted on all fire department connections serving sprinklers or standpipes. Such signs shall read **Automatic Sprinklers** and/or **Standpipe**.

SECTION 1215.0 WATER SUPPLY AND OTHER EXTINGUISHING MEDIA

1215.1 Required: All fire suppression and standpipe systems shall be provided with at least one automatic supply of extinguishing material of adequate pressure, capacity and reliability to perform the function intended, except as provided in Section 1213.0.

1215.2 Combination sprinkler/standpipe water supply: Where both sprinklers and standpipes are installed and have a common fire water service as their combined source of supply, the water supply line shall be adequately sized to meet the flow and pressure demands of the water supplies for the sprinkler system or the standpipe system, whichever is greater.

1215.3 Combination sprinkler/domestic water supply: Where a sprinkler system is connected to the domestic water supply system, the supply system shall be of adequate pressure, capacity and size for the simultaneous operation of the water sprinkler system and domestic water needs. Taps for domestic water from water sprinkler systems are prohibited.

1215.4 Size: The extinguishing material supply for fire suppression systems shall be sized in an approved manner in accordance with this code.

1215.5 Standpipe water service: All standpipe systems shall be connected to a street water main. Water mains shall be adequately sized and have enough pressure and discharge capacity to supply the total water demand for the building. Taps into the main and water service lines from the main to the building shall be at least equal in size to the largest supply line inside the building. Common supply lines from the main, from which standpipes, domestic or sprinkler systems are supplied, shall be sized to satisfy total demand.

1215.6 Standpipe interconnection: The required water supply shall be connected to the base of each standpipe riser. Where more than one standpipe riser is required, all risers shall be interconnected at their base with a common supply line and an approved indicating valve shall be installed at the base of each riser so as to permit individual risers to be taken out of service if damaged or broken without interrupting the water supply to other risers.

1215.7 Standpipes in unheated areas: Standpipes installed so that all or any portion of the system is installed through unheated areas subject to freezing shall be so arranged through the use of approved devices as to admit water to the system automatically by opening a hose valve or through the use of approved remote control devices located at each hose station.

SECTION 1216.0 YARD HYDRANTS

1216.1 Fire hydrants: Fire hydrants installed on private property shall be located and installed as directed by the fire department. Hydrants shall conform to the standards of the administrative authority of the jurisdiction and the fire department. Hydrants shall not be installed on a water main less than six (6) inches in diameter.

SECTION 1217.0 FIRE PROTECTIVE SIGNALING SYSTEMS

1217.1 Plans and specifications: Where a fire protective signaling system is required by this code, the plans and specifications shall show the location and number of all sending stations and signals with specifications of the type, construction and operation of the system. Installation of all equipment shall conform to the requirements of this code and the applicable NFiPA standards listed in Appendix I.

1217.2 Approval: The fire protective signaling system shall be approved for the particular application and shall be used for the fire protective signaling purpose only. Alarm boxes shall be painted a distinctive red color.

1217.3 Where required: A fire protective signaling system shall be installed and maintained in full operating condition in the locations described in Sections 1217.3.1 through 1217.3.6.

1217.3.1 Use Group A: In all buildings of Use Group A.

1217.3.2 Use Group B: In all buildings of Use Group B when three or more stories in height.

1217.3.3 Use Group I: In all buildings of Use Group I.

1217.3.4 Use Group I-1: In all buildings of Use Group I-1. The manual pull boxes shall be permitted to be locked, provided that staff is present within the subject area when occupied.

1217.3.5 Use Group R-1: In all buildings of Use Group R-1.

1217.3.6 Use Group R-2: In all buildings of Use Group R-2 when four or more stories in height.

1217.4 Location: Manual pull stations shall be located in each story, including basements, not more than five (5) feet from each exit. In buildings of Use Group A, where a stage is provided, a manual pull station shall be located adjacent to the lighting control panel.

Exception: In buildings of Use Group A, manual pull stations may be omitted at exits, but shall be provided at constantly attended locations such as ticket booths, refreshment facilities, bars, etc. Where the building official determines that it is impractical to have a constantly attended location in an assembly occupancy other than a theater, manual pull stations shall be provided at each required building exit.

1217.4.1 Pull station height: The height of the manual pull station boxes shall be a minimum of forty-two (42) inches and a maximum of fifty-four (54) inches measured vertically, from the floor level to the activating handle or lever of the pull station.

1217.5 Coding: Systems shall be either coded or noncoded. Coded stations shall be coded in conformance with NFiPA 72A listed in Appendix I.

1217.6 Power supply: The power for the fire protective signaling system shall be provided from an emergency electrical system conforming to NFiPA 72A listed in Appendix I.

1217.7 Requirements: Fire protective signaling systems shall be of the closed circuit type and shall be electrically or mechanically supervised. In addition, such systems shall comply with Sections 1217.7.1 through 1217.7.4.

1217.7.1 Wiring: All wiring or mechanical tubing shall conform to the requirements of the Massachusetts Electrical Code.

1217.7.2 Alarms: Audible alarms of the approved type shall be provided. The operation of any fire alarm device shall cause all audible or visual alarms to operate. Visual and audible alarms shall be provided in occupancies housing the hard of hearing. Alarm sounding devices shall be of approved type, shall provide a distinctive tone and shall not be used for any purpose other than that of a fire alarm. They shall be of such character and so located as to be seen or effectively heard above all other sounds, by all the occupants, in every occupied space within the building.

Exceptions:

1. Smoke detectors in buildings of Use Group I-1 shall be permitted to alarm at a constantly attended location and are not required to accomplish general alarm indication.
2. Audible alarms in buildings of Use Group A shall sound only in a constantly attended receiving station within the building for purposes of initiating emergency action. Occupant notification shall be by means of either voice or prerecorded message announcement initiated by the person in the constantly attended receiving station. In buildings of Use Group A utilizing reduced lighting levels on a regular basis, lights providing normal lighting levels shall be activated simultaneously with the beginning of the voice or prerecorded message announcement. Where the building official determines that it is impractical to have a constantly attended location in an assembly occupancy other than a theater, the fire alarm system shall be arranged to automatically provide prerecorded evacuation instructions.

1217.7.2.1 Definition of evacuation signal for voice evacuation signaling systems: The evacuation signal shall be a standard "slow whoop" tone. The slow whoop shall be an ascending tone commencing at approximately 600 Hertz and terminating at approximately 1100 Hertz with a duration of approximately 3-1/2 seconds and an interruption between tones of approximately 1/2 second. The slow whoop shall be transmitted in a temporal pattern of three (3) pulses with a silent period of approximately four (4) seconds between each group of pulses.

1217.7.2.2 Definition of evacuation signal for systems using bells or horns: The general evacuation signal for fire alarm systems using bells, horns or other non-verbal signaling, except chimes, shall be the sounding of such devices in a temporal pattern. This pattern shall be a series of pulses. Each pulse shall be on for approximately 3-1/2 seconds with an interruption between pulses of approximately 1/2 second. The evacuation signal shall be transmitted in a temporal pattern of three (3) pulses with a silent period of approximately four (4) seconds between each group of pulses.

1217.7.2.3 Definition of evacuation signal for systems using chimes and other single stroke devices: Chimes and similar single stroke devices shall use a temporal pattern of three (3) distinct pulses with approximately one (1) second separation. There shall be a separation of approximately four (4) seconds between each three

(3) pulse group. In hospital intensive care units, special care units and operating rooms, the audible signal need not be sounded; however a visual alarm shall be displayed on an approved device. The audible signal shall have a sound intensity at least ten (10) dbA above the ambient background noise level. If this sound level would exceed ninety-two (92) dbA at ten (10) feet from the sounding device, then the signal level shall be held at such a level as to produce an intensity of ninety-two (92) dbA at ten feet from the sounding device, and an approved visual signaling device(s) shall be installed. The device(s) shall be so located as to be readily visible to persons in the high sound level area. All sound levels shall be measured using an approved sound level meter.

1217.7.2.4 Length of the general evacuation signal: Once initiated, the general evacuation signal shall sound continuously on all connected devices for at least fifteen (15) minutes. The general evacuation signal may be automatically terminated at the end of this fifteen (15) minute period in order to preserve standby battery power. This automatic termination shall be permitted only if the alarm is transmitted directly to the fire department having jurisdiction. Transmitted directly shall mean transmission of the alarm via transmission facilities covered by NFiPA 71, 72B or 72C listed in Appendix I and with the permission of the head of the fire department. The term general evacuation signal shall mean the signal sounded/displayed on all signaling devices as required by NFiPA 72F or 72G listed in Appendix I which is used to require all occupants to evacuate the protected property.

1217.7.2.5 Where voice alarm is required, the following taped message shall be provided to all areas requiring voice alarm:

> **Attention please. The signal tone you have just heard indicates a report of an emergency in this building. If your floor evacuation signal sounds after this message, walk to the nearest stairway exit and leave the floor. Do not use elevators. All handicapped occupants shall follow the building evacuation plan. While the report is being verified, occupants on other floors should await further instructions. This message shall be repeated once. A female voice shall be used for this message.**

1217.7.3 Presignal system: Presignal systems shall not be installed unless approved by the code official and by the fire department. Where a presignal system is installed, twenty-four (24) hour personnel supervision shall be provided at a location approved by the fire department, in order that the alarm signal can be actuated in the event of fire or other emergency.

1217.7.4 Zones: Each floor shall be zoned separately. If the floor area exceeds 20,000 square feet, additional zoning shall be provided. The length of any zone shall not exceed 300 feet in any direction. Zoning indicator panels and controls shall be located as approved by the department. Annunciators shall lock in until the system is reset.

1217.8 Acceptance tests: Upon completion of the fire protective signaling system, the installation shall be subjected to a performance test to demonstrate its efficiency of operation.

SECTION 1218.0 AUTOMATIC FIRE DETECTION SYSTEMS

1218.1 Plans and specifications: Where an automatic fire detection system is required by this code, the plans and specifications shall show the location and number of all sending stations and signals with specifications of the type, construction and operation of the system including all automatic detection devices. Installation of all equipment shall conform to requirements of this code and NFiPA 72E listed in Appendix I. The system shall be installed in accordance with this section and shall be part of and subject to the requirements of a fire protective signaling system specified in Section 1217.0.

1218.2 Approval: The automatic fire detection system shall be approved for the particular application and shall only be used for detection and signaling in the event of fire. The automatic detecting devices shall be smoke detectors, except an approved alternative type of detector shall be installed in spaces such as boiler rooms where during normal operation products of combustion are present in sufficient quantity to cause alarm.

1218.3 Where required: An automatic fire detection system shall be installed and maintained in full operating condition in the locations described in Sections 1218.3.1 through 1218.3.5.

1218.3.1 Use Group I-2: In all buildings of Use Group I-2.

1218.3.2 Use Group I-1: Automatic smoke detectors shall be installed throughout all resident housing areas.

Exception: Smoke detectors shall not be required in sleeping rooms with four or less occupants in buildings protected throughout with an approved automatic fire suppression system.

1218.3.3 Use Group R-1: In all buildings of Use Group R-1.

Exception: Motel/hotel units that do not have interior corridors and which have direct access to the outside from the sleeping unit at grade level.

1218.3.4 Use Group B or R-2: In all buildings of Use Group B or R-2 when such buildings have floors used for human occupancy located more than 75 feet above the lowest level of fire department vehicle access.

Exception: In buildings of Use Group R-2, smoke detectors are not required within the individual dwelling units except as required by Section 1218.3.5.

1218.3.5 Sleeping areas and dwelling units: In addition to any automatic fire protective signaling system required by Sections 1218.3.1, 1218.3.3 and 1218.3.4, a minimum of one single-station smoke detector shall be installed in each guest room, suite or sleeping area in buildings of Use Group R-1 and in dwelling units, in the immediate vicinity of the bedrooms, in buildings of Use Group R-2 or R-3. When actuated, the detector shall provide an alarm suitable to warn the occupants within the individual unit. In buildings of Use Groups R-1 and R-2 which have basements an additional smoke detector shall be installed in the basement. In buildings of Use Group R-3, smoke detectors shall be required on every story of the

dwelling unit including basements. In dwelling units with split levels, a smoke detector installed on the upper level shall suffice for the adjacent lower level provided the lower level is less than one full story below the upper level. If there is an intervening door between the adjacent levels, a smoke detector shall be installed on both levels. All detectors shall be installed in approved locations. Where more than one detector is required to be installed within an individual dwelling unit, the detectors shall be wired in such a manner that the actuation of one alarm will actuate all the alarms in the individual unit.

1218.4 Sprinklered buildings exception: Buildings or portions thereof equipped throughout with an automatic fire suppression system are not required to be equipped with an automatic fire detection system, but are required to be equipped with a manual fire protective signaling system conforming to Section 1217.0. This exception does not apply to buildings of Use Group I, or to single-station smoke detectors as required in Section 1218.3.5.

1218.5 Distances: Smoke detectors shall be installed not to exceed the lineal or square footage allowances specified, based on the test standards under which they were tested and approved.

1218.6 Zones: The automatic fire detection system shall be connected to the same zones as those required for the fire protective signaling system in Section 1217.0. Automatic detectors which have separate indication on the annunciator panel from the manual pull stations and the fire suppression systems shall have detection zones which match the pull station zones in size and arrangement.

SECTION 1219.0 SMOKE CONTROL SYSTEMS

1219.1 General: Smoke control systems required by this code shall conform to the provisions of this section.

1219.1.1 Acceptance: Before a certificate of occupancy is issued, the smoke control system shall be tested in an approved manner to show compliance with the applicable requirements of this section.

1219.1.2 Standby power: All equipment required to provide smoke control shall be equipped with a standby source of power complying with the Massachusetts Electrical Code.

1219.1.3 Inspections: All operating parts of the smoke control systems specified in Section 437.2.1 (including dampers) shall be tested by the owner every three months and a log of the tests shall be kept for examination by the fire department. At six-month intervals, the system shall be inspected and operated in accordance with the fire prevention code listed in Appendix B.

SECTION 1220.0 SUPERVISION

1220.1 Fire suppression systems: Fire suppression systems required for buildings of Use Groups A, I or R shall be supervised by methods 1, 2, 3 or 4 below. All other fire suppression systems shall be supervised by one of the following methods:

1. Approved central station system in accordance with NFiPA 71 listed in Appendix I.
2. Approved proprietary system in accordance with NFiPA 72D listed in Appendix I.
3. Approved remote station system of the jurisdiction in accordance with NFiPA 72C listed in Appendix I.
4. Approved local alarm service which will cause the sounding of an audible signal at a constantly attended location in accordance with NFiPA 72A listed in Appendix I.
5. Locking valves open.
6. Approved auxiliary protective system(s) which will cause the sounding of an audible signal at a constantly attended location in accordance with NFiPA 72B as listed in Appendix I.

Exceptions:
1. Underground gate valves with roadway boxes.
2. Halogenated extinguishing systems.
3. Carbon dioxide extinguishing systems.
4. Dry chemical extinguishing systems.
5. Limited area sprinkler systems.

1220.2 Fire protection systems: All required fire protection systems, other than fire suppression systems, shall be connected to an approved central station system, proprietary system, or remote station system of the jurisdiction when approved by the fire department. Fire suppression systems shall conform to Section 1220.1.

Exceptions:
1. Standpipe systems.
2. Fire alarm systems in buildings of Use Group R when less than five stories in height.
3. Single-station detectors required by Section 1218.3.5.
4. Smoke detectors in buildings of Use Group I-1.

SECTION 1221.0 FIRE EXTINGUISHERS

1221.1 Approval: Portable fire extinguishers shall bear the label of an approved agency and shall be installed in a location visible and accessible to the occupants.

1221.2 Where required: A portable fire extinguisher shall be installed in the following locations in accordance with NFiPA 10 listed in Appendix I.
1. In all buildings of Use Groups A-1, A-2, A-3, A-4, I-2, R-1 and H.
2. In all areas containing commercial kitchen exhaust hood systems.
3. In all areas where fuel is dispensed.
4. In all areas where a flammable or combustible liquid is used in the operation of spraying, coating or dipping.
5. In all buildings of Use Group I-1 at staff locations. Access to portable extinguishers shall be permitted to be locked.
6. On each completed floor of buildings under construction, other than buildings of Use Group R-3.

(PAGES 451 THROUGH 453 ARE RESERVED FOR FUTURE USE.)

NON-TEXT

NON-TEXT

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ARTICLE 13

PRECAUTIONS DURING BUILDING OPERATIONS

SECTION 1300.0 GENERAL

1300.1 Scope: The provisions of this article shall apply to all construction operations in connection with the erection, alteration, repair, removal or demolition of buildings and structures. The execution of the detail requirements shall be regulated by the approved rules and the safety codes for building construction listed in Appendix B.

1300.2 Other laws: Nothing herein contained shall be construed to nullify any rules, regulations or statutes of state agencies governing the protection of the public or workmen from health or other hazards involved in manufacturing, mining and other processes and operations which generate toxic gases, dust or other elements dangerous to the respiratory system, eyesight or health.

1300.2.1 Other regulations: In addition, the following regulations also shall apply when not covered by this code: Rules and Regulations for the Prevention of Accidents in Construction Operations (441 CMR 10.00); and Keeping, Storage, Use, Manufacture, Sale, Handling, Transportation or other Disposition of Explosives (527 CMR 13.00).

1300.3 Combustible and explosive hazards: The provisions of this code which apply to the storage, use or transportation of explosives, highly flammable and combustible substances, gases and chemicals shall be construed as supplemental to the requirements of the federal laws, the regulations of the Department of Transportation (DOT) and the rules and regulations of the jurisdiction.

SECTION 1301.0 PLANS, SPECIFICATIONS AND SPECIAL PERMITS

1301.1 Temporary construction: Before any construction operation is started, plans and specifications shall be filed with the building official showing the design and construction of all sidewalk sheds, truck runways, trestles, foot bridges, guard fences and other similar devices required in the operation; and the approval of the building official shall be secured before the commencement of any work.

1301.2 Special permits: All special licenses and permits for the storage of materials on sidewalks and highways, for the use of water or other public facilities and for the storage and handling of explosives shall be secured from the administrative authorities having jurisdiction.

1301.3 Temporary encroachments: Subject to the approval of the building official, sidewalk sheds, underpinning and other temporary protective guards and devices may project beyond the interior and street lot lines as may be required to insure the safety of the adjoining property

and the public. When necessary, the consent of the adjoining property owner shall be obtained.

SECTION 1302.0 TESTS

1302.1 Loading: It shall be unlawful to load any structure, temporary support, scaffolding, sidewalk bridge or sidewalk shed or any other device or construction equipment during the construction or demolition of any building or structure in excess of its safe working capacity as provided in Article 7 for allowable loads and working stresses.

1302.2 Unsafe equipment: Whenever any doubt arises as to the structural quality or strength of scaffolding plank or other construction equipment, such material shall be replaced; provided, however, the building official may accept a strength test to four (4) times the superimposed live load to which the material or structural member is to be subjected. The member shall sustain the test load without failure.

SECTION 1303.0 INSPECTION

1303.1 Unsafe conditions: When inspection of any construction operation reveals that any unsafe or illegal conditions exist, the building official shall notify the owner and direct him to take the necessary remedial measures to remove the hazard or violation.

1303.2 Failure to comply with orders: Unless the owner so notified proceeds to comply with the orders of the building official within twenty-four (24) hours, the building official shall have full power to correct the unsafe conditions as provided in Sections 124.0 and 125.0. All expenses incurred in the correction of such unsafe conditions shall become a lien on the property.

1303.3 Unsafe construction equipment: When the strength and adequacy of any scaffold or other device or construction equipment is in doubt, or when any complaint is made, the building official may inspect such equipment and shall prohibit its use until tested as required in Section 1302.2 or until all danger is removed.

SECTION 1304.0 MAINTENANCE

1304.1 General: All construction equipment and safeguards shall be constructed, installed and maintained in a substantial manner and shall be so operated as to insure protection to the workmen engaged thereon and to the general public. It shall be unlawful to remove or render inoperative any structural, fire protective or sanitary safeguard or device herein required except when necessary for the actual installation and prosecution of the work.

SECTION 1305.0 EXISTING BUILDNGS

1305.1 Protection: All existing and adjoining public and private property shall be protected from damage incidental to construction operations.

1305.2 Chimney, soil and vent stacks: Whenever a new building or structure is erected to greater or lesser heights than an adjoining building, the construction and extension of new or existing chimneys shall conform to the provisions of Section 1005.0 and to soil and vent stacks, and the location of window openings shall conform to the provisions of Article 17 and Sections 1305.2.1 through 1305.2.3.

1305.2.1 Extension above new building: When a new building is erected higher than an existing building, windows or other wall openings shall not be located nearer than six (6) feet to an existing soil or vent stack on the lower building unless the owner of the new building makes the necessary provision to extend such soil or vent stacks to a height of not less than three (3) feet above the topmost opening at his own expense and with the approval of the adjoining owner.

1305.2.2 Extension above existing building: When the existing adjoining building is of greater height than the new building, the owner of the structure of greater height may, with the consent of the new oener of the new structure, extend all new soil, waste or vent stacks which are located within twenty (20) feet of the common lot line to a level above the higher existing roof.

1305.2.3 Exemption: Approved fixed window assemblies of the required fireresistance rated construction which comply with the provisions of Article 9, when permitted in lot line walls, shall not be deemed wall openings within the meaning of this section.

1305.3 Adjoining walls: The owner of the new or altered structure shall preserve all adjoining independent and party walls from damage as provided herein. He shall underpin where necessary and support the adjoining building or structure by proper foundations to comply with Section 1307.0.

1305.3.1 Maintenance: In case an existing party wall is intended to be used by the person who causes an excavation to be made, and such party wall is in good condition and sufficient for the use of both the existing and proposed building, such person shall preserve the party wall from injury and support it by proper foundations at his own expense, so that it shall remain as safe and useful as it was before the excavation was commenced. During the demolition, the party wall shall be maintained weather-proof and structurally safe by adequate bracing until such time as the permanent structural supports shall have been provided.

1305.3.2 Beam holes: When a structure involving a party wall is being

demolished, the owner of the demolished structure shall, at his own expense, bend over all wall anchors at the beam ends of the standing wall and shall brick-up all open beam holes and otherwise maintain the safety and usefulness of the wall.

1305.3.3 Party wall exitways: A party wall balcony or horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved by the building official.

1305.4 Adjoining roofs: When a new building or demolition of an existing building is being prosecuted at a greater height, the roof, roof outlets and roof structures of adjoining buildings shall be protected against damage with adequate safeguards by the person doing the work.

SECTION 1306.0 PROTECTION OF PUBLIC AND WORKMEN

1306.1 General: Whenever a building or structure is erected, altered, repaired, removed or demolished, the operation shall be conducted in a safe manner and suitable protection for the general public and workmen employed thereon shall be provided.

1306.2 Fences: An adequate fence or other barrier shall be erected when required by the building official during construction operations.

1306.3 Sidewalk bridge: Whenever the ground is excavated under the sidewalk, a sidewalk bridge shall be constructed at least four (4) feet wide, or a protected walkway of equal width shall be erected in the street, provided the required permit for such walkway is obtained from the administrative authority.

1306.4 Sidewalk shed

1306.4.1 Within ten feet of street lot line: When any building or part thereof which is located within ten (10) feet of the street lot line is to be erected or raised to exceed forty (40) feet in height, or whenever a building more than forty (40) feet in height within ten (10) feet of the street lot line is to be demolished, a sidewalk shed shall be erected and maintained for the full length of the building on all street fronts for the entire time that work is performed on the exterior of the building.

1306.4.2 Within 20 feet of street lot line: When the building being demolished or erected is located within twenty (20) feet of the street lot line and is more than forty (40) feet in height, exterior flare fans or catch platforms shall be erected at vertical intervals of not more than two (2) stories.

1306.4.3 Buildings higher than six stories: When the building being demolished or erected is more than six (6) stories or seventy-five (75) feet in height, unless set back from the street lot line a distance more than one-half (½) its height, a sidewalk shed shall be provided.

1306.4.4 Walkway: An adequately lighted walkway at least four (4) feet wide and eight (8) feet high in the clear shall be maintained under all sidewalk sheds for pedestrians. Where ramps are required, they shall conform to the provisions of this article and Section 615.0.

1306.5 Thrust-out platforms: The building official may approve thrust-out platforms or other substitute protections in lieu of sidewalk sheds when deemed adequate to insure the public safety. Thrust-out platforms shall not be used for the storage of materials.

1306.6 Watchman: Whenever a building is being demolished, erected or altered, a watchman shall be employed to warn the general public when intermittent hazardous operations are conducted across the sidewalk or walkway.

SECTION 1307.0 EXCAVATIONS

1307.1 Temporary support: Until permanent support has been provided, all excavations shall be safeguarded and protected by the person causing the excavations to be made, to avoid all danger to life or limb. Where necessary, such excavations shall be retained by temporary retaining walls, sheet-piling and bracing or other approved method to support the adjoining earth. (See 441 CMR 10.00).

1307.1.1 Examination of adjoining property: Before any excavation or demolition is undertaken, license to enter upon adjoining property for the purpose of physical examination shall be afforded by the owner and tenants of such adjoining property to the person undertaking such excavation or demolition, prior to the commencement and at reasonable periods during the progress of the work.

1307.1.2 Notice to the building official: If the person who causes an excavation to be made or an existing structure to be demolished has reason to believe that an adjoining structure is unsafe, he shall forthwith report in writing to the building official. The building official shall inspect such premises, and if the structure is found unsafe, he shall order it repaired as provided in Section 123.0.

1307.1.3 Responsibility of adjoining owner: The person making or causing an excavation to be made shall, before starting the work, give at least one (1) week's notice in writing to the owner of each neighboring building or structure, the safety of which may be affected. Having received consent to enter a building, structure or premises, he shall make the necessary provisions to protect it structurally and to insure it against damge by the elements which may ensue from such excavation. If license to enter is not afforded, then the adjoining owner shall have the entire responsibility of providing both temporary and permanent support of his premises at his own expense; and for that purpose, he shall be

afforded the license when necessary to enter the property where the excavation is to be made.

1307.1.4 Excavations for other than construction purposes: Excavations made for the purpose of removing soil, earth, sand, gravel, rock or other materials shall be performed in such a manner as will prevent injury to neighboring properties or to the street which adjoins the lot where such materials are excavated, and to safeguard the general public health and welfare.

1307.2 Permanent Support

1307.2.1 Excavations: Whenever an excavation is made below the established grade, the person who causes such excavation to be made, if afforded the necessary license to enter the adjoining premises, shall preserve and protect from injury at all times and at his own expense such adjoining structure or premises which may be affected by the excavation. If the necessary license is not afforded, it shall then be the duty of the owner of the adjoining premises to make his building or structure safe by installing proper underpinning or foundations or otherwise; and such owner, if it be necessary for the prosecution of his work, shall be granted the necessary license to enter the premises where the excavation or demolition is contemplated (see Section 1307.1.3).

1307.2.2 Deleted

SECTION 1308.0 REGULATION OF LOTS

1308.1 Grading of lot: When a building or structure has been demolished or removed and a building operation has not been projected or approved, the vacant lot shall be filled with non-organic fill, graded and maintained in conformity with adjacent grades. The lot shall be maintained free from the accumulation of rubbish and all other unsafe or hazardous conditions which endanger the life or health of the public; and provisions shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

1308.2 Utility connections: All service utility connections shall be discontinued and capped in accordance with Section 116.1.

SECTION 1309.0 RETAINING WALLS AND PARTITION FENCES

1309.1 General: When the adjoining grade is not higher than the legal level, the person causing an excavation to be made shall erect, when necessary, a retaining wall at his own expense and on his own land. Such wall shall be built to a height sufficient to retain the adjoining earth, shall be properly coped as required in Section 870.0 and shall be provided with a guard rail or fence not less than forty-two (42) inches in height.

SECTION 1310.0 STORAGE OF MATERIALS

1310.1 General: All materials and equipment required in construction operations shall be stored and placed so as not to endanger the public, the workmen or adjoining property.

1310.2 Design capacity: Materials or equipment stored within the building, or on sidewalks, sheds or scaffolds shall be placed so as not to overload any part of the construction beyond its design capacity, nor interfere with the safe prosecution of the work.

1310.3 Special loading: Unless the construction is designed for special loading, materials stored on sidewalk sheds and scaffolds shall not exceed one (1) day's supply. All materials shall be piled in an orderly manner and height, to permit removal of individual pieces without endangering the stability of the pile.

1310.4 Pedestrian walkways: Materials or equipment shall not be stored on the street without a permit issued by the administrative official having jurisdiction. When so stored they shall not unduly interfere with vehicular traffic, or the orderly travel of pedestrians on the highways and streets. The piles shall be arranged to maintain a safe walkway not less than four (4) feet wide, unobstructed for its full length, and adequately lighted at night and at all necessary times for the use of the public.

1310.5 Obstructions: Material and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, utility boxes, catch basins, or manholes, nor shall they be located within twenty (20) feet of a street intersection, or so placed as to obstruct normal observations of traffic signals or to hinder the use of street car loading platforms.

SECTION 1311.0 REMOVAL OF WASTE MATERIAL

1311.1 Removal of waste material: Material shall not be dropped by gravity or thrown outside the exterior walls of a building during demolition or erection. Enclosed chutes shall be provided for this purpose and any material which in its removal will cause an excessive amount of dust shall be wetted down to prevent the creation of a nuisance.

SECTION 1312.0 PROTECTION OF ADJOINING PROPERTY

1312.1 General: Adjoining property shall be completely protected from any damage incidental to the building operation when the owner of the property permits free access to the building at all reasonable times to provide the necessary safeguards in accordance with Section 1307.0.

SECTION 1313.0 PROTECTION OF FLOOR AND WALL OPENINGS

1313.1 Noncombustible floor construction: The arches, slabs or structural floor fillings of buildings or fireproof construction (Type I) and noncombustible construction (Type 2) shall be installed as the building progresses.

1313.2 Combustible floor construction: In wood joist floor construction (Types 3 and 4) when double flooring is used, the underfloor shall be laid on each story as the building progresses; and when double floors are not used, the floors shall be planked over two (2) stories below the level where work is being performed.

1313.3 Steel structural frames: In steel construction, the entire tier of iron or steel beams upon which the structural work is in progress shall be planked over within two (2) floors but not more than twenty-five (25) feet, with the exception of necessary hoistways and permanent openings; and the steel work shall not advance more than four (4) floors or forty-eight (48) feet ahead of unfinished bolting or welding above the foundation or highest permanently secured floor, nor more than six (6) floors ahead of the permanent floor construction.

1313.4 Guardrails: All floor and wall openings shall be protected with substantial guard rails and toe boards in accordance with accepted engineering practice.

SECTION 1314.0 SCAFFOLDS

1314.1 Load capacity: Scaffolds and their components shall be capable of supporting without failure at least four (4) times the maximum intended load. All platforms and supporting elements of scaffolds shall be designed and constructed to support uniform minimum live loads in pounds per square foot (psf) of the platform area in accordance with the classifications described in the following Table 1314.

1314.2 Erection: Built-up, swinging, and suspended scaffolds shall be erected by competent workmen only.

1314.3 Fire-retardant construction

1314.3.1 All buildings: All scaffolding exceeding sixty (60) feet or seven (7) stories in height used in construction operations involving the erection, alteration or maintenance of buildings, shall be constructed of noncombustible or fire-retardant materials except for the platform planking which may be of wood, complying with the provisions of Section 903.0.

Table 1314

SCAFFOLD LOAD CAPACITY

Classification	Service type	Load (pounds per square foot)
Light duty	Carpenters	25
	Stone setters (No stone on scaffold)	25
	Miscellaneous (No material on scaffold)	25
Medium duty	Bricklayers	50
	Stucco	50
	Lathers & plasterers	50
Heavy duty	Stone masons	75

1314.3.2 Institutional buildings: All scaffolding used in construction operations involving the repair or partial demolition of institutional buildings (use groups I-1 and I-2), during occupancy of the building shall be constructed of noncombustible or fire-retardant materials complying with the the provisions of Section 903.0.

SECTION 1315.0 HOISTS

1315.1 Equipment for handling and hoisting materials: Equipment for handling and hoisting materials shall be in accordance with Article 17 of the Rules and Regulations for the Prevention of Accidents in Construction Operations (441 CMR 10.00).

1315.2 Deleted

1315.3 Deleted

1315.4 Deleted

SECTION 1316.0 STAIRWAYS AND LADDERS

1316.1 Temporary stairways: When a building has been constructed to a greater height than fifty (50) feet or four (4) stories, or when an existing building which exceeds fifty (50) feet in height is altered, at least one (1) temporary lighted stairways are shall be provided unless one (1) or more of the permanent stairways is erected as the construction progresses.

1316.2 Ladders: Temporary ladders, when permitted for access to floors before stairways are installed, or which are designed for other working purposes, shall extend at least forty-two (42) inches above the floor level which they serve.

SECTION 1317.0 LIGHTING

1317.1 General: All stairways and parts of buildings under demolition, erection or repair shall be adequately lighted while persons are engaged at work, to comply with the provisions of Section 624.0 and Article 15.

SECTION 1318.0 FIRE HAZARDS

1318.1 General: The provisions of this code and of the fire prevention regulations shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

1318.2 Temporary heating: Whenever salamanders or other heating devices are used for temporary heating, all regulations as to maximum temperature, distance from combustible materials, spark arrestors, removal of noxious gases, and other requirements prescribed by the building official shall be fully observed. When the source of temporary heat consists of salamanders or other open-flame devices, temporary canvas enclosures shall comply with Section 904.0.

1318.3 Steam boilers: All temporary or permanent high pressure steam boilers shall be operated, or be in charge of engineers or firemen licensed in accordance with the provisions of Inspection of Boilers, Air Tanks, etc.; Licenses of Hoisting Machinery, Chapter 146 of the Massachusetts General Laws Annotated, as amended, and as listed under Boiler Regulations in Appendix B. When such boilers are located within a building or within ten (10) feet thereof, all such boilers shall be enclosed with approved noncombustible construction.

1318.4 Storage of flammables: Storage of gasoline for hoists, oils, paints and other highly flammable materials shall be permitted only as specified in Article 4 and when stored in approved safety containers. The storage of larger quantities may be approved by the administrative official when stored in separate compartments or enclosures of approved noncombustible construction.

1318.5 Flame cutting and welding: The use of oxyacetylene torches for cutting or welding shall be permitted only in accordance with the applicable standards for air and gas welding in building construction.

1318.6 Concrete forms: Combustible materials shall not be stored on any floor of a building under construction until all combustible concrete forms are removed from the tier immediately above.

1318.7 Fire-extinguishing equipment: Required fire extinguishers, water buckets, auxiliary fire-fighting tools or other portable extinguishing equipment shall be installed and maintained on all floors of a construction operation in accessible locations as required in Article 12 and the fire prevention regulation.

1318.8 Standpipes and fire lines: Where standpipes are provided as a permanent part of the building, they shall be installed and made ready for instant use of the fire department as the structure progresses in accordance with the provisions of Section 1212.0. Free access from the street to such standpipes shall be maintained at all times; and materials shall not be stored within five (5) feet of any fire hydrant or in the roadway between such hydrant and the center line of the street.

1318.9 Housekeeping: Rubbish and trash shall not be allowed to accumulate on the site and shall be removed as fast as conditions warrant; combustible rubbish shall be removed daily, and shall not be disposed of by burning on the premises or in the immediate vicinity, and the entire premises and area adjoining and around the operation shall be kept in a safe and sanitary condition and free of accumulations of trash, rubbish, nuts, bolts, small tools and other equipment.

SECTION 1319.0 HEALTH HAZARDS

1319.1 General: Every construction or maintenance operation which results in the diffusion of dust, stone and other small particles, toxic gases or other harmful substances in quantities hazardous to health shall be safeguarded by means of local ventilation or other protective devices to insure the safety of the public as required by the regulations of the administrative official.

1319.2 Removal of dust: Dust, sand blasts or other harmful agents, when employed or occurring in construction operations, shall be disposed of at or near the point of origin to prevent their diffusion over adjoining premises or streets.

1319.3 Protective equipment: Facilities shall be provided for housing the necessary vision, respiratory and protective equipment required in welding operations in approved closed containers and in accordance with the regulations of the administrative official (see Section 1319.1).

SECTION 1320.0 WELDING SAFETY PRECAUTIONS

1320.1 Welding enclosures: All welding and flame-cutting operations shall be performed in protected areas with full consideration to safety and fire hazards. Such closed spaces shall be properly ventilated while welding or cutting is being done. Suitable protection against the rays of the electric arc shall be maintained by the contractor where arc-welding operations might be viewed within harmful range by persons other than the welding operators and inspectors.

1320.2 Flammable materials: Proper precautions shall be taken to avoid all risk of fire or explosion, and flammable or explosive materials shall not be stored in the vicinity of welding or cutting operations.

SECTION 1321.0 DELETED

SECTION 1322.0 DISPUTES

1322.1 General: The building official, when requested by any person, aggrieved or otherwise, shall serve a written notice on any owner, tenant and their agents who fail to conform to the requirements of this article directing him to take the necessary remedial action. If the person whose duty it is to protect his own or adjoining property under those provisions fails to proceed to fully comply with such notice within three (3) days of the receipt thereof, or within a reasonable time thereafter as determined by the building official, he may cause the necessary work to be done when the health, safety and general welfare of the public are involved. The cost of such work shall become a lien against the property of the offending owner and the legal authority of the jurisdiction shall institute appropriate action for its recovery.

ARTICLE 14

SIGNS

SECTION 1400.0 GENERAL

1400.1 Scope: The provisions of this article shall govern the construction, alteration, repair and maintenance of all signs, together with their appurtenant and auxiliary devices in respect to structural and fire safety.

1400.2 Zoning law: Where more restrictive in respect to location, use, size or height of signs, the limitations of the zoning laws affecting required light and ventilation requirements and use of land shall take precedence over the regulations of this code.

1400.3 Approved rules: In the absence of approved rules governing details of construction, the provisions of the applicable standards listed in Appendix B shall be deemed to confirm to the requirements of this code unless otherwise specified in this article.

1400.3.1 Commonwealth of Massachusetts regulations: Outdoor advertising subject to the Rules and Regulations of the Outdoor Advertising Board, Massachusetts General Laws Annotated, as amended, and as listed in Appendix B and 311 CMR 1.00-3.00, requires the approval of the said Board prior to permit issuance.

SECTION 1401.0 PLANS, SPECIFICATIONS AND PERMITS

1401.1 Owner's consent: Before any permit is granted for the erection of a sign, plans and specifications shall be filed with the building official showing the dimensions, materials and required details of construction, including loads, stresses and anchorage. The applications shall be accompanied by the written consent of the owner or lessee of the premises upon which the sign is to be erected.

1401.2 New signs: A new sign shall not hereafter be erected, constructed, altered or maintained except as herein provided and until after a permit has been issued by the building official and the bond, if required, shall have been filed in accordance with Section 1406.0.

1401.3 Deleted

1401.4 Alterations: A sign shall not be enlarged or relocated except in conformity to the provisions of this article for new signs, nor until a proper permit has been secured. The changing of movable parts of an approved sign that is designed for such changes, or the repainting or reposting of display matter, shall not be deemed an alteration; provided the conditions of the original approval and the requirements of this article are not violated.

1401.5 Plans and specifications: Any sign twelve (12) feet or over in height above average adjoining grade, or any free-standing sign with an area of over sixty (60) square feet, or any roof sign, projecting sign, or marquee sign, shall have structural drawings and specifications, including foundations, submitted by a registered professional engineer.

SECTION 1402.0 EXEMPTIONS

1402.1 General: A permit shall not be required for the signs covered by the provisions of this section. Such exceptions, however, shall not be construed to relieve the owner of the sign from responsibility for its erection and maintenance in a safe manner.

1402.2 Wall signs: A sign painted on the surface of a fence or approved building wall; or any non-illuminated wall sign on a building or structure which is not more than ten (10) square feet in area.

1402.3 Ground signs: The ground signs listed in the following Sections 1402.3.1 through 1402.3.3 shall not require a permit.

1402.3.1 Sale or rent: Signs erected to announce the sale or rent of the property so designated, provided such signs are not more than twenty-five (25) square feet in area.

1402.3.2 Transit directions: The erection or maintenance of a sign designating the location of a transit line, a railroad station or other public carrier when not more than three (3) square feet in area.

1402.3.3 Street signs: A sign erected by a jurisdiction for street direction.

1402.4 Projecting signs: A projecting sign not exceeding two and one-half (2½) square feet of display surface.

1402.4.1 Government building signs: Signs erected on a municipal, state or federal building which announce the name, nature of the occupancy and information as to use of, or admission to, the premises.

SECTION 1403.0 UNSAFE AND UNLAWFUL SIGNS

1403.1 Notice of unsafe signs: When any sign becomes insecure, in danger of falling, or otherwise unsafe, or if any sign shall be unlawfully installed, erected or maintained in violation of any of the provisions of this code, the owner thereof or the person or firm maintaining same, shall upon written notice of the building official, forthwith in the case of immediate danger and in any case within not more than ten (10) days, make such sign conform to the provisions of this article or shall remove it. If within ten (10) days the order is not compiled with, the building official may remove such sign at the expense of the owner or lessee thereof as provided in Section 124.0.

1403.2 Unlawful signs: The location or positioning of signs listed in the following Sections 1403.2.1 through 1403.2.4 shall be considered unlawful.

1403.2.1 Egress obstructions: A sign shall not be erected, constructed, or maintained so as to obstruct any fire escape, required exitway, window or door opening used as an element of a means of egress or to prevent free passage from one part of a roof to another part thereof or access thereto as required by the provisions of Article 6 or for the fire-fighting forces having jurisdiction.

1403.2.2 Obstruction to ventilation: A sign shall not be attached in any form, shape or manner which will interfere with any opening required for ventilation by Article 5, except than such signs may be erected in front of and may cover transom windows when not in violation of the provisions of this code.

1403.2.3 Projecting signs: A projecting sign erected at other than right angles to the wall of the building or structure outside of the building line which extends above the roof cornice or parapet wall, or above the roof level when there is not a cornice or parapet wall and which obstructs access to the roof is hereby deemed unlawful. Such signs shall be reconstructed or removed as herein required.

1403.2.4 Alley signs: Signs shall not be permitted to project beyond alley lot lines.

SECTION 1404.0 EXISTING SIGNS

1404.1 Removing or reconstructing signs: A sign heretofore approved and erected shall not be repaired, altered or moved, nor shall any sign, or any substantial part thereof, which is blown down, destroyed or removed be re-erected, reconstructed, rebuilt or relocated unless it is made to comply with all applicable requirements of this article.

1404.2 Repair of unsafe signs: This section shall not be construed to prevent the repair or restoration to a safe condition as directed by the building official of any part of an existing sign when damaged by storm or other accidental emergency.

1404.3 Relocating signs: Any sign that is moved to another location either on the same or to other premises shall be considered a new sign and a permit shall be secured for any work performed in connection therewith when required by this article.

1404.4 Projecting signs: See Section 1403.2.3.

SECTION 1405.0 MAINTENANCE AND INSPECTION

1405.1 Removal: The building official may order the removal of any sign that is not maintained in accordance with the provisions of this article.

1405.2 Maintenance: All signs for which a permit is required, together with all their supports, braces, guys, and anchors shall be kept in repair in accordance with the provisions of this article and Article I; and when not galvanized or constructed of approved corrosion-resistive, non-combustible materials shall be painted when necessary to prevent corrosion.

1405.3 Housekeeping: It shall be the duty and responsibility of the owner or lessee of every sign to maintain the immediate premises occupied by the sign in a clean, sanitary and healthful condition.

1405.4 Inspection: Every sign shall be subject to the inspection and approval of the building official.

SECTION 1406.0 BONDS AND LIABILITY INSURANCE

1406.1 Filing: A person shall not erect, install, remove, rehang or maintain over public property any sign for which a permit is required under the provisions of this code until approved bond or liability insurance shall have been filed in accordance with the requirements of the municipality, if any.

1406.2 Conditions: Such bond or insurance policy may provide that the municipality shall be protected and held harmless from any and all claims or demands for damages by reason of any negligence of the sign hanger, contractor or his agents, or by any reason of defects in the construction or damages resulting from the collapse, failure or combustion of the sign or parts thereof.

1406.3 Notice of cancellation: Any such obligation shall remain in force and effect during the lifetime of every such sign and shall not be cancelled by the principal or surety until after thirty (30) days' notice to the building official.

SECTION 1407.0 GENERAL REQUIREMENTS FOR ALL SIGNS

1407.1 Construction: All signs shall be designed and constructed in conformity to the provisions for materials, loads and stresses of Articles 7 and 8 and the requirements of this article.

1407.2 Design loads: Loads listed in the following Sections 1407.2.1 through 1407.2.2 shall be as the minimum for the design of signs.

1407.2.1 Wind: All signs shall be designed and constructed to withstand wind pressure as provided in Section 715.0.

1407.2.2 Earthquake: Signs adequately designed to withstand wind pressures shall generally be considered capable of withstanding earthquake shocks, except as provided in Section 716.0 and for combined loading in Section 717.0.

1407.3 Illumination: A sign shall not be illuminated by other than electrical means and electrical devices, and wiring shall be installed in accordance with the requirements of the Massachusetts State Electrical Code (527 CMR 12.00) listed in Appendix B. Any open spark or flame shall not be used for display purposes unless specifically approved by the building official.

1407.4 Use of combustibles: The following Sections 1407.4.1 through 1407.4.2 shall apply to combustible material for signs.

1407.4.1 Ornamental features: In all signs required to be constructed of noncombustible materials under the provisions of this code, wood or other materials of combustible characteristics similar to wood may be used for moldings, cappings, trim, nailing blocks, letters, latticing, and other purely ornamental features.

1407.4.2 Sign facings: Sign facings may be made of approved combustible plastic providing the total area of such facing is not more than one hundred twenty (120) square feet, or provided that sections of facings be separated from each other by a distance not less than six (6) feet, and the wiring for electric lighting is entirely enclosed in the sign cabinet with a clearance of not less than two (2) inches from the facing material. Such facings, in the plane of the wall, shall not be permitted above seventy-five (75) feet.

1407.5 Servicing devices: Ladders, platforms, hooks, rings and all other devices for the use of servicing personnel shall have safety devices and design loading in accordance with the safety requirements in Appendix B.

1407.6 Animated devices: Signs which contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than fifteen (15) inches. The fail-safe device shall be in addition to the mechanism and its housing which operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

SECTION 1408.0 GROUND SIGNS

1408.1 Bottom clearance: The bottom capping of all ground signs shall be at least thirty (30) inches above the ground but the intervening space may be filled with open lattice work or platform decorative trim.

1408.1.1 Deleted

1408.1.2 Deleted

1408.2 Maximum size: In all locations, when constructed entirely of noncombustible material, ground signs may be erected to a height of one hundred (100) feet above the ground; and to greater heights when approved by the building official and located so as not to create hazard or danger to the public.

SECTION 1409.0 ROOF SIGNS

1409.1 Materials: All roof signs shall be constructed entirely of metal or other approved noncombustible materials except as provided in Section 1407.4. Provisions shall be made for electric ground of all metallic parts; and where combustible materials are permitted in letters or other ornamental features, all wiring and tubing shall be kept free and insulated therefrom.

1409.2 Bottom clearance: There shall be a clear space of not less than six (6) feet between the lowest part of the sign and the roof level, except for necessary structural supports.

1409.3 Closed signs: A closed roof sign shall not be erected to a height greater than fifty (50) feet above the roof of Types 1 and 2 constructed buildings nor more than thirty-five (35) feet above the roof of Types 3 and 4 constructed buildings.

1409.4 Open signs: An open roof sign shall not exceed a height of one hundred (100) feet above the roof of buildings of Types 1 and 2 construction; and not more than sixty (60) feet above the roof of buildings of Types 3 and 4 construction.

1409.5 Combustible supports: A roof sign which exceeds forty (40) feet in height shall not be supported on or braced to wooden beams or other combustible construction of a building or structure unless otherwise approved by the building official.

SECTION 1410.0 WALL SIGNS

1410.1 Materials: Wall signs which have an area exceeding forty (40) square feet shall be constructed of metal or other approved noncombustible materials, except for nailing rails and as provided in Section 1407.4.

1410.2 Extension: Wall signs shall not be erected to extend above the top of the wall, nor extend beyond the ends of the wall to which they are attached, unless meeting all the requirements for roof signs, projecting signs or ground signs as the case may be.

SECTION 1411.0 PROJECTING SIGNS

1411.1 Materials: Projecting signs shall be constructed entirely of metal or other approved noncombustible materials except as provided in Section 1407.4.

1411.2 Maximum projection: A projecting sign shall not extend beyond a vertical plane two (2) feet inside the curb line.

1411.3 Clearances: A clear space of not less than ten (10) feet shall be provided below all parts of such signs.

1411.4 Additional loads: Projecting sign structures which could be used to support an individual on a ladder or other servicing device whether or not specifically designed for the servicing device shall be capable of supporting the anticipated additional load but in no case less than one hundred (100) pounds concentrated horizontal load and three hundred (300) pounds vertical concentrated load applied at the point of assumed loading or point of most eccentric loading. The building component to which the projecting sign is attached shall also be designated to support the additional loads.

SECTION 1412.0 MARQUEE SIGNS

1412.1 Materials: Marquee signs shall be constructed entirely of metal or other approved noncombustible materials except as provided in Section 1407.4.

1412.2 Marquee: Marquee signs shall be attached to approved marquees constructed in accordance with Section 310.10.

1412.3 Dimensions: Marquee signs may extend the full length, but they shall not project beyond the perimeter of the marquee.

SECTION 1413.0 MISCELLANEOUS AND TEMPORARY SIGNS

1413.1 Banner and cloth signs: Temporary signs and banners attached to or suspended from a building, constructed of cloth or other combustible material shall be strongly constructed and shall be securely attached to their supports. They shall be removed as soon as torn or damaged, and not later than sixty (60) days after erection; except that permits for temporary signs suspended from or attached to a canopy or marquee shall be limited to a period of ten (10) days.

1413.2 Maximum size: Temporary signs of combustible construction shall be not more than ten (10) feet in one (1) dimension nor more than five hundred (500) square feet in area.

1413.3 Supports: When more than one hundred (100) square feet in area, temporary signs and banners shall be constructed and fastened to

supports capable of withstanding the design loads listed in Section 715.0.

1413.4 Special permits: Temporary signs used for holiday, public demonstrations or promotion of civic welfare or charitable purposes which extend across streets or other public spaces, shall be subject to special approval of the authority having jurisdiction.

SECTION 1414.0 ILLUMINATED SIGNS

1414.1 Certificates: All electrically-illuminated signs shall conform to the requirements of the Massachusetts State Electrical Code (527 CMR 12.00). Permits shall be issued for the erection of illuminated signs within the limitations set forth in this article for the location, size and type of sign or outdoor display.

1414.2 Additional approval: Approval shall be obtained for the erection or maintenance of illuminated signs in accordance with the Massachusetts Electrical Code (527 CMR 12.00).

1414.3 Relettering signs: The requirements of this section shall not apply to the relettering of illuminated signs, except where such relettering requires a change of wiring or piping of the sign.

SECTION 1415.0 PORTABLE SIGNS

1415.1 Conformance: Portable signs shall conform to all requirements for ground, roof, projecting, flat and temporary signs when they are used in a similar capacity. The stipulations in this section shall not be construed as to require portable signs to have connections to surfaces, tie-down or foundations when provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

1415.2 Electrical: Portable signs which require electrical service shall conform to the Massachusetts State Electrical Code (527 CMR 12.00).

ARTICLE 15

ELECTRICAL WIRING AND EQUIPMENT

Chapter 143, Section 3L of the Massachusetts General Laws Annotated, as amended, provides that all installation, repair and maintenance of electrical wiring and electrical fixtures used for light, heat and power purposes in buildings and structures shall be in conformance with the Massachusetts Electrical Code (527 CMR 12.00) promulgated by the Board of Fire Prevention Regulations of the Commonwealth of Massachusetts, Department of Public Safety.

ARTICLE 16

ELEVATOR, DUMBWAITER AND CONVEYOR EQUIPMENT, INSTALLATION AND MAINTENANCE

Chapter 143, Section 69 of the Massachusetts General Laws Annotated, as amended, provides that elevators, dumbwaiters, moving stairways (escalators), and moving walks shall be installed, relocated, or materially changed in conformance with Elevator and Escalator Regulations (524 CMR 3.00), and Elevator, Dumbwaiter, Escalator, and Moving Walk Regulations (524 CMR 15.00 through 33.00) promulgated by the Board of Elevator Regulations of the Commonwealth of Massachusetts, Department of Public Safety.

ARTICLE 17

PLUMBING AND GASFITTING

Chapter 142, Section 13 of the Massachusetts General Laws Annotated, as amended, provides that all construction, alteration, repair and inspection of plumbing and gasfitting shall be in conformance with the Massachusetts State Plumbing Code (248 CMR 2.00) and the Massachusetts Fuel Gas Code (248 CMR 3.00 through 8.00) promulgated by the Commonwealth of Massachusetts Board of State Examiners of Plumbers and Gas Fitters.

ARTICLE 18

MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE HOMES

SECTION 1800.0 GENERAL

1800.1 Installation in the State: The provisions of this article shall govern the materials, design, manufacture, handling, storage, transportation, assembly, construction and/or installation of manufactured buildings and building components intended for installation in the Commonwealth of Massachusetts. Manufactured buildings or building components shall not be installed in any jurisdiction of this State unless such manufactured buildings or building components have been approved and certified, in accordance with the applicable codes as provided in this article, applicable provisions of the code, and the Rules and Regulations for Manufactured Buildings, Building Components and Mobile Homes of the State Building Code Commission, listed in Appendix Q, and hereinafter referred to in this article as the "rules and regulations."

Exception: All manufactured buildings and building components manufactured prior to January 1, 1975, with the approval of the building official and which met all the requirements of state laws, rules and regulations, or local by-laws or ordinances in force at that time shall be deemed approved in accordance with the provisions of Section 114.4 of this code; provided that such manufactured buildings or building components are used for the purpose and within the limitations for which they were approved and provided such uses are not detrimental to the health and safety of the occupants and the public.

1800.2 Manufactured in the State: The provisions of this article shall also govern manufactured buildings and building components manufactured in the State for shipment to any other State or government jurisdiction where such manufactured buildings and building components and the label thereon are accepted.

1800.3 Mobile homes: The article shall also govern the installation within the State of all mobile homes. The evaluation and approval of all mobile homes for installation in the State shall be in accordance with the Mobile Home Construction and Safety Standards of the U.S. Department of Housing and Urban Development (hereinafter referred to as "HUD") as listed in Appendix B.

Exception: All mobile homes manufactured between January 1, 1975 and July 17, 1976 and sold, delivered to or installed on building sites in any jurisdiction of this State shall comply with the provisions of ANSI A119.1 (1974 edition) as amended by the State Building Code Commission and with this article and the rules and regulations pursuant thereto.

SECTION 1801.0 APPROVAL

1801.1 General: The Commonwealth of Massachusetts, Department of Public Safety, Division of Inspection (hereinafter referred to as the "Division of Inspection" in this article) shall evaluate manufactured buildings and building components and recommend approval to the State Building Code Commission of those which it determines to be in compliance with applicable sections of this article, other applicable sections of this code, and the rules and regulations.

However, all approvals of plumbing, electrical or gas systems shall be made by the appropriate state agencies having jurisdiction, as specified in the rules and regulations.

1801.2 Approved tests: The Division of Inspection may utilize the results of approved tests to determine whether a manufactured building or building component meets the requirements of this article and the rules and regulations, if that determination cannot be made from evaluation of plans, specifications and documentation alone.

1801.3 Approval of compliance assurance programs: The Division of Inspection shall evaluate manufacturers' compliance assurance programs and make recommendations for approval to the Commission of those which it determines to be in compliance with this article and the rules and regulations.

1801.4 Authorization to vary: A manufactured building, building component or a compliance assurance program which has approval shall not be varied in any way without prior authorization by the Division of Inspection in accordance with the rules and regulations.

SECTION 1802.0 CERTIFICATION

1802.1 Labeling: Any manufactured building or building component which has approval, in accordance with Section 1801.0, shall have an approved device or seal affixed as certification of such approval.

SECTION 1803.0 RECIPROCITY

1803.1 General: If the Commission finds that the standards for manufacture and inspection of manufactured buildings or building components prescribed by the statutes or rules and regulations of another state or other governmental agency meet the objectives of this article and the rules and regulations, and such standards are enforced satisfactorily by such other state or governmental agency or by its agents, the Commission shall grant approval and the Division of Inspection shall accept all manufactured buildings or building components which have been approved by such other state or governmental agency and shall insure that the product is properly labeled.

1803.1.1 Condition of reciprocity: The standards of another state shall not be deemed to be satisfactorily enforced unless such other state provides for notification to the Division of Inspection of suspensions or revocations of approvals issued by that other state, in a manner satisfactory to the Commission.

1803.2 Suspension of reciprocal approval: The Division of Inspection shall suspend or cause to be suspended reciprocal approval for the following reasons:

1. if it determines that the standards for the manufacture and inspection of such manufactured buildings or building components of another state or other governmental agency do not meet the objectives of this article and the rules and regulations or that the standards are not being enforced to the satisfaction of the Division of Inspection; and
2. if another state or governmental agency, or its agent, suspends or revokes its approval, the approval granted under this section shall be suspended or revoked accordingly.

SECTION 1804.0 ASSURANCE INSPECTION

1804.1 General: Any person or firm manufacturing buildings or building components desiring certification shall agree in writing that the Division of Inspection has the right to conduct unannounced inspections at any reasonable time.

1804.2 Responsibilities of Division of Inspection: The Division of Inspection shall carry out the following responsibilities:

1. Periodically make, or cause to be made, inspections of the entire process of manufacture of buildings or building components in order to verify the reliability of the compliance assurance program and of the approved inspection agency.
2. In addition to other on-site inspection provided for in this section, the Division of Inspection shall inspect, or cause to be inspected, certified manufactured buildings or building components which it determines to have been sufficiently damaged after certification to warrant such action with regard to such buildings or building components as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions.

   Note: An inspection entailing disassembly, damage to or destruction of certified manufactured buildings or building components shall not be conducted except to implement the provisions of this article.

SECTION 1805.0 RESPONSIBILITY OF THE LOCAL ENFORCEMENT AGENCIES

1805.1 Issuance of building permits: Upon application and in conformity with the provisions of this code, the building official shall issue building permits for installation of certified manufactured buildings or building components or mobile homes.

1805.2 Inspection: The local enforcement agency shall make the following inspections:

1. The site preparation work, including foundations, installation of any certified manufactured buildings or building components or approved homes; and for all utility service connections, including plumbing, electrical, gas, water and sewer; for compliance with the applicable codes.
2. Inspect all certified manufactured buildings or building components or approved mobile homes upon, or promptly after, installation at the building sites to determine whether all applicable instructions or conditions have been followed. This may include tests for tightness of plumbing and mechanical systems, for malfunctions in the electrical system, and a visual inspection for obvious violations of the rules and regulations. Destructive disassembly of certified buildings or building components or approved mobile homes shall not be performed in order to conduct such inspections. Nondestructive disassembly may be performed only in accordance with the rules and regulations.

1805.3 Issuance of certificates of occupancy: The building official shall issue a certificate of occupancy for all certified manufactured buildings or approved mobile homes that have been installed and inspected and that meet the requirements of this code.

SECTION 1806.0 SUSPENSION AND REVOCATION OF CERTIFICATION

1806.1 General: The Commission shall suspend or revoke the approval of any manufactured building or building component which does not comply with the provisions of this code or with the rules and regulations.

1806.2 Labels of certification: The Division of Inspection shall remove or cause to be removed the label of certification from any such manufactured building or building component not in compliance until such time as it is brought into compliance with this article and the rules and regulations.

1806.3 Notice of suspension or revocation: Notice shall be submitted in writing to the affected parties stating the reason for the suspension or revocation.

1806.4 Appeals Procedure: All appeals from suspension or revocation shall be heard by the State Building Code Appeals Board as specified in the pertinent provisions of Section 126.0 of this code.

ARTICLE 19

LIGHT-TRANSMITTING PLASTIC CONSTRUCTION

SECTION 1900.0 GENERAL

1900.1 Scope: The provisions of this article shall govern the quality and methods of application of plastics for use as light-transmitting materials in buildings and structures. When used as interior finish, plastic materials shall meet the requirements of Section 920.0.

1900.2 Approved materials: The use of plastics which meet the strength, durability, sanitary and fireresistive requirements of this code, ASTM D635 Standard Method of Test for Flammability of Self-Supporting Plastic, ASTM D374 Method of Test for Thickness of Solid Electrical Insulation, ASTM D1929 Method of Test for the Ignition Properties of Plastics, and ASTM D2843 Method of Test for Measuring the Density of Smoke from the Burning or Decomposition of Plastics as listed in Appendix C, and ASTM E84 Method of Test for Surface Burning Characteristics of Building Materials as listed in Appendix G, shall be permitted subject to the limitations of this article.

1900.2.1 Definitions

Approved plastic: An approved plastic shall be any thermoplastic, thermosetting, or reinforced thermosetting plastic material which has a self-ignition temperature of six hundred fifty (650) degrees F. or greater when tested in accordance with ASTM D1929 Method of Test for Ignition Properties of Plastics listed in Appendix C, a smoke density rating not greater than four hundred fifty (450) when tested in the way intended for use by ASTM E84 listed in Appendix G or a smoke density rating not greater than seventy-five (75) when tested in the thickness intended for use according to ASTM D2843 Standard Method of Test for Measuring the Density of Smoke from the Burning or Decomposition of Plastics listed in Appendix C, and which meet one (1) of the following combustibility classifications:

Class C-1: Plastic materials which have a burning extent of one (1) inch or less when tested in nominal point zero sixty (.060) inch thickness, or in the thickness intended for use, by ASTM D635 listed in Appendix C.

Class C-2: Plastic materials which have a burning rate of two and one-half (2½) inches per minute or less when tested in nominal point zero sixty (.060) inch thickness, or in the thickness intended for use, by ASTM D635.

Light-diffusing system: A suspended construction consisting in whole or in part of lenses, panels, grids, or baffles suspended below independently mounted electrical lighting sources.

Plastic glazing: Plastic materials which are glazed or set in frame or sash and not held by mechanical fasteners which pass through the glazing material.

Plastic roof panels: Plastic materials which are fastened to structural members or to structural panels or sheathing and which are used as light-transmitting media in roofs.

Plastic wall panels: Plastic materials which are fastened to structural members or to structural panels or sheathing and which are used as light-transmitting media in exterior walls.

Glass fiber reinforced plastic: Plastic reinforced with glass fiber having not less than twenty (20) per cent of glass fibers by weight.

Thermosetting materials: A plastic material which is capable of being changed into a substantially non-reformable product when cured.

Thermoplastic material: A plastic material which is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

1900.2.2 Application for approval: Applicants for approval of a plastic material shall furnish, in accordance with Section 804.0, all technical data in accordance with the applicable reference standards of this code. The data may include the chemical composition; pertinent physical, mechanical and thermal properties such as fireresistance, flammability, and flame-spread; weather-resistance, electrical properties; products of combustion and coefficients of expansion.

1900.3 Identification: All plastic materials approved for use under this code shall be identified by the trade formula number or name or other acceptable identification. Each unit or package shall bear the approval number or other identification mark of the approving authority.

SECTION 1901.0 DESIGN AND INSTALLATION

1901.1 Structural requirements: All plastic materials and their assemblies shall be of adequate strength and durability to withstand the loads and forces specified in Article 7 for their approved use.

1901.2 Connections and supports: All fastenings, connections and supports shall be proportioned to safely transmit two and one-half (2½) times the design live load. Adequate allowance shall be made in the fastenings and supports for differential expansion and contraction of the connected materials.

SECTION 1902.0 GLAZING OF UNPROTECTED OPENINGS

2205.1

1902.1 Use in Type 4B construction: Doors, sash and framed openings which are not required to be fireresistance rated may be glazed with approved plastic materials in buildings of Type 4B (unprotected, frame) construction.

2205.2

1902.2 Use group F: In all types of construction of use group F (factory and industrial), doors, sash and framed openings which are not required to be fireresistance rated may be glazed with approved plastic materials.

2205.3

1902.3 Other classes of construction and use group: In other classes of construction and use, such openings not required to be fireresistance rated by Section 914.0 may be glazed or equipped with approved plastic materials subject to the requirements listed below:

2205.3.1 1. The area of such glazing shall not exceed twenty-five (25) per cent of the wall face of the story in which it is installed (see Section 1902.4).

2205.3.2 2. The area of a unit or pane of glazing installed above the first story shall not exceed sixteen (16) square feet and the vertical dimension of a unit or pane shall not exceed four (4) feet. There shall be a minimum three (3) feet vertical spandrel wall between stories.

2205.3.3 3. Approved plastics shall not be installed more than seventy-five (75) feet above grade level.

2205.3.4 4. Approved thermoplastic materials may be installed in areas up to fifty (50) per cent of the wall area of each story in structures less than one hundred fifty (150) feet in height which are provided on each floor above the first floor with continuous architectural projections constituting an effective fire canopy extending at least three (3) feet from the surface of the wall in which the glazing is installed. The size and the dimensions of individual units shall not be limited in such installations except as required to meet structural loading requirements.

2205.4

1902.4 Automatic fire suppression: When a complete approved automatic fire suppression system is provided in the building, the permissible area of glazing permitted by Section 1902.3, Item 1, may be increased one hundred (100) per cent.

SECTION 1903.0 EXTERIOR PANEL WALLS

2105.2

1903.1 General: Approved plastic materials may be used as wall panels, in exterior walls not required to have a fireresistance rating (except in use goups A-1, A-2, H and I) subject to the requirement listed in the following Sections 1903.1.1 through 1903.3.

2105.2.1

1903.1.1 Installation: Exterior wall panels installed as provided herein shall not alter the type-of-construction classification of the building.

2105.2.2

1903.1.2 Height limitation: Approved plastics shall not be installed more than seventy-five (75) feet above grade level, except as allowed by Section 1903.2.

2105.2.3

1903.1.3 Area limitation and separation: Area limitation and separation requirements of exterior wall panels shall be as provided in Table 1903.

Table 1903
AREA LIMITATION AND SEPARATION REQUIREMENTS FOR PLASTIC WALL PANELS[1]

Fire separation (ft.)	Class of plastic	Max. % area of ext. wall in plastic panels	Max. sq. ft. single area	Minimum separation of panels (ft.) Vertical	Horizontal
6 ft. or less	—	NP[3]	NP	—	—
6 ft. or more but less than 11 ft.	C1	10	50	8	4
	C2	NP	NP	—	—
11 ft. or more but less than 30 ft.	C1	25	90	6	4
	C2	15	70	8	4
Over 30	C1	50	Not limited	3[2]	0
	C2	50	100	6[2]	3

Note 1. See Section 1903.3 for combination of glazing and wall panel areas permitted.
Note 2. See Section 1903.1.5.

2105.2.4

1903.1.4 Spandrel separation: Vertical spandrel wall separation between stories shall be as follows:

1. three (3) feet for Class C-1 plastic wall panels, and
2. four (4) feet for Class C-2 plastic wall panels.

2105.2.5

1903.1.5 Fire canopies: In structures which are provided, on any floor above the first, with continuous architectural projections constituting an effective fire canopy extending at least thirty-six (36) inches from the surface of the wall in which plastic wall panels are installed, there need not be vertical separation at that floor except that provided by the vertical thickness of the projection.

2105.2.6

1903.2 Automatic fire suppression: When a complete approved automatic fire suppression system is provided in the building, the maximum per cent area of exterior wall in plastic panels and the maximum square feet of single area given in Table 1903 may be increased one hundred (100) per cent but the area of plastic wall panels shall not exceed fifty (50) per cent of the wall area. Exempt height limitations

2105.2.7

1903.3 Combinations of glazing and wall panels: Combinations of plastic glazing and plastic wall panels shall be subject to the area, height and percentage limitations, and separation requirements applicable to the class of plastics as prescribed for wall panel installations and shall be subject to the provisions of Articles 3 and 9 controlling exterior wall openings.

SECTION 1904.0 ROOF PANELS

2306.1

1904.1 General: Approved plastic roof panels may be installed (except in use groups A-1, A-2, A-3, H and I) as follows:

1. in roofs of buildings protected by a complete approved automatic fire suppression system;
2. where the roof is not required to have a fireresistance rating by Table 214; or
3. where the roof panels meet the requirements for roof coverings of the particular occupancy group.

2306.2

1904.2 Separations: Individual roof panels shall be separated from each other by a distance of not less than four (4) feet measured in a horizontal plane.

2306.3

1904.3 Location: Where exterior wall openings are required to be fireresistance rated by Section 914.0, a roof panel or unit shall not be installed within six (6) feet of such exterior wall.

2306.4

1904.4 Area limitations: Roof panels or units shall be limited in area, and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 1904.

Table 1904

AREA LIMITATIONS FOR ROOF PANELS

Class of plastic	Maximum area individual unit of panel (sq. ft.)	Maximum aggregate area (% of floor area)
C1	300	30
C2	100	25

1904.5 Exceptions: The uses listed below shall be exempt from the requirements of Section 1904.4.

1. One (1) story buildings not more than sixteen (16) feet in height and not exceeding twelve hundred (1200) square feet in area and not closer than eleven (11) feet to another building are exempt from the limitations of Section 1904.4.
2. Low hazard use buildings such as swimming pool shelters, greenhouses, etc., are exempt from the area limitations of Section 1904.4 provided the buildings do not exceed five thousand (5,000) square

feet in area and are not closer than eleven (11) feet to the property line or adjacent buildings.

3. Roof coverings over terraces and patios of one- and two-family dwellings shall be permitted with approved plastics.

SECTION 1905.0 SKYLIGHT ASSEMBLIES

1905.1 Skylight assemblies: Skylight assemblies may be glazed with approved plastic materials (except in use group H) in accordance with the following provisions.

1905.1.1 Mounting: The plastic shall be mounted above the plane of the roof on a curb constructed consistent with the requirements for the type of construction classification, but at least four (4) inches above the plane of the roof. Edges of plastic skylights or domes shall be protected by metal or noncombustible material.

1905.1.1.1 Dome-shape: Dome-shape skylights shall rise above the mounting flange a minimum distance equal to ten (10) per cent of the maximum span of the dome, but not less than five (5) inches.

1905.1.2 Maximum area of skylight units: Each skylight unit shall have a maximum area within the curb of one hundred (100) square feet.

1905.1.3 Aggregate area of skylights: The aggregate area of skylights shall not exceed thirty-three (33) per cent when Class C-1 materials are used, and twenty-five (25) per cent when Class C-2 materials are used, of the floor area of the room or space sheltered by the roof in which they are installed.

1905.1.4 Separation: Skylights shall be separated from each other by a distance of not less than four (4) feet measured in a horizontal plane.

1905.1.5 Location: Where exterior wall openings are required to be fireresistance rated by Section 914.0, a skylight shall not be installed within six (6) feet of such exterior wall.

1905.1.6 Exception: The provisions of 1905.0 need not be applied if: a) the building on which the skylights are located is not more than one (1) story in height, the building has an exterior separation from other buildings of at least thirty (30) feet, and the room or space sheltered by the roof is not classified as a high hazard or institutional use group or as a means of egress; or b) the plastic material meets the fireresistive requirements of the roof.

1905.1.7 Combinations of roof panels and skylights: Combinations of plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to roof panel installations.

SECTION 1906.0 LIGHT-DIFFUSING SYSTEMS

2001.5

1906.1 General: Light-diffusing systems shall not be installed in use groups H and I, nor in exitways, unless protected with a fire suppression system. Plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers. Hangers shall be at least No. 12 Steel Wire Gauge (0.106 inch) galvanized wire or equivalent.

2001.5.1 1906.2 Installation: Approved plastic diffusers shall comply with Section 920.0 (interior finish) unless the plastic panels will fall from their mountings before igniting and at an ambient temperature of at least two hundred (200) degrees F. below their ignition temperature. The panels must, however, remain in place at an ambient room temperature of one hundred seventy-five (175) degrees F. for a period of not less than fifteen (15) minutes.

2001.5.2 1906.3 Size limitations: Individual panels or units shall not exceed ten (10) feet in length nor thirty (30) square feet in area.

1906.4 Fire suppression system: In buildings having a complete approved automatic fire suppression system, the sprinklers shall be installed 2001.5.3 below the plastic light-diffusing systems. Areas of light-diffusing systems shall not be limited if properly protected by an approved fire suppression system.

1906.5 Electrical lighting fixtures: Plastic light-transmitting panels and light-diffuser panels installed in approved electrical lighting fixtures 2001.5.4 shall comply with Section 920.0 unless the plastic panels meet the requirements of Section 1906.2. The area of approved plastic materials when used in required fire exits or corridors shall not exceed thirty (30) per cent of the aggregate area of the ceiling in which they are installed, unless the occupancy is protected by an approved fire suppression system.

SECTION 1907.0 PARTITIONS

2001.6 1907.1 General: Approved light-transmitting plastics may be used in or as partitions provided the requirements of the occupancy class as given in Section 920.0 are met. Such partitions may be installed as provided in Section 909.3.

SECTION 1908.0 BATHROOM ACCESSORIES

2001.7 1908.1 Use of plastics: Approved plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures, and similar accessory units (see Section 857.5.6).

SECTION 1909.0 AWNINGS AND SIMILAR STRUCTURES

S#17

3001.8

1909.1 General: Approved light-transmitting plastics may be used on awnings and similar structures in conformity with general performance provisions of other sections of this code.

SECTION 1910.0 GREENHOUSES

1910.1 General: Approved light-transmitting plastics may be used in lieu of plain glass in greenhouses.

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NON-TEXT PAGE

ARTICLE 21

BUILDING CODE PROVISIONS FOR ONE AND TWO-FAMILY DWELLINGS

SECTION 2100.0 GENERAL

2100.1 Scope: Contained within Article 21 of the State Building Code are provisions which shall regulate one- and two-family dwellings. These provisions are supplied to provide a single comprehensive reference for one and two-family dwellings. These provisions shall be considered as being applicable as stated.

2100.1.1 Basic code provisions: The requirements for one and two-family dwellings are stated in other articles of the basic code on a performance-oriented basis and may be used at the option of the designer. In addition, any requirements for which provisions are not made within this article shall be subject to the provisions of the other articles of the basic code.

2100.1.2 Reference standards: * Standards referenced in the text of Article 21 represent recognized practices and specifications to be applied specifically using Article 21. If your copy of Article 21 has been printed separately, these reference standards are located immediately after the text of Article 21. Where Article 21 has been included as a portion of the Basic Code, these specific reference standards are included in Appendix W. Other reference standards contained in the Basic Code may be used at the option of the designer, in accordance with the provisions of Section 2100.1.1.

2100.2 Energy conservation

2100.2.1 Building design: Building design shall be based on compliance with the energy conservation performance standards of the basic code. If systems analysis or non-depletable energy sources are used, refer to Article 20.

2100.2.2 Exempt buildings: The following buildings are exempt from the energy conservation provisions of this article:

1. Buildings and structures or portions thereof whose peak design rate of energy usage is less than one (1) watt per square foot or three and four tenths (3.4) Btu/h per square foot of floor area for all purposes.

2. Buildings which are neither heated nor cooled.

2100.2.3 Additions to existing buildings: Additions to existing buildings or structures may be made without making the entire

* Editorial addition

building or structure comply with the requirements of this code. The new construction shall conform to the requirements of this article as they relate to the addition only.

2100.2.4 Alterations to existing buildings: Alterations to existing buildings shall comply with this article on a component basis. When there are alterations to or replacement of the building enclosure elements (walls, roof or floors) or mechanical systems, those components only shall comply.

2100.3 Definitions

2100.3.1 Meaning: Unless otherwise expressly stated, the following terms shall, for the purpose of this code, have the meaning indicated in this section.

2100.3.2 Tense, gender and number: Words used in the present tense include the future; words used in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.

2100.3.3 Terms not defined: Where terms are not defined, they shall have their ordinarily accepted meanings or such as the context may imply. Any terms relating to plumbing and electrical wiring shall have their terms as defined by the Regulations of the Commonwealth of Massachusetts pertaining to plumbing and electrical wiring.

Accepted engineering practice: That which conforms to accepted principles, tests or standards of nationally recognized technical or scientific authorities.

Accessory structure: A building or structure, the use of which is incidental to that of the main building or structure and which is located on the same lot.

Accessory use: A use incidental to the principal use of a building as defined or limited by the provisions of the local zoning laws.

Addition: An extension or increase in floor area or height of a building or structure.

Air-conditioning: The treatment of air so as to control simultaneously its temperature, humidity, cleanness and distribution to meet the requirements of a conditioned space.

Air duct: A tube or conduit used for conveying air.

Alteration: A change or modification of a building or structure, or the service equipment thereof, that affects safety or health and that is not classified as ordinary repairs.

Alternate inspector: A person appointed to act in the absence of the inspector of buildings in case of illness, disability, or conflict of interest.

Approved: Approved by the commission, the building official or accepted engineering practice. (See Section 110.0.)

Approved material, equipment and methods: Approved by the Commission or by an agency approved by the Commission.

Approved rules: Those rules approved by the State Building Code Commission unless otherwise specified.

Area (building): The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if included within the horizontal projection of the roof or floor above.

Areaway (form of construction): An uncovered subsurface space adjacent to a building.

Attic: The space between the ceiling beams of the top habitable story and the roof rafters.

Attic (habitable): A habitable attic is an attic which has a stairway as a means of access and egress and in which the ceiling area at a height of seven and one-third (7-1/3) feet above the attic floor is not less than one-third (1/3) the area of the floor next below.

Automatic detecting device: A device which automatically detects heat, smoke or other products of combustion.

Automatic fire alarm system: A system which automatically detects a fire condition and actuates a fire alarm signal device.

Basement: That portion of a building which is partly below and partly above grade, and having at least one-half (1/2) its height above grade (see "Grade", "Story" and "Cellar").

Basic code: The State Building Code of the Commonwealth of Massachusetts, also referred to as "this Code".

Bay (part of a structure): The space between two (2) adjacent piers or mullions or between two (2) adjacent lines of columns.

Bay window: A window projecting beyond the wall line of a building.

Boiler: A closed heating appliance intended to supply hot water or steam for space heating, processing or power purposes.

Boiler capacity: The amount of heat output in Btu/h at the design temperature rise and rated input.

Brick (clay or shale): A solid masonry unit of clay or shale, usually formed into a rectangular prism while plastic and burned or fired in a kiln.

Calcium-silicate brick (sand lime brick): A building unit made of sand and lime.

Concrete brick: A solid masonry unit having a shape approximately a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.

Hollow brick: A masonry unit of clay or shale whose net cross-sectional area in any plane parallel to the bearing surface is not less than sixty (60) per cent or more than seventy-five (75) per cent of its gross cross-sectional area measured in the same plane.

Building: Any structure used or intended for supporting or sheltering any use or occupancy.

Building commissioner: The administrative chief of the building department in a municipality who is charged with the administration and enforcement of this code. See also Inspector of Buildings and Section 107.1.

Building component: Any subsystem, subassembly or other system designed for use in or as part of a structure.

Building department: The person, body, agency, department or office of any municipality charged with the administration and enforcement of this code.

Building envelope: The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior.

Building, existing: Any structure erected or one for which a legal building permit has been issued prior to the adoption of this code (and its amendments).

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

Building official: The officer or other designated authority charged with the administration and enforcement of this code. Building official as used herein includes the building commissioner or the inspector of buildings and the local inspector.

Building service equipment: The mechanical, electrical and elevator equipment, including piping, wiring, fixtures and other accessories, which provide sanitation, lighting, heating, ventilation, fire-fighting and transportation facilities essential for the habitable occupancy of the building or structure for its designated use and occupancy.

Building site: The area occupied by a building or structure, including the yards and courts required for light and ventilation, and such areas that are prescribed for access to the street.

Buttress: A projecting part of a masonry wall built integrally therewith to furnish lateral stability which is supported on proper foundations.

Cellar: That portion of a building which is partly or completely below grade and having at least one-half (1/2) its height below grade (see "Grade", "Story" and "Basement").

Certificate of use and occupancy: The certificate issued by the building official which permits the use of a building in accordance with the approved plans and specifications and which certifies compliance with the 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.

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

Chimney: A primarily vertical enclosure containing one (1) or more passageways.

Factory-built chimney: A chimney that is factory-made, listed by a nationally recognized testing or inspection agency, for venting gas appliances, gas incinerators and solid or liquid fuel burning appliances.

Masonry chimney: A field constructed chimney of solid masonry units, bricks, stones, listed hollow masonry units or reinforced concrete built in accordance with nationally recognized standards.

Metal chimney (smokestack): A field constructed chimney made of metal and built in accordance with nationally recognized standards.

Chimney connector: A pipe which connects a fuel burning appliance to a chimney.

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

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

Combustible (material): A combustible (material) is a material which cannot be classified as noncombustible in accordance with that definition.

Commenced: Any physical action begun on the job site for the purposes of construction for which a building permit is required.

Commission: See State Building Code Commission.

Component: An integral part of a building or its mechanical systems; an element of a building envelope.

Concrete: A mixture of cement, aggregates and water, of such proportions and manipulation as to meet specific requirements.

Concrete masonry unit: A building unit or block larger in size than twelve (12) by four (4) by four (4) inches made of cement and suitable aggregates.

Conditioned floor area: All portions of interior gross floor area which are contained within exterior walls and which are conditioned directly or indirectly by an energy-using system. (See gross floor area).

Conflagration hazard: The fire risk involved in the spread of fire by exterior exposure to and from adjoining buildings and structures.

Construction operation: The erection, alteration, repair, renovation, demolition or removal of any building or structure; and the excavation, filling, grading and regulation of lots in connection therewith.

Construction supervisor: Any individual directly supervising persons engaged in construction, reconstruction, alterations or repairs involving the structural elements of buildings and structures.

Controlled construction: The construction of a building or structure or a specific part thereof which has been designated and erected under the supervision of a licensed professional engineer or architect using controlled materials as herein defined in compliance with accepted engineering practice under the procedure of Section 127.0.

Corridor: A hallway, passageway or other compartmented space providing the occupants with access to the required exitways of the building or floor area.

Court: An open, uncovered, and unoccupied space on the same lot with a building.

Inner court: Any court other than an outer court.

Outer court: A court extending to and opening upon a street, public alley, or other approved open space, not less than fifteen (15) feet wide, or upon a required yard.

Degree day, heating: A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65° F there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65° F.

Department/DPS: The Department of Public Safety, Division of Inspections.

Draft: The pressure difference existing between the equipment or any component part of the atmosphere which causes a continuous flow of air and products of combustion through the gas passages of the appliance to the atmosphere.

Forced draft: The pressure difference created by the action of a fan, blower or ejector which supplies the primary combustion air above atmospheric pressure.

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

Natural draft: The pressure difference created by a vent or chimney due to its height and the temperature difference between the flue gases and the atmosphere.

Draft regulator: A device which functions to maintain a desired draft in the appliance by automatically reducing the draft to the desired value.

Duct: A tube or conduit used for conveying or encasing purposes as specifically defined below:

Air duct: A tube or conduit used for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

Pipe duct: A tube or conduit used for encasing pipe.

Wire duct: A tube or conduit used for encasing either moving or stationary wire, pipe, etc.

Dwellings:
One-family dwelling: A building containing one (1) dwelling unit with not more than three (3) lodgers or boarders.

Two-family dwelling: A building containing two (2) dwelling units with not more than three (3) lodgers or boarders per family but not more than twenty (20) individuals.

Dwelling unit: A single unit providing complete, independent living facilities for one (1) or more persons including permanent provisions for living, sleeping, eating, cooking, and sanitation.

Energy: The capacity for doing work. Energy takes a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (motion), electrical, and chemical. In customary units, energy is measured in kilowatt-hours (kwh) or British thermal units (Btu).

Energy efficiency ratio (EER): The ratio of net cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions.

Existing building: See "Building, existing".

Existing equipment: Any equipment covered by this article which was installed prior to the effective date of this code or for which an application for permit to install was filed with the building official prior thereto.

Exitway: That portion of a means of egress which is separated from all other spaces of a building or structure by construction or equipment as required in this code to provide a protected way of travel to the exitway discharge.

Exterior envelope: The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior:

Fenestration: Any light-transmitting device in the building envelope admitting natural light.

Fire door: A door and its assembly, so constructed and assembled in place as to give protection against the passage of fire.

Fire door assembly: The assembly of a fire door and its accessories, including all hardware and closing devices and their anchors; and the door frame, when required, and its anchors.

Fireresistance: That property of materials or their assemblies which prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

Fireresistance rating: The time in hours or fractions thereof that materials or their assemblies will resist fire exposure as determined by fire tests conducted in compliance with recognized standards.

Fire separation wall: A fireresistance rated assembly of materials not having unprotected openings, designed to restrict the spread of fire.

Fire wall: A fireresistance rated wall, having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof.

Fire window: A window constructed and glazed to give protection against the passage of fire.

Flameresistance: The property of materials or combinations of component materials which restricts the spread of flame as determined by the flameresistance tests specified in this code.

Flame spread: The propagation of flame over a surface.

Flame spread rating: The measurement of flame spread on the surface of materials or their assemblies and determined by tests conducted in compliance with recognized standards.

Flammable: Subject to easy ignition and rapid flaming combustion.

Floor area, gross: Gross floor area shall be the floor area within the perimeter of the outside walls of the building under consideration, without deduction for hallways, stairs, closets, thickness of walls, columns, or other features.

Floor area, net: For the purpose of determining the number of persons for whom exitways are to be provided, net floor area shall be the actual occupied area, not including accessory unoccupied areas or thickness of walls.

Foundation: A base constructed to support any building or structure including but not limited to footings, floating foundation, piles, 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.

Fuel: A solid, liquid, or gaseous substance with a high energy content that can be burned to release the energy.

Fuel oil: A liquid mixture or compound derived from petroleum which does not emit flammable vapor below a temperature of one hundred and twenty-five (125) degrees F. in a Tag closed-cup tester (ASTM D56).

Furnace

Floor furnace: A self-contained, connected or vented furnace designed to be suspended from the floor of the space being heated taking air for combustion outside this heated space and with means for observing the flame and lighting the appliance from the space being heated.

Forced warm air furnace: A furnace equipped with a blower to provide the primary means for circulating air.

Warm air furnace: A solid, liquid or gas-fired appliance for heating air to be distributed with or without duct systems to the space to be heated.

Garage, private: A garage for four (4) or less passenger motor vehicles without provision for repairing or servicing such vehicles for profit.

Grade: A reference plane representing the average of finished ground level adjoining the building at all exterior walls.

Grade hallway, grade lobby, grade passageway: An enclosed hallway or corridor that is an element of an exitway, terminating at a street or an open space or court communicating with a street.

Heat: The form of energy that is transferred by virtue of a temperature difference.

Habitable space: Space in a structure for living, sleeping, eating, or cooking. Bathrooms, toilet compartments, closets, halls, storage or utility space, and similar areas are not considered habitable space.

Heated slab: Containing heating pipes or ducts that constitute a radiant slab or portion thereof for complete or partial heating of the house.

Heating appliance: Any device designed or constructed for the generation of heat from solid, liquid or gaseous fuel or electricity.

Recessed heater: A completely self-contained heating unit usually recessed in a wall and located entirely above the floor of the space it is intended to heat.

Unit heater: A factory-assembled device designed to heat and circulate air. Essential components are a heat transfer element, housing and fan with driving motor. Normally designed for free delivery of recirculated air.

Heated space: A space within a building which is provided with a positive heat supply to maintain air temperature of fifty (50) degrees F. or higher.

Height, building: The vertical distance from the grade to the top of the highest roof beams of a flat roof, or to the mean level of the highest gable or slope of a hip roof. When a building faces on more than one (1) street, the height shall be measured from the average of the grades at the center of each street front.

Height, court: The vertical distance from the lowest level of the court to the mean height of the top of the enclosing walls.

Height, story: The vertical distance from top to top of two (2) 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.

Height, wall: The vertical distance from the foundation wall or other immediate support of such wall to the top of the wall.

Hereafter: After the time that this code becomes effective.

Heretofore: Before the time that this code becomes effective.

Hollow masonry unit: A masonry unit whose net cross-sectional area in any plane parallel to the bearing surface is less than seventy-five (75) per cent of its gross cross-sectional area measured in the same plane.

Humidistat: An instrument which measures changes in humidity and controls a device(s) for maintaining a desired humidity.

HVAC: Heating, ventilating, and air conditioning.

HVAC system: A system that provides either collectively or individually the processes of comfort heating, ventilating, and/or air-conditioning within or associated with a building.

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 and/or the effect of differences in the indoor and the outdoor air density.

Inspector of buildings: The administrative chief of the building department in a municipality who is charged with the administration and enforcement of this code. See also building commissioner. (See Section 107.1).

Interior lot line: Any lot line other than one adjoining a street or public space.

Lintel: A beam placed over an opening or recess in a wall which supports the wall construction above.

Local enforcement agency: A department or agency in a municipality charged with the enforcement of this code and appropriate specialized codes which include, but are not limited to, the Massachusetts Plumbing Code, Massachusetts Fuel Gas Code, and the Massachusetts Electrical Code.

Local inspector: A person in a municipality who assists the building commissioner or inspector of buildings in the performance of his duties and is charged with the enforcement of this code. (See Section 107.11).

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

Corner lot: A lot with two (2) adjacent sides abutting upon streets or other public spaces.

Interior lot: A lot which faces on one (1) street or with opposite sides on two (2) streets.

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

Maintenance: Restoring or replacing deteriorated elements.

Manual: Capable of being operated by personal intervention. (See automatic).

Masonry: A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other approved units bonded together with mortar or monolithic concrete. Reinforced concrete is not classed as masonry.

Means of egress: A continuous and unobstructed path of travel from any point in a building or structure to a public way.

Mechanical ventilation: The mechanical process of supplying air to, or removing air from, any space.

Mortar: A plastic mixture of approved cementitious materials, fine aggregates and water used to bond masonry or other structural units.

Municipality: Any city or town in the Commonwealth of Massachusetts. The word "municipality" shall be construed, where the context requires, as though followed by the words "or combination of municipalities".

Native lumber: Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with the regulations of the State Building Code Commission. Such wood is ungraded but is stamped or certified in accordance with the requirements of Section 852.1.1 of the code. For the purpose of this definition, native lumber shall be restricted to use in one and two-story dwellings, barns, sheds, agricultural and accessory buildings and structures, and other uses when permitted by section 852.1.1.

Nominal dimension:
Lumber: A dimension that may vary from actual dimensions as provided in American Lumber Standard listed in Appendix C.
Masonry: A dimension that may vary from actual masonry dimensions by the thickness of a mortar joint but not to exceed one-half (1/2) inch.

Non-depletable energy sources: Sources of energy (excluding minerals) derived from incoming solar radiation including photosynthetic processes; from phenomena resulting therefrom including wind, waves and tides, lake or pond thermal differences; and energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

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

Occupancy: The purpose for which a building, or part thereof, is used or intended to be used.

Occupancy load: The number of individuals normally occupying the building, or part thereof, or for which the exitway facilities have been designed.

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

Opaque areas: All exposed areas of a building envelope which enclose conditioned space, except opening for windows, skylights, doors, and building service systems.

Ordinary materials: Materials which do not conform to the requirements of this code for controlled materials.

Outside air: Air taken from the outdoors and, therefore, not previously circulated through the system.

Overall thermal transfer value, (ottv): Overall heat gain through
the building wall.

Owner: Every person who alone or jointly or severally with others (a) has legal title to any building or structure; or (b) has care, charge, control of any building or structure in any capacity including but not limited to agent, executor, executrix, administrator, administratrix, trustee or guardian of the estate of the holder of legal title; or (c) lessee under a written letting agreement; or (d) mortgagee in possession; or (e) agent, trustee or other person appointed

by the courts. Each such person is bound to comply with the provisions of the Basic Code.

Packaged terminal air-conditioner: A factory-selected combination of heating and cooling components, assemblies, or sections, intended to serve a room or zone.

Panel (Part of a structure): The section of a floor or wall comprised between the supporting frame of two (2) adjacent rows of columns and girders or column bands of floor construction.

Party wall: A fire wall on an interior lot line used or adapted for joint service between two (2) buildings.

Penthouse: An enclosed structure above the roof of a building, other than a roof structure or bulkhead, occupying not more than thirty-three and one-third (33-1/3) per cent of the roof area.

Permit: An official document or certificate issued by the authority having jurisdiction authorizing performance of a specified activity.

Person: Every individual, partnership, corporation, firm, association, trustee or group, including a city, town, county, authority or other governmental unit, owning property or conducting any activity regulated by this Basic Code.

Plenum: An air compartment or chamber to which one (1) or more ducts are connected, and which forms part of an air distribution system.

Positive heat supply: Heat supplied to a space by design.

Power: In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted; in customary units, it is measured in watts (W) or British thermal units per hour (Btu/h).

Prefabricated: Construction materials or assembled units fabricated prior to erection or installation in a building or structure.

Prefabricated building: The completely assembled and erected building or structure, including the service equipment, of which the structural parts consist of prefabricated individual units or subassemblies using ordinary or controlled materials; and in which the service equipment may be either prefabricated or at-site construction.

Prefabricated subassembly: A built-up combination of several structural elements designed and fabricated as an assembled section of wall, ceiling, floor or roof to be incorporated into the structure by field erection of two (2) or more such subassemblies.

Prefabricated unit: A built-up section forming an individual structural element of the building, such as a beam, girder, plank, strut, column or truss, the integrated parts of which are prefabricated prior to incorporation into the structure, including the necessary means for erection and connection at the site to complete the structural frame.

Prefabricated unit service equipment: A prefabricated assembly of mechanical units, fixtures and accessories comprising a complete service unit of mechanical equipment, including bathroom and kitchen plumbing assemblies, unit heating and air-conditioning systems and loopwiring assemblies of electric circuits.

Preservative treatment (treated material): Unless otherwise noted, is impregnation under pressure with a wood preservative. Wood preservative is any suitable substance that is toxic to fungi, insects, borers, and other living wood-destroying organisms.

Primary member: Any member of the structural frame of a building or structure used as a column; grillage beam; or to support masonry walls and partitions; including trusses, isolated lintels spanning an opening of eight (8) feet or more; and any other member required to brace a column or a truss.

Professional engineer or architect: An individual technically and legally qualified to practice the profession of engineering or architecture.

Public way: Any street, alley or other parcel of land open to the outside air leading to a public street, deeded, dedicated, or otherwise permanently appropriated to the public for public use and having a clear width of not less than ten (10) feet.

Reinforced concrete: Concrete in which reinforcement, other than that provided for shrinkage or temperature changes, is combined in such manner that the two (2) materials act together in resisting forces.

Repair: Any maintenance which affects structure, egress, fire protection systems, fire ratings, energy conservation provisions (Article 20), or utilities. A building permit is required.

Repairs, ordinary: Any maintenance which does not affect structure, egress, fire protection systems, fire ratings, energy conservation provisions (Article 20), plumbing, sanitary, gas, electrical or other utilities. A building permit is not required for ordinary repairs.

Reset: Adjustment of the set point of a control instrument to a higher or a lower value, either automatically or manually in order to conserve energy.

Residential unit: In R-3 use group, a room or group of rooms occupied as a single unit.

Resistance, thermal R: A measure of the ability to retard the flow of heat. The R value is the reciprocal of a heat transfer coefficient as expressed by U. $R = 1/U$.

Required: Shall be construed to be mandatory by provisions of this code.

Roof: The roof slab or deck with its supporting members, not including vertical supports.

Roof covering: The covering applied to the roof for weather resistance, fireresistance or appearance.

Roof structure: An enclosed structure on or above the roof of any part of a building.

Room air conditioner: An encased assembly designed as a unit for mounting in a window or through a wall, or as a console. It is designed primarily to provide free delivery of conditioned air to an enclosed space, room or zone. It includes a prime source of refrigeration for cooling and dehumidification and means for circulating and cleaning air, and may also include means for ventilating and heating.

Rubble masonry: Masonry composed of roughly shaped stones.

Secondary member: Any member of the structural framework other than a primary member, including filling-in beams of floor systems.

Sensible heat: Heat added or removed which can be measured by a change in temperature of the substance.

Separate sleeping area: Area or areas of the family living unit in which the bedrooms (or sleeping rooms) are located. Bedrooms (or sleeping rooms) separated by other use areas, such as kitchens or living rooms (but not bathrooms), shall be considered as separate sleeping areas.

Service systems: All energy-using systems in a building that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering or similar functions.

Service water heating: Supply of hot water for domestic or commercial purposes other than comfort heating.

Service water heating demand: The maximum design rate of heated water withdrawal from a service water heating system in a designated period of time (usually an hour or a day).

Shall: The term, when used in this code, shall be construed as mandatory.

Smoke detector: An approved, listed detector sensing visible or invisible particles of combustion.

Solar energy source: Source of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

Solid masonry: Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar, or consisting of plain concrete.

Stairway: One (1) or more flights of stairs, and the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one floor to another. A flight of stairs, for the purposes of this article, must have at least three (3) risers.

State building code: The State Building Code and amendments and rules and regulations thereto as promulgated by the State Building Code Commission under Sections sixteen (16), seventeen (17), and eighteen (18) of Chapter twenty-three (23)B of the Massachusetts General Laws Annotated as amended.

State building code commission (SBCC): The Massachusetts State Building Code Commission established by Section sixteen (16) of Chapter twenty-three (23)B of the Massachusetts General Laws Annotated as amended.

State inspector: An employee of the Division of Inspection, State Department of Public Safety, who is charged with administering and enforcing the Basic Code 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 the Basic Code relative to all buildings and structures other than those owned by the Commonwealth. (See Section 108.9).

Story: That portion of a building included between the upper surface of a floor and upper surface of the floor or roof next above.

Story (first): The lower-most story entirely above the grade plane.

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

Street lot line: The lot line dividing a lot from a street or other public space.

Structural clay tile: A hollow masonry unit composed of burned clay, shale, fireclay or mixtures thereof, and having parallel cells.

Structural steel member: Any primary or secondary member of a building or structure consisting of a rolled steel structural shape, cold-formed steel, light gage steel or steel joist members.

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

System: A combination of equipment and/or controls, accessories, interconnecting means, and terminal elements by which energy is transformed and delivered to desired areas so as

to perform a special function, such as HVAC, service water heating, or illumination.

Thermal resistance R: A measure of the ability to retard the flow of heat. The R value is the reciprocal of the heat transfer coefficient. R = 1/U.

Thermal transmittance, U: Coefficient of heat transmission (air to air) expressed in units of Btu per hour per square foot per degree F. It is the time rate of heat flow. The U value applies to combinations of different materials used in series along the heat flow path, single materials used in series along the heat flow path, single materials that comprise a building section, cavity air spaces, and surface air films on both sides of a building element.

Thermal transmittance overall, U_o or overall U_o: Overall (average) heat transmission of a gross area of the exterior building envelope, expressed in units of Btu per hour per square foot per degree F. The Uo value applies to the combined effect of the time rate of heat flows through the various parallel paths, such as windows, doors, and opaque construction areas, comprising the gross area of one or more exterior building components, such as walls, floors, or roof/ceiling.

Thermostat: An instrument which measures changes in temperature, and controls device(s) for maintaining a desired temperature.

Tile: A ceramic surface unit, usually relatively thin in relation to facial area, made from clay or a mixture of clay and other ceramic materials, called the body of the tile, having either "glazed" or "unglazed" face and fired above red heat in the course of manufacture to a temperature sufficiently high to produce specific physical properties and characteristics.

Unitary cooling and heating equipment: One or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well. Where such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Unitary heat pump: One or more factory-made assemblies which normally 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. It is designed to provide the functions of air-circulation, air cleaning, cooling, and heating with controlled temperature, and dehumidifying, and may optionally include

the function of humidifying. When such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Vent: A conduit or passageway, vertical or nearly so, for conveying products of combustion to the outside atmosphere. Type B and B-W: A gas venting system consisting of vent piping and fittings listed for use with a listed gas appliance.

Type L: A low temperature venting system, consisting of listing vent piping and fittings for use with oil-burning appliances listed for use with Type L vents, or with listed gas appliances.

Vent connector: The pipe used to connect an approved fuel-fired appliance to a chimney or vent.

Vent system: A continuous open passageway from the flue collar or draft hood of a fuel burning appliance to the outside atmosphere for the purpose of removing products of combustion.

Ventilation: The process of supplying air to, or removing air from, any space. Such air may or may not have been conditioned.

Ventilation air: That portion of supply air which comes from outdoors, plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

Vertical opening: An opening through a floor or roof.

Wall:

Bearing wall: A wall supporting any vertical load in addition to its own weight.

Cavity wall: A wall built of masonry units or of plain concrete, or a combination of these materials, arranged to provide an air space within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

Composite wall: A wall built of a combination of two (2) or more masonry units of different materials bonded together, one (1) forming the back-up and the other the facing elements.

Non-bearing wall: A wall which does not support vertical load other than its own weight.

Parapet wall: That part of a wall entirely above the roof line.

Retaining wall: A wall designed to resist the lateral displacement of soil or other material.

Veneered wall: A wall having a facing of masonry or other weather-resisting noncombustible materials securely attached to the backing, but not so bonded as to exert common action under load.

Winder: A step in a winding stairway.

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

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

Yard: An unoccupied open space.

Zone: A space or group of spaces within a building with heating and/or cooling requirements 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.

SECTION 2101.0 BUILDING PLANNING

2101.1 General: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

2101.1.1 Material and equipment identification: Where practicable, all materials and equipment requiring conformance to this code shall be marked in order to show compliance with the approved plans and specifications.

2101.1.2 Alternate materials, methods of construction, design or insulating systems: The provisions of this article are not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved as specified in Section 110.0.

2101.2 Design criteria

2101.2.1 General: One and two-family dwelling structures shall be designed based upon the wind, snow, and live load criteria of Article 7 of the basic code. (30 psf-bedrooms, 40 psf-living areas and 30 psf-roof).

2101.3 Design conditions for energy conservation: The criteria of this section establish the minimum requirements for the thermal design of the exterior envelope of buildings and for HVAC systems and their parts.

2101.3.1 Thermal performance: A building that is designed to be both heated and cooled shall meet the more stringent of the heating or cooling requirements as provided in this article.

2101.3.2 Design parameters: The following design parameters shall be used for calculations required. (See Table 2101-1).

Table 2101-1
DESIGN TEMPERATURES AND DEGREE DAYS

	Heating Degree Days	Heating Degrees F.	Cooling Degrees F. Dry Bulb	Cooling Degrees F. Wet Bulb
Boston	5634	+10	88	74
Clinton	6517	+ 2	85	74
Fall River	5774	+ 9	86	74
Framingham	6144	+ 3	89	74
Lawrence	6195	+ 1	88	74
Lowell	6056	+ 3	89	74
New Bedford	5395	+13	84	73
Pittsfield	7578	+ 1	84	74
Springfield	5844	+ 1	88	74
Taunton	6184	+ 5	86	75
Worcester	6969	+ 1	87	73

2101.4 Location on lot: Exterior walls of dwellings located less than three (3) feet from property lines shall have not less than one (1) hour fireresistive rating.

2101.4.1 Opening protectives: Openings shall not be permitted in exterior walls of dwellings located less than three (3) feet from the property line.

2101.5 Light and ventilation: All habitable rooms shall be provided with aggregate glazing area of not less than eight (8) per cent of the floor area of such rooms. One-half (1/2) of the required area of glazing shall be openable.

Exception: A combination of natural and mechanical ventilation shall be allowed when evidence is submitted that the combination meets the minimum requirements established in this article.

2101.5.1 Alcove rooms: When alcove rooms open without obstruction into adjoining rooms, the required window openings to the outer air shall be based on the combined floor area of room and alcove. An alcove space shall be not more than sixty (60) square feet in area and the opening to the adjoining room shall not be less than fifty (50) per cent of the superficial area of the dividing wall, unless provided with separate means of light and ventilation.

2101.5.2 Mechanical ventilation: Ventilation air shall conform to Std. RS-21-12. The minimum value for each type of room use is given in Table 2101-2. The ventilation quantities specified are for one hundred (100) per cent outdoor air ventilating systems. A reduction to thrity-three (33) per cent of the specified outdoor values for recirculating HVAC systems is permitted. In no case shall the outdoor air quantity be less than five (5) cfm per person.

Exception: If outdoor air quantities other than those specified are used or required because of special occupancy requirements or other standards, the required outdoor air quantities shall be used as the basis for calculating the heating and cooling design loads.

Table 2101-2
VENTILATION REQUIREMENTS FOR ONE- AND TWO-FAMILY DWELLINGS

Type of Room	Required ventilation air in cubic feet per minute per human occupant
General living areas, bedrooms	5
Kitchens	20
Baths, toilet rooms	20
Basements, utility rooms	5

Note: If design occupancy is not known, ventilation is to be based upon an estimate of five (5) persons per one thousand (1,000) square feet of floor area.

2101.5.2.1 Natural ventilation: In a bathroom, if a window is available which is unrestricted and opens directly to the outer air, no mechanical ventilation shall be necessary.

2101.6 Room dimensions

2101.6.1 Ceiling heights: Habitable (space) rooms, other than kitchens, storage rooms and laundry rooms shall have a ceiling height of not less than seven (7) feet three (3) inches. Hallways, corridors, bathrooms, water closet rooms, and kitchens shall have a ceiling height of not less than seven (7) feet measured to the lowest projection from the ceiling.

If any room in a building has a sloping ceiling, the prescribed ceiling height for the room is required in only one-half (1/2) the area thereof. No portion of the room measuring less than five (5) feet from the finished floor to the finished ceiling shall be included in any computation of the minimum area thereof.

If any room has a furred ceiling, the prescribed ceiling height is required in two-thirds (2/3) of the area thereof, but in no case shall the height of the furred ceiling be less than seven (7) feet.

2101.6.2 Floor area: Habitable rooms except kitchens shall have an area of not less than seventy (70) square feet between enclosing walls or partitions, exclusive of closet and storage spaces.

2101.6.3 Width: No habitable room other than a kitchen shall be less than seven (7) feet in any dimension.

Exception: Beams and girders spaced not less than six (6) feet on center may project not more than seven (7) inches below the required average ceiling height.

2101.7 Glazing

2101.7.1 Human impact loads: Individual glazed areas in hazardous locations such as those indicated in Section 2101.7.2 shall comply with the requirements of the ANSI Z97.1 standard listed in RS-21-2, or by comparative test shall be proven to produce at least equivalent performance. Annealed glass shall not be used.

2101.7.2 Specific hazardous locations: The following shall be considered specific hazardous locations for purposes of glazing:

1. glazing in ingress and egress doors;
2. glazing in fixed and sliding panels of sliding type doors (patio and mall type);
3. glazing in storm doors;
4. glazing in all unframed swinging doors;
5. glazing in shower doors and tub enclosures;
6. glazing in fixed panels within sixty (60) inches horizontally of the nearest vertical edge of the ingress and egress door;
7. glazing in fixed panels with a bulkhead less than thirty-six (36) inches above the finish floor level which because of their size or design may be mistaken as a means of ingress or egress; and
8. glazing closer to the floor than eighteen (18) inches and exceeding six (6) square feet in area.

2101.8 Sanitation: Every dwelling unit shall meet the requirements of the Department of Public Health and the Massachusetts State Plumbing Code (248 CMR 2.00) relative to sanitation.

2101.9 Private garages

2101.9.1 Openings: There shall be no openings from a private garage directly into a room used for sleeping purposes. Other openings between the garage and residence shall be equipped with doors providing a fire rating equivalent to twenty (20) minutes.

2101.9.2 Fire protection: The garage shall have five-eighths (5/8) inch gypsum board on the garage side of wall or floor adjacent to the house, and wherever the attic area is continuous between the garage and the house a firestop of one-half (1/2) inch gypsum board shall be used to form a barrier to separate the garage and house.

2101.9.3 Flooring: Garage and carport floor surfaces shall be approved nonabsorbent, noncombustible material.

2101.9.4 Floor level: The floor level of all door openings between the garage and the dwelling shall have either a minimum four (4) inch raised sill or the floor shall have a ramp or floor pitched a minimum of five (5) per cent in the direction of the overhead garage doors.

2101.10 Egress

2101.10.1 Means of egress: In one- and two-family dwellings, each dwelling unit shall have two (2) independent means of egress, remote as possible from each other and leading to grade; in addition, every floor within a dwelling unit shall have at least one (1) means of egress which shall provide a continuous and unobstructed path leading to grade.

2101.10.2 Egress doors: Access to grade at termination of the required means of egress may be provided by the use of both side-hinged swinging doors or sliding glass doors. Swinging doors provided to meet this requirement may swing inward.

2101.10.3 Emergency egress: Sleeping rooms shall have at least one (1) openable window or exterior door to permit emergency egress or rescue. A required window must be openable from the inside without the use of separate tools, and shall conform to the following:

1. the sill height shall be not more than forty-four (44) inches above the finish floor;
2. shall provide a minimum net clear opening area of 3.3 square feet with a rectangle having minimum net clear opening dimensions of twenty (20) inches by twenty-four (24) inches, in either direction. If a double hung unit is used, then such dimensions shall apply to the bottom half.

2101.10.4 Doorways and hallways

2101.10.4.1 Interior doorways: The minimum nominal width of any interior doorway, except in closets, storage areas and bathrooms, shall be two (2) feet six (6) inches. There shall be no minimum requirement for doorway width in closets, storage areas and bathrooms.

2101.10.4.2 Exitway doorways: The minimum nominal width of every required exitway doorway to or from a stairway shall be thirty-six (36) inches.

Exception: Second means of egress doorways may be thirty-two (32) inches.

2101.10.4.3 Nominal height: The minimum nominal height of required egress doorways shall be six (6) feet six (6) inches.

2101.10.4.4 Exitway access: The minimum clear width of a hallway or exitway access shall be three (3) feet.

2101.10.4.5 Door hardware: Double cylinder dead bolts requiring a key operation on both sides are prohibited on required means of egress doors serving more than one dwelling unit.

2101.10.5 Landings: A landing shall be provided on each side of an egress door. The interior floor or landing shall not be more than two (2) inches lower than the threshold of the doorway. Where doors open over landings, the landings shall have a minimum width and depth of three (3) feet.

Exception: A landing is not required where the exit door does not swing over the stair.

2101.10.6 Door swing: A door may open at the top of a flight of stairs provided the door does not swing over the top step and the top step is not more than seven and one-half (7-1/2) inches below the threshold level.

2101.10.7 Accessory doors: Storm, screen or other doors accessory to exit doors which swing over stairs shall require a landing where they swing in the direction of the stairs. The landing shall be not more than seven and one-half (7-1/2) inches below the threshold level.

2101.10.8 Stairways: Required egress stairways shall be not less than three (3) feet in clear width. Headroom, rise and run shall conform to Figure 2101-1. Minimum headroom for basement cellar and service stairs shall be six (6) feet six (6) inches. Handrails may project from each side of a stairway a distance of three and one-half (3-1/2) inches into the required width.

2101.10.8.1 Loading: Stairways and landings shall provide for safe ascent and descent under normal and emergency conditions and for the transport of furniture and equipment.

2101.10.8.2 Spiral stairways: Spiral stairways may be used as an element of a means of egress within a single dwelling unit. The minimum width of tread shall be twenty-six (26) inches with each tread having a seven and one-half (7-1/2) inch minimum tread width at twelve (12) inches from the narrow edge. All treads shall be identical and the rise shall be not more than nine and one-half (9-1/2) inches. A minimum headroom of six and one-half (6-1/2) feet shall be provided.

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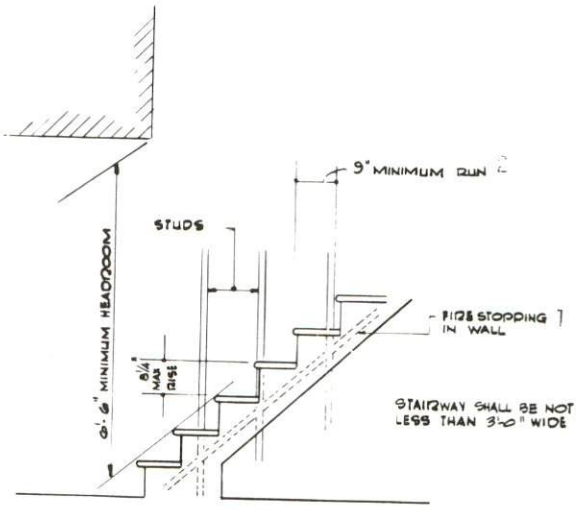
2101.10.8.3 Winders: Winders may be used as an element of a means of egress, provided the width of the tread, at a point not more than eighteen (18) inches from the side where the treads are narrower, is not less than nine (9) inches.

Figure 2101-1



STAIR DETAIL

[1] Indicate Firestopping as the dotted lines parallel to the stair stringers

[2] Nosing not to exceed one and one-quarter (1¼) inches

2101.11 Handrails and guardrails: Handrails having minimum and maximum height of thirty (30) inches and thirty-four (34) inches, respectively, measured vertically from the nosing of the treads shall be provided on at least one (1) side of stairways of three (3) or more risers. Open sides of all stairs shall be similarly protected by guards. However, handrails shall not be required on stairways with three (3) or more risers where the raised platform to which they lead is thirty (30) inches or less above the floor or grade.

2101.11.1 Other guardrails: Porches, balconies or raised floor surfaces located more than thirty (30) inches above the floor or grade below shall have guardrails not less than thirty-six (36) inches in height.

2101.11.2 Details: Guards shall be constructed so that the area in the plane of the guard, from the top of the tread to the top of the guard, is subdivided or filled in one (1) of the following methods:

1. a sufficient number of intermediate longitudinal rails constructed so that the clear distance between rails (measured at right angles to the rail) does not exceed nine (9) inches. The bottom rail shall not be more than nine (9) inches (measured vertically) from the tread nosing; or
2. balusters spaced not more than nine (9) inches apart; or
3. panels of wire mesh, or expanded metal, or ornamental grills which provide protection equivalent to that provided by the intermediate rails or balusters specified in the two (2) preceding paragraphs; or
4. walls; or
5. any combination of the foregoing.

2101.12 Gutters and downspouts: When a city or town requires by ordinance or by-law, run-off control, then the provisions of Sections 2101.12.1 and 2101.12.2 shall apply.

2101.12.1 Minimum size of gutters: Gutters shall have the same area as downspouts for spacings up to forty (40) feet between downspouts. The width of the gutter shall be increased by one (1) inch for each additional twenty (20) feet of gutter.

2101.12.2 Downspouts: Downspouts shall be sized on the basis of approximately one hundred (100) square feet of roof surface to one (1) square inch leader.

2101.13 Flame spread for walls and ceilings

2101.13.1 Flame spread: All room, wall and ceiling finishes shall have a flamespread classification of not greater than two hundred 200 as tested in accordance with ASTM E84.

Exception: Flamespread requirements are not applicable to bathrooms.

2101.14 Fire protection

2101.14.1 Smoke detectors: All buildings which are defined by this code as one or two-family dwellings, including manufactured homes, shall contain a Type III system in conformance

with 2101.14.1.1 of this section with smoke detectors located as herein required and installed in conformance with NFiPA 74.

2101.14.1.1 Type III system: A Type III system shall be installed in accordance with NFiPA 74. Power shall be supplied from a permanently wired connection directly to an A.C. primary source of power or monitored batteries. All power for A.C. powered detectors shall be taken from a single branch circuit which also provides other electrical service to a habitable area; and the power source for the detectors shall be on the supply side, ahead of any switches. All required smoke detectors shall be provided with a visible power-on indication. All required smoke detectors shall be inter-connected so that when one actuates, all will sound to meet the requirements of NFiPA 74, Section 2-2.4. All required smoke detectors shall conform to Section 2101.14.3.

2101.14.2 Location: Smoke detectors shall be located to comply with the following minimum requirements:

1. Minimum number of detectors:
   a. No less than one (1) approved smoke detector shall be provided on the highest habitable level and on each floor, story or level below, including basements or cellars.
   b. For any floor, level or story exceeding twelve hundred (1200) square feet in area, one (1) approved smoke detector shall be provided for each twelve hundred (1200) square feet or part thereof.
2. Location of detectors:
   a. One (1) approved smoke detector shall be located outside of each separate sleeping area, in accordance with the definition of "Separate Sleeping Area".
   b. One (1) approved smoke detector shall be located on the ceiling near the base of, but not within, each stairway.
3. Combined coverage: Smoke detectors required by item 2-a of this section may be used to fulfill the requirements of item 2-b of this section.

2101.14.3 Approved devices: Single station and multiple station smoke detection devices: Smoke detectors of single station and multiple station types shall meet the requirements of U.L. 217 and be listed or approved by a nationally-recognized fire testing laboratory.

2101.14.4 Maintenance and testing:

1. It shall be the responsibility of the owner to properly maintain the system.

2101.15 Building in a flood plain: Where a structure is located in a flood plain or coastal high hazard area as determined by the building official or the governmental body having jurisdiction, such a structure must be designed to resist or overcome the anticipated flood conditions in accordance wth the provisions of Section 744.0.

2101.16 Fire separation: The requirements for the construction of fire separation walls in buildings containing single-family dwellings or two-family dwellings (use group R-3 or R-4) are as follows:

1. Two-family dwelling, superimposed dwelling units: When one(1) dwelling unit of a two-family dwelling is located wholly or partly above the other dwelling unit, the two (2) dwelling units shall be completely separated by fire separation walls and floor-ceiling assemblies of not less than one (1) hour fireresistance rated construction.
2. Two-family dwelling, side-by-side dwelling units: When adjacent dwelling units of a two-family dwelling are attached by a common wall, said wall shall be a fire separation wall, having a minimum one (1) hour fire-resistance rating that shall serve to completely separate the dwelling units.
3. Multiple single-family dwellings, side-by-side: When multiple single-family dwellings (use group R-3) are attached by a common wall, said wall shall be a fire separation wall, having a minimum one (1) hour fire-resistance rating. Said wall shall extend from the foundation to the underside of the roof sheathing, and to the inside of the exterior wall sheathing.
4. Multiple two-family dwellings; side-by-side: When a multiple two-family dwellings (use group R-3) are attached by a common wall, said wall shall be a fire separation wall, having a minimum one (1) hour fire-resistance rating. Said wall shall extend from the foundation to the underside of the roof sheathing and to the inside of the exterior wall sheathing.

SECTION 2102.0 FOUNDATIONS

2102.1 General: Foundations, footings and basement walls shall be constructed in accordance with the requirements of this section.

2102.2 Materials: Conformity with the applicable standards specified in the reference standards of this Article shall be acceptable as providing compliance with the requirements of this Article.

2102.2.1 Compressive strength: The ultimate compressive strength of concrete foundations at twenty-eight (28) days shall be not less than two thousand (2,000) pounds per square inch except where weather exposure requires a greater strength or cement content.

2102.3 Footings: All exterior walls, bearing walls, columns and piers shall be supported on solid masonry, or concrete footings, or other approved structural systems which shall be of sufficient design to support safely the loads imposed as determined from the character of the soil.

2102.3.1 Grade clearance: Foundation walls shall extend at least eight (8) inches above the finished grade adjacent to the foundation at all points, except where otherwise approved by the building official.

2102.3.2 Foundations on sloping grade: Foundations for all buildings where the surface of the ground slopes more than one (1) foot in ten (10) feet shall be level or shall be stepped so that both top and bottom of such foundations are level.

2102.3.3 Unformed foundation walls: Unformed foundation walls may be used when soil conditions warrant, subject to the approval of the building official.

2102.3.4 General: Footings of adequate size shall be provided when necessary to properly distribute the load within the allowable bearing pressure of the soil. All permanent supports of buildings and structures shall extend a minimum of four (4) feet below finished grade except when erected upon sound bedrock or when protected from frost, or when the foundation grade is established by a registered professional engineer and is approved by the building official. The engineer shall support the design grade with data including the type and extent of free-draining foundation material, ground water levels, and climatic records.

2102.4 Basement walls: Basement walls shall be constructed in accordance with the provisions of this section and in accordance with accepted practice.

2102.4.1 Masonry and concrete walls: Where unstable soil or ground water conditions do not exist, walls may be constructed of unreinforced masonry or concrete with the thickness shown in Table 2102-1.

2102.4.1.1 Reinforced masonry or concrete: Where unstable soil conditions exist or in seismic zones specified by the State Building Code Commission, basement walls may be constructed of reinforced masonry or concrete as set forth in Table 2102-1

provided the walls are not subjected to equivalent fluid pressures of more than thirty (30) pounds per square foot.

Exception: Basement walls retaining less than four (4) feet of unbalanced fill need not be reinforced.

2102.4.2 Design and installation:

1. Basement walls subjected to more than thirty (30) pounds per square foot equivalent fluid pressure shall be designed in accordance with accepted engineering practices.
2. Backfill adjacent to the wall shall not be placed until the wall has sufficient strength or has been sufficiently braced to prevent damage by the backfill.
3. Basement walls shall be drained and dampproofed in accordance with Section 2102.5 and Section 2102.6 respectively.

2102.5 Waterproofing: Drains shall be provided around concrete and masonry foundations enclosing habitable or usable spaces located below grade and which are subjected to ground water conditions. Drains shall be installed at or below the area to be protected and shall discharge by gravity or by mechanical means into an approved drainage system.

2102.5.1 Drainage tile protections: The top joints and perforations of drain tiles shall be protected with strips of building paper and the tiles shall be placed on two (2) inches of crushed rock and covered with not less than six (6) inches of the same material.

2102.6 Dampproofing: Exterior foundation walls of masonry construction enclosing basements shall be dampproofed by applying not less than three-eighths (3/8) inch of portland cement parging to the wall from footing to finish grade. The parging shall be covered with a coat of approved bituminous material applied at the recommended rate. Exterior foundation walls of concrete construction enclosing basements shall be dampproofed by applying a coat of approved bituminous material to the wall from the footing to the finish grade at the recommended rate.

2102.6.1 Concrete and masonry: Foundation walls of habitable rooms located below grade shall be waterproofed with membranes extending from the edge of the footing to the finish grade line. The membrane shall consist of either two (2) ply hot-mopped felts, six (6) mil polyvinyl chloride, fifty-five (55) pound roll roofing or equivalent material. The laps in the waterproofing membrane shall be sealed and firmly affixed to the wall.

2012.6.2 Other methods: Basement walls may be dampproofed or waterproofed using materials or methods of construction

other than covered in the section when approved by the building official.

2102.7 Foundation kneewalls: Studs shall have a minimum length of fourteen (14) inches and shall be not less in size and spacing than the studding required for exterior walls, and when exceeding four (4) feet in height shall be of the size required for an additional story.

2102.7.1 Kneewall bracing: Foundation kneewall studs of exterior walls and bearing partitions shall be thoroughly and effectively cross-braced (see Table 2103.3).

2102.8 Protection against decay and termites

2102.8.1 Wood in contact with the ground: All wood in contact with the ground and supporting permanent structures shall be approved treated wood. All wood below two (2) inches above surrounding grade, or in locations subject to ponding of water and/or dampers shall be of approved wood type or treated (pressure).

2102.8.2 Untreated wood: Untreated wood may be used where entirely below ground water level or continuously submerged in fresh water; and may be used in contact with the ground for detached accessory buildings not intended for human occupancy, for temporary structures, and for fences.

2102.8.3 Wood joists or the bottom of wood structural floors: When wood joists or the bottom of wood structural floors without joists are closer than eighteen (18) inches, or wood girders are closer than twelve (12) inches, to exposed ground located within the periphery of the building over crawl spaces or unexcavated areas, they shall be approved durable or treated wood. Ventilation shall be provided as required in Section 2102.9.

2102.8.4 Sills: All sills which rest on concrete or masonry exterior walls and are less than eight (8) inches from exposed earth shall be approved durable or treated wood.

2102.8.5 Wood posts or columns: Posts or columns in cellars shall be supported by piers projecting at least two (2) inches above the finish floor and separated therefrom by an approved impervious barrier except when approved durable or treated wood is used. Posts or columns used in damp locations below grade shall be of approved durable or treated wood.

2102.8.6 Wall pockets: Ends of wood girders entering masonry or concrete walls shall be provided with a one-half (1/2) inch

TABLE 2102-1
MINIMUM THICKNESS AND ALLOWABLE DEPTH OF
UNBALANCED FILL FOR UNREINFORCED MASONRY
AND CONCRETE WALLS[1] WHERE UNSTABLE
SOIL OR GROUND WATER CONDITIONS DO NOT EXIST

Foundation Wall Construction	Nominal Thickness (inches)	Maximum depth of unbalanced fill in feet[1]		
		Type of Super-Structure		
		Wood Frame	Masonry Veneer	Masonry
Masonry of Hollow Units	8	4 (6)	4.5 (6)	5 (7)
	10	5 (7)	5.5 (7)	6 (7)
	12	7	7	7
Masonry of Solid Units	6	3	4	4
	8	5 (7)	5.5 (7)	6 (7)
	10	6 (7)	6 (7)	6.5 (7)
	12	7	7	7
Plain Concrete	6[2]	4	4	4
	8	7	7	7
	10	7	7	7
	12	7	7	7
Rubble Stone	Foundation walls of rubble stone shall be at least sixteen (16) inches thick. Rough or random rubble shall not be used as foundations for walls exceeding 35 feet in height.			

Note 1: The depth of unbalanced fill may be increased up to the values shown in parentheses where it is warranted by soil conditions. Unbalanced fill is the height of outside finish grade above the basement floor or inside grade.

Note 2: Six (6) inch plain concrete walls shall be formed both sides.

TABLE 2102-2
REINFORCEMENT REQUIRED FOR BASEMENT WALLS SUBJECTED TO NOT MORE THAN 30 POUNDS PER SQUARE FOOT EQUIVALENT FLUID PRESSURE .

Material Type	Height of Unbalanced Fill in Feet[3]	Length of Wall Between Supporting Masonry or Concrete Walls in Feet	Minimum Wall Thickness in Inches[1]	Required Reinforcing	
				Horizontal Bar in Upper 12 Inches of Wall	Size and Spacing of Vertical Bars
Hollow Masonry	4 or less	unlimited	8	not required	not required
	more than 4	design required	design req.	design required	design required
Concrete or Solid Masonry[2]	4 or less	unlimited	8	not required	not required
	more than 4	less than 8	8	2 - No. 3	No. 3 @ 18" O.C.
	8 or less	8 to 10	8	2 - No. 4	No. 3 @ 18" O.C.
	8 or less	10 to 12	8	2 - No. 5	No. 3 @ 18" O.C.
	more than 8	design required	design req.	design required	design required

Note 1: Thickness of concrete walls may be six (6) inches provided reinforcing is placed not less than one (1) inch nor more than two (2) inches from the face of the wall not against the earth.

Note 2: Solid masonry shall include solid brick or concrete units and hollow concrete units with all cells grouted.

Note 3: Backfilling shall not be commenced until after the wall is anchored to the floor.

air space on top, sides and end, unless approved durable or treated wood is used.

2102.8.7 Clearance between wood siding: Clearance between wood siding and earth on the exterior of a building shall be not less than six (6) inches.

2102.8.8 Wood used in a retaining wall: Wood used in a retaining wall shall be approved durable or treated wood, except as follows:

1. when the wall is not more than two (2) feet in height and is located on the property line; or
2. when the wall is not more than four (4) feet in height and is separated from the property line by a minimum distance equal to the height of the wall.

2102.8.9 Where approved durable or treated woods are required: Where approved durable or treated woods are required in this code, the building official shall require identification by an approved mark or certificate of inspection. All lumber and plywood required to be preservatively treated shall bear an approved quality mark of an inspection agency that maintains continuing control, testing and inspection over the quality of the product.

2102.8.10 Pressure treatment: Where pressure treatment of wood members is required by this code, preservations and methods of treatment shall conform to the standards for pressure treatment and preserving of lumber listed in Reference Standard RS-21-4.

2102.9 Underfloor space ventilation

2102.9.1 General: The space between the bottom of the floor joists and the earth under any building (except such space as is occupied by a basement or cellar) shall be provided with a sufficient number of ventilating openings through foundation walls or exterior walls to insure ample ventilation, and such openings shall be covered with a corrosion-resistant wire mesh not greater than one-half (1/2) inch nor less than one-quarter (1/4) inch in any dimension. The minimum total area of ventilating openings shall be proportioned according to Section 2121.2. Vents shall be located to provide cross-ventilation.

Exception: Ventilation openings may be omitted when crawl space is used as a plenum.

2102.9.2 Access: An access crawl hole eighteen (18) inches by twenty-four (24) inches shall be provided to the underfloor space.

2102.9.3 Vegetation and organics: The underfloor grade shall be cleaned of all vegetation and organic material.

2102.9.4 Thermal performance: Floor sections over areas exposed to outside air shall meet the criteria for thermal transmittance specified in Table 2123-1.

SECTION 2103.0 WALL CONSTRUCTION

2103.1 General: Wall and partition construction shall conform to the requirements of this section.

2103.1.1 Specifications: Conformity with the applicable grading, material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this section.

2103.1.2 Energy conservation requirements: Exterior walls shall meet the thermal transmittance requirements as specified in Table 2123-1.

2103.2 Wood

2103.2.1 Identification: All load-bearing lumber, plywood and particleboard shall conform to applicable standards or grading rules and shall be so identified by the grade mark, or certificate of inspection issued by an approved grading or inspection bureau or agency.

2103.2.2 Grade: All headers and studs shall be at least of No. 2, Standard or Stud Grade Lumber or equivalent.

Exceptions:
1. Bearing studs not supporting floors may be No. 3 or Utility Grade or equivalent provided the studs are spaced not more than sixteen (16) inches on center.
2. Nonbearing studs may be of No. 3 or Utility Grade or equivalent lumber.

2103.2.3 Construction: Exterior walls of wood frame residential buildings shall be constructed in accordance with Figures 2103-1 and 2103-2, and Tables 2103-2 and 2103-3.

2103.2.4 Engineering design: Exterior walls subject to wind pressure greater than thirty (30) pounds per square foot, as established in this code shall be designed in accordance with accepted engineering practice.

2103.2.5 Cutting and notching: It shall be unlawful to notch, cut or pierce wood beams, joists, rafters or studs in excess of the limitations herein specified unless proven safe by structural analysis, or suitably reinforced to transmit all calculated loads. Notches in the top or bottom of joists shall not exceed one-sixth (1/6) the depth of the member and shall not be located in the middle of one-third (1/3) of the span. Notches located closer to the supports than three (3) times the depth of the member shall not exceed one-fifth (1/5) the depth. Holes bored or cut into joists for piping or electrical cables shall not be closer than two (2) inches to the top or bottom of the joist and the diameter of the hole shall not exceed one-third (1/3) the depth of the joist. In studs of bearing walls or partitions, notches or bored holes made to receive piping, electrical conduit, air-conditioning or heating duct work or for other fabricating purposes shall not be cut or bored more than one-third (1/3) the depth of the stud. When the stud is cut or bored in excess of one-third (1/3) its depth, it shall be reinforced to be equal in load-carrying capacity to a stud notched not more than one-third (1/3) its depth.

2103.2.6 Headers: The allowable span for headers in bearing walls shall not exceed the values set forth in Table 2103-4.

2103.2.7 Firestopping: Firestopping shall be provided to cut off all concealed draft openings (both vertical and horizontal) and form an effective fire barrier between stories, and between a top story and the roof space. It shall also be used in:

1. stud walls at ceilings and floor levels; and
2. in walls parallel to stair stringers; and
3. any other locations not specifically mentioned above, such as holes for pipes, shafting, behind furring strips, and similar places which could afford a passage for flames.

2103.2.7.1 Dimensions: Firestopping shall consist of approved noncombustible materials or of wood two (2) inches nominal thickness or three-quarter 3/4" plywood. If width of opening is such that more than one (1) piece of lumber is necessary, there shall be two (2) thicknesses of one (1) inch nominal material with staggered joints.

2103.3 Native lumber: Native lumber, as defined in this code, shall be acceptable for use in one and two-story dwellings, barns, sheds, agricultural and accessory structures. Native lumber shall also be acceptable for use in other structures of less than three (3) stories as columns when the design loads are twenty-five (25) per cent greater than required elsewhere by this code; as joists, principal beams, and girders in floor constructions when the design loads are fifteen (15) per cent greater than required elsewhere by this code; and as other

elements when the design loads are as required elsewhere by this code.

Each piece of native lumber produced shall be stamped with the name and registration number of the producer in accordance with the rules and regulations of the State Building Code Commission. In addition, all native lumber shall bear an approved mark identifying the species of wood. In lieu of the stamp bearing the name and registration number and species identification, a certification bearing the same information may be provided by the producer for pre-cut or remanufactured lumber in accordance with the rules and regulations of the Commission. When native lumber is used, it shall be subject to the following requirements:

1. Sizing criteria: For lumber sized in accordance with the American Softwood Lumber Standard PS-20-70, figures for maximum fiber stress and modulus of elasticity for framing grade No. 2 will be used in establishing span and spacing characteristics for all structural members.

2. Stress increases: Lumber which is sized in excess of the dimensions established by the American Softwood Lumber Standard PS-20-70 for the given nominal size referenced shall be allowed to have a maximum fiber stress increase above that provided in Item 1 above in proportion to the increased bearing capacity of the cross-section as provided in Table 2103-1 or as calculated.

2103.4 Metal: Steel structural elements in walls and partitions may be either hot rolled structural steel shapes or bar sections or members cold formed to shape from steel sheet, strap or plate, or a fabricated combination thereof. Members shall be straight and free of any defects which would significantly affect their structural performance. The allowable span for steel headers in bearing walls shall not exceed the values set forth in Table 2103-4.

2103.4.1 Aluminum materials: Aluminum structural elements in walls and partitions shall be constructed of materials and designed in accordance with accepted engineering practice.

2103.5 Masonry construction: For additional information on masonry construction, see Article 8 of the basic code.

2103.5.1 Corbelling: Corbels may be built only into solid masonry walls twelve (12) inches or more in thickness. The projection for each course in such corbel shall not exceed one-third (1/3) of total thickness of the wall when used to support structural members, and not more than six (6) inches when used to

support a chimney built into the wall. The top course of all corbels shall be a header course.

2103.5.2 Combined units: In walls or other structural members composed of different kinds or grades of units, materials, or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination units, materials, and mortars of which the member is composed. The net thickness of any facing unit which is used to resist stress shall be not less than one and one-half (1-1/2) inches.

2103.5.3 Stack bond: In unreinforced masonry where masonry units are laid in stack bond, longitudinal reinforcements consisting of not less than two (2) continuous wires each with a minimum aggregate cross-sectional area of .017 square inch shall be provided in horizontal bed joints spaced not more than sixteen (16) inches on center vertically.

2103.5.4 Unsupported height: The unsupported height of masonry walls shall not exceed the values set forth in Table 2103-6. The unsupported height shall be measured between points of anchorage. Footings may be considered as points of lateral support.

Where wall stability is provided by intersecting walls or vertical stiffening elements such as pilasters, the unsupported length may be measured between these elements providing the stiffening elements are anchored to the roof and floor with connectors capable of transmitting all tributary wind and seismic forces.

2103.5.5 Lintels: Masonry walls shall be reinforced over openings in accordance with Table 2103-7. Exceptions are allowed when an engineering analysis using standard accepted practice is provided to justify variations from the table below.

2103.5.5.1 Reinforcement: The reinforcement shall be located in spaces fully grouted to a depth of not less than eight (8) inches and shall extend not less than twelve (12) inches beyond the sides of the opening.

2103.5.6 Beam supports: Beams, girders or other concentrated loads supported by a wall or column shall have bearing of at least three (3) inches in depth measured parallel to the beam and three (3) inches in length upon solid masonry or upon a metal bearing plate of adequate design and dimensions to distribute the load safely, or upon a continuous reinforced masonry member projecting not less than four (4) inches from the face of the wall.

2103.5.6.1 Joists shall be supported in accordance with accepted engineering practice.

2103.6 Hollow unit masonry

2103.6.1 General: Hollow unit masonry shall be laid with full face shell mortar beds and head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. For details, see Article 8 of the basic code.

2103.7 Solid masonry

2103.7.1 General: In each wythe of plain solid masonry, not less than seventy-five (75) percent of the units in any vertical plane perpendicular to the wall plane shall lap the ends of the units above and below a distance not less than one and one-half (1-1/2) inches or one-half (1/2) the height of the units, whichever is greater, or the masonry shall be reinforced longitudinally. For details, see the applicable reference standards and Article 8 of the basic code.

2103.8 Cavity wall masonry

2103.8.1 General: Cavity wall masonry is that type of construction made with brick, structural clay tile or concrete masonry units or any combination of such units in which facing and backing are completely separated except for the metal ties which serve as bonding. For details, see the applicable reference standards and Article 8 of the basic code.

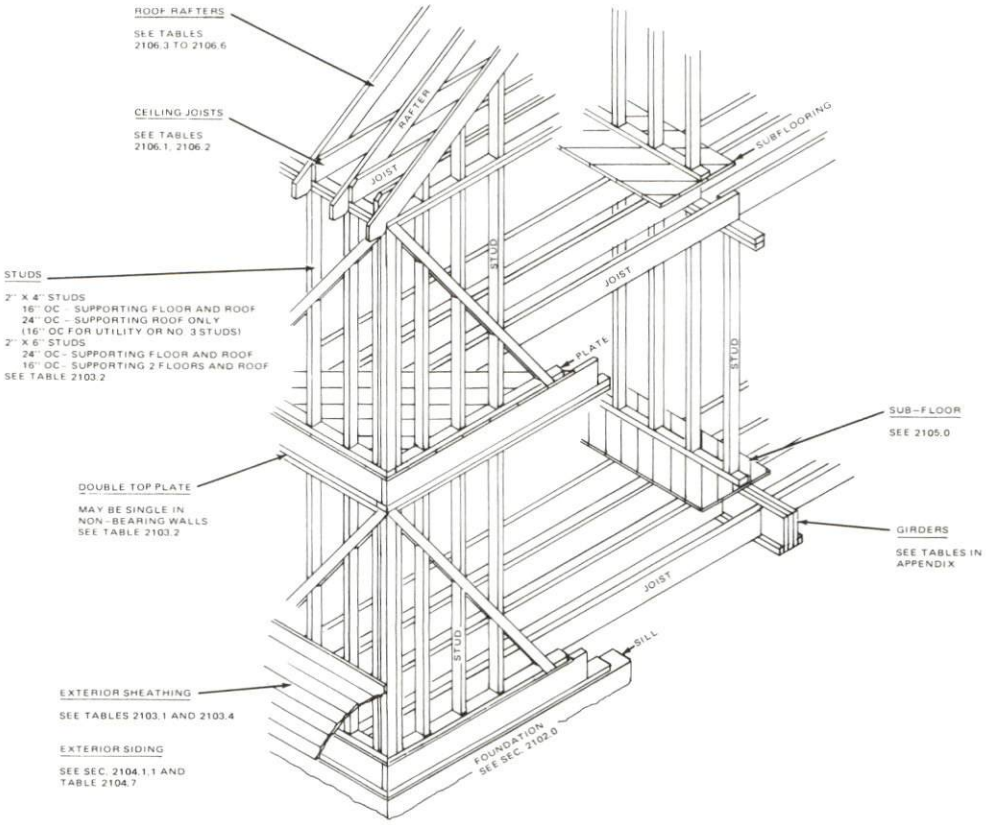
2103.8.2 Reinforcing: The facing and backing of cavity walls shall be bonded with three-sixteenths (3/16) inch diameter steel rods or metal ties of equivalent strength and stiffness embedded in the horizontal joints. There shall be one (1) metal tie for not more than each four and one-half (4-1/2) square feet of wall area for cavity widths up to three and one-half (3-1/2) inches net in width. Where the cavity exceeds three and one-half (3-1/2) inches net in width, there shall be one (1) metal tie for not more than three (3) square feet of wall area. Ties in alternate courses shall be staggered and the maximum vertical distance between ties shall not exceed twenty-four (24) inches and the maximum horizontal distance shall not exceed thirty-six (36) inches. Rods bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical; in other walls the ends of ties shall be bent to ninety (90) degree angles to provide hooks not less than two (2) inches long. Additional bonding ties shall be provided at all openings, spaced not more than three (3) feet apart around the perimeter and within twelve (12) inches of the opening. Ties shall be of

corrosion-resistant metal, or shall be coated with a corrosion-resistant metal or other approved protective coating.

2103.9 Grouted masonry

2103.9.1 General: At the time of laying, all masonry units shall be free of excessive dust and dirt. Only Type M and Type S mortar consisting of a mixture of portland cement, hydrated lime and aggregate shall be used. For details, refer to the applicable reference standards and Article 8 of the basic code.

FIGURE 2103-1



PLATFORM FRAME CONSTRUCTION

(SEE REFERENCE STANDARDS FOR OTHER FRAMING METHODS)

FIGURE 2103-2

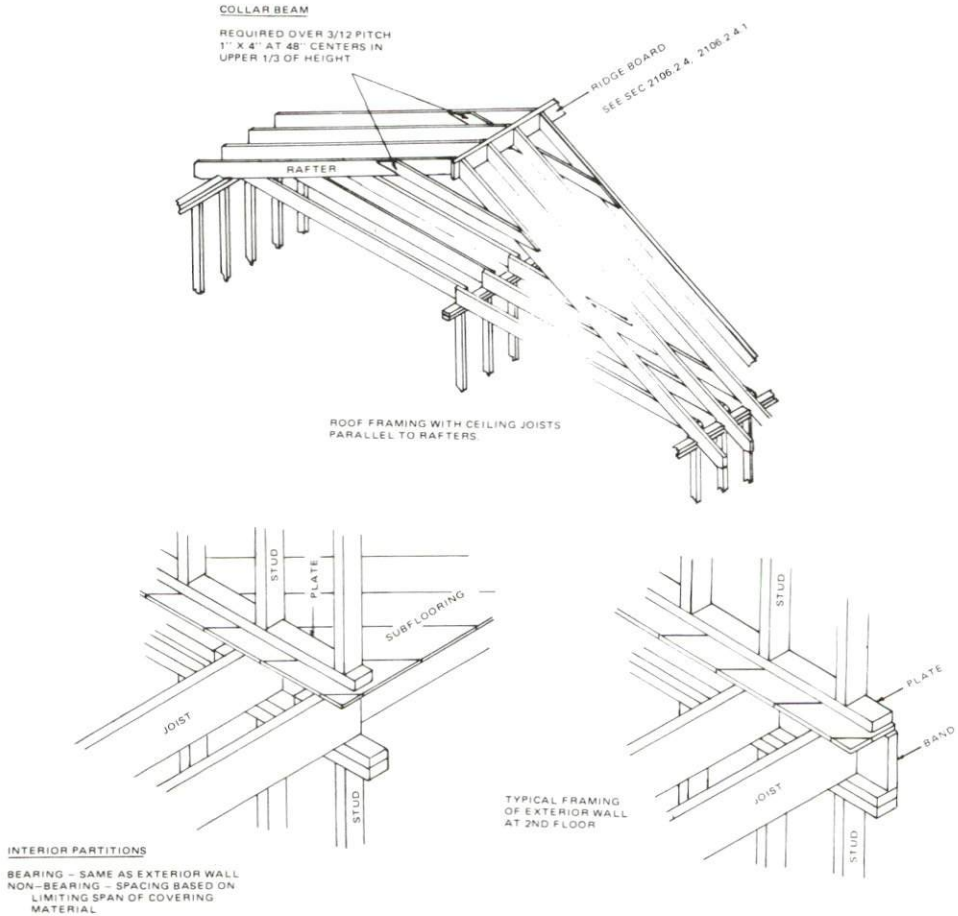
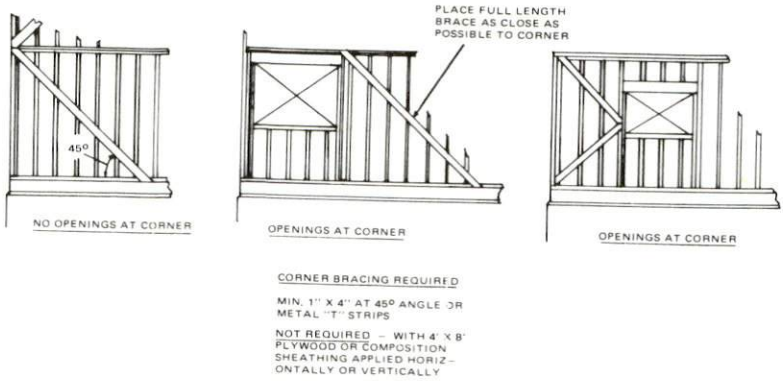


FIGURE 2103-3



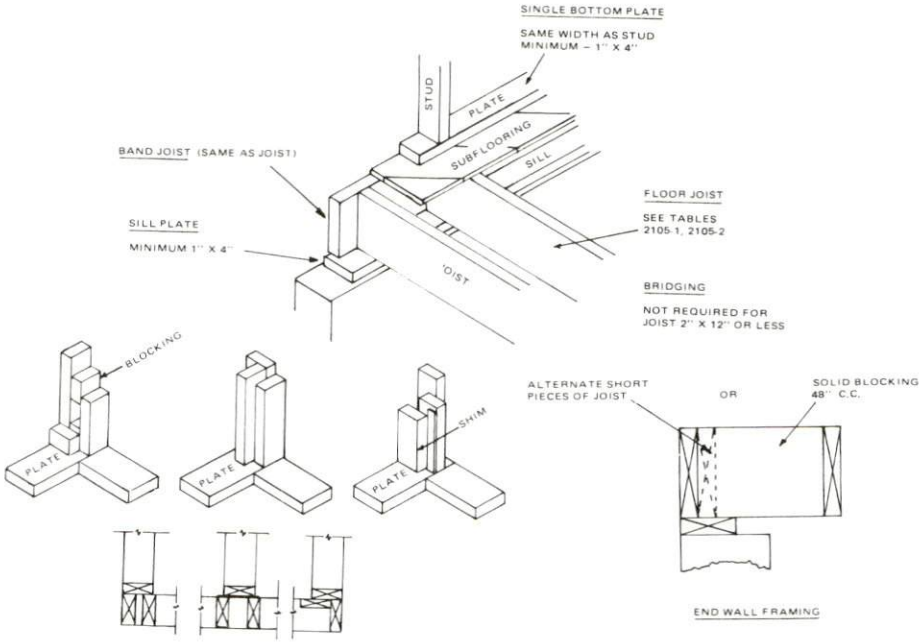


Table 2103-1
NATIVE LUMBER ALLOWABLE STRESS

	Actual Lumber Size. Closest Size which does not exceed the Dimension Shown	Multiplier Factor Lumber Based on Width	Factor to be Added to Column 3 Factor for Lumber Oversized in Thickness	
Nominal Size	Actual Size Thickness Width		Thick-ness In-crease of 1/4" to 1/2"	Thick-ness In-crease of over 1/2" to 1"
3 x 8	2-1/2 x 7-1/2 x 7-3/4 x 8	1.0 x Fs 1.07 1.14	+0.10	+0.20
3 x 10	2-1/2 x 9-1/2 x 9-3/4 x 10	1.0 1.05 1.11		
3 x 12	2-1/2 x 11-1/2 x 11-3/4 x 12	1.0 1.04 1.09		
3 x 14	2-1/2 x 13-1/2 x 13-3/4 x 14	1.0 1.04 1.07		
4 x 10	3-1/2 x 9-1/2 x 9-3/4 x 10	1.0 1.05 1.11	+0.07	+0.14
4 x 12	3-1/2 x 11-1/2 x 11-3/4 x 12	1.0 1.04 1.09		
4 x 14	3-1/2 x 13-1/2 x 13-3/4 x 14	1.0 1.04 1.08		

Notes to Table 2103-1

Note 1. Notation: Fs is the allowable maximum fiber stress for the assumed grade as established by this code in Sections 2105.2.2 and 2106.2.1. F's ("operating" stress) is the modified allowable maximum fiber stress which may be used in the span tables and for calculating required lumber sizes. F's is found by multipying Fs by the factors given in the table.

Note 2. Table Columns:

Column 1: is the nominal commonly used lumber size.
Column 2: is a list of actual sizes of the supplied lumber. Column 2 lists the sizes on the basis of a constant thickness and a width increasing by one-quarter (1/4) inch and one-half (1/2) inch.
Column 3: gives the multiplier for increasing the assumed allowable stress (Fs) based on the increase in width as listed in Column 2.
Column 4: gives the mutiplier for increasing the assumed allowable stress (Fs) based on increases in thickness.

Note 3. Example: Fiber stress for assumed grade = one thousand (1,000) psi - Actual size 3-1/8 x 9-3/4

Nominal size 3 x 10	1. Multiplier factor for Width	= 1.05
3-1/8 = increase of 1/8" total	2. Multiplier factor for Thickness	+ = .20
	Sum	1.25

3. Operating stress F's = 1.25 x Fs
F's = 1.25 x 1,000 = 1,250

Therefore, F's = 1,250 psi is used for calculations and in the span tables.

Table 2103-2 FASTENER SCHEDULE FOR STRUCTURAL MEMBERS 5

DESCRIPTION OF BUILDING MATERIALS	NUMBER & TYPE[1] OF FASTENER[2,3,5]	SPACING OF FASTENERS
Joist to sill or girder, toe nail	3-8d	-
1" x 6" subfloor to each joist, face nail	2-8d 2-staples, 1 3/4"	- -
Wider than 1" x 6" subfloor to each joist, face nail	3-8d 4-staples, 1 3/4"	- -
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	4-8d or 3-16d	-
Doubled studs, face nail	16d	24" o.c.
Doubled top plates, face nail	16d	16" o.c.
Top plates, taps and intersections, face nail	2-16d	-
Continued header, two pieces	16d	16" o.c. along each edge
Ceiling joists to plate, toe nail	2-16d	-
Continuous header to stud, toe nail	4-8d	-
Ceiling joist, taps over partitions, face nail	3-16d	-
Ceiling joist to parallel rafters, face nail	3-16d	-
Rafter to plate, toe nail	3-8d	-
1" brace to each stud and plate, face nail	2-8d 2-staples, 1 3/4"	- -
1" x 6" sheathing to each bearing, face nail	2-8d 2-staples, 1 3/4"	-
1" x 8" sheathing to each bearing, face nail	2-8d 3-staples, 1 3/4"	- -
Wider than 1" x 8" sheathing to each bearing, face nail	3-8d 4-staples, 1 3/4"	- -
Built-up corner studs	16d	30" o.c.
Built-up girder and beams	20d	32" o.c. at top & bottom & staggered 2-20d at ends & at ea. splice.
2-inch planks	2-16d	at each bearing
Roof rafters to ridge, valley or hip rafters, toe nail face nail	2-16d 3-16d	- -
Collar ties to rafters, face nail	3-8d	

Table 2103-2 (continued)

DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION[1] OF FASTENERS[2,3,5]	SPACING OF FASTENERS edges.	inter. sup.[4]
Plywood subfloor, roof and wall sheathing to frame			
1/2 inch - 5/16 inch	6d staple 16 ga.	6" 4"	10" 7"
5/8 inch - 3/4 inch	8d smooth or 6d deformed	6"	10"
7/8 inch	8d	6"	10"
1 inch - 1 1/8 inch	10d smooth or 8d deformed	6"	6"
	Other wall sheathing [6]		
1/2" Fiberboard sheathing	1-1/2"gavlanized roofing nail 6d common nail staple 16 ga. 1-1/8" long	3"	6"
25/32" Fiberboard Sheathing	1-3/4" galvanized roofing nail 8d common nail staple 16 ga. 1-1/2" long	3"	6"
1/2" Gypsum Sheathing	1-1/2 galvanized roofing nail 6d common nail staple 16 ga. 1-1/2" long	4"	8"
Particleboard wall Sheathing (Exterior-Type 2-B-1) 3/8" - 1/2"	6d common nail	6"	12"
5/8" - 3/4"	8d common nail staple 16 ga. 1-1/2" long	6"	12"
Combination subfloor-underlayment to framing			
3/4 inch and less	6d deformed	6"	10"
7/8 inch - 1 inch	8d deformed	6"	10"
1-1/8 inches - 1-1/4 inches	10d smooth or 8d deformed	6"	6"

Note 1. All nails are smooth-common, box or deformed shanks except where otherwise stated.

Note 2. Nail is a general description and may be T-head, modified round head or round head.

Note 3. Staples are sixteen (16) gauge wire and have a minimum seven-sixteenths (7/16) inch O.D. crown width.

Note 4. Nails shall be spaced at not more than six (6) inches o.c. at all supports where spans are forty-eight (48) inches or greater. Nails shall be spaced at not more than ten (10) inches o.c. at intermediate supports for floors.

Note 5. The number of fasteners required for connections not included in this table shall be based on the values set forth in Reference Standard RS-21-6.

Note 6. 4' x 8' or 4' x 9' panels shall be applied vertically.

Table 2103-3
FRAMING SIZES

Stud Size	Wall Bearing	Maxim Spacing	Min. # & Plate Size	Min. Sole	Max. Stud Height	Comments & Notes
2"x6"	yes f	24"	single 2"x6" a, d	2"x6"	20'b,c,e	2 post corner see Figure 2103-3
2"x6"	no	48"	single 2"x6" a, d	2"x6"	note i	
3"x4"	yes f	24"	single 2"x4"	2"x4"	14' b	
2"x4"	yes f	16"	double 2"x4" g	2"x4"	14' b,e,h	
2"x3"	no	48"	single 2"x3"	2"x3"	10' e,f,i	Exterior wall & Interior patition junction - see Figure 2103-3
2"x4"	no	24"	double 2"x4" g	2"x4"	14' b,e	

Notes to Table 2103-3

Note a. Allowed if plate spliced directly over studs.

Note b. Maximum eight (8) foot height for utility studs.

Note c. Allowed in up to three (3) story buildings only.

Note d. Allowed if 1/8" x 1 1/2" x 6" inches metal tie plates used and if ceiling joists and/or roof trusses directly over studs

Note e. Maximum allowable height unless braced laterally.

Note f. Allowed if supporting not more than a ceiling and roof load when using utility studs.

Note g. If all elements line up, then twenty-four (24) inch spacing allowed with single plate.

Note h. Allowed only up to two (2) stories in height unless first floor is framed with 2" x 6" studs, then three (3) stories.

Note i. Ten (10) foot maximum for utility studs.

Note j. One (1(1) inch sole plate attached to studs by end nailing is acceptable.

Note k. Exceptions are allowed when an engineering analysis using standard accepted practice is provided to justify variations from the above Table 2103-3.

Table 2103-4
MAXIMUM ALLOWABLE SPANS FOR HEADERS
SUPPORTING WOOD FRAME WALLS

Size of Steel Header	Size of Wood Header [3]	Allowable Span of Headers in Feet for Bearing Walls [1,2]			
		Sptg. Roof	One Story Above	Two Stories Above	Allowable Span of Headers in Garages or in Walls not Supporting Floors or Roofs
2-½x2-¼x1/4	2-2"x4"	4'	-	-	6'
3-½x3-¼x1/4	2-2"x6"	4' to 6'	4'	-	6' to 8'
6x1-7/8 jr	2-2"x8"	6' to 8'	4' to 6'	-	8' to 10'
4x2-5/8	2-2"x10"	8' to 10'	6' to 8'	4' to 6'	10' to 12'
7x2-1/8 jr	2-2"x12"	10' to 12'	8' to 10'	6' to 8'	12' to 16'

Notes to Table 2103-4

Note 1. Based on header providing support for wall height equal to width of opening.

Note 2. Nominal four (4) inch wide single headers may be substituted for the double members.

Note 3. Spans are based on number two (2) or Standard Grade lumber. Number three (3) Grade lumber may be used with appropriate design.

Table 2103-5
PLYWOOD WALL SHEATHING
Face Grain Parallel or
Perpendicular to Studs

Minimum Thickness	Panel Identification Index	Stud Spacing (inches)		
		Siding Nailed to Studs	Sheathing Parallel to Studs	Siding Nailed to Sheathing Sheathing Perpendicular to Studs
5/16	12/0, 16/0 20/0	16	—	16
3/8	16/0, 20/0 24/0	24	16	24
1/2	24/0, 32/16	24	24	24

Table 2103-6
ALLOWABLE SPAN FOR MASONRY WALLS BETWEEN LATERAL SUPPORTS

TYPE OF MASONRY WALL	ALLOWABLE[4] H or L (between supports)[1]
Stone	$14 \times t^2$
Cavity and[3] Hollow Units	$18 \times t^2$
Solid and Grouted (plain)	$20 \times t^2$
Reinforced Grouted	$25 \times t^2$

Notes to Table 2103-6

Note 1. Support may be provided by roofs, floors, foundations, beams, etc., in vertical direction or by pilasters, columns, piers, cross walls, etc., in horizontal direction, either but not both are required.

Note 2. "t" is taken as the nominal thickness of the wall in inches.

Note 3. "t" for cavity walls, is the sum of the nominal thickness of the wythes without the cavity.

Note 4. An additional unsupported height of six (6) feet is permitted for gable end walls.

Table 2103-7
ALLOWABLE SPAN FOR MASONRY AND STEEL LINTELS SUPPORTING MASONRY WALLS

Number of 1/2"[1] Diameter, or Equivalent Area, Reinforcing Bars	Allowable Span in[2] Feet and Inches			Structural[3] Steel
	No Floor Above	One Floor Above	Two Floors Above	
1	4'-6"	3'-0"	2'-6"	∠ 2-1/2 x 2-1/2 x 5/16 ∠ 3 x 3 x 1/4
2	6'-0"	4'-0"	3'-6"	∠ 3-1/2 x 3-1/2 x 5/16 ST 5 I
3	8'-6"	5'-0"	4'-0"	ST 5 ST 6 I
4	10'-0"	6'-0"	5'-0"	ST 6 ST 8 B

Notes to Table 2103-7

Note 1. Depth of reinforced lintels shall be not less than eight (8) inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than eight (8) inches into the support.

Note 2. Based on ten (10) foot tributary floor and roof loads; in other words, headers located in exterior walls and supporting twenty (20) foot span joists or headers located in interior bearing walls and supporting joists spanning ten (10) foot wide rooms on each side.

Note 3. Extend steel lintels six (6) inches into the support.

TABLE 2103-7A
ALLOWABLE SPANS FOR LINTELS
SUPPORTING MASONRY VENEER

Size of Steel Angle[1]	No Story Above	One Story Above	Two Stories Above	No. of 1/2" or Equivalent Reinforcing Bars[2]
∠ 3 X 3 X 1/4	6' - 0"	3' - 6"	3' - 0"	1
∠ 4 X 3 X 1/4	8' - 0"	5' - 0"	3' - 0"	1
∠ 6 X 3 1/2 X 1/4	14' - 0"	8' - 0"	3' - 6"	2
∠2 - 6 X 3 1/2 X 1/4	20' - 0"	11' - 0"	5' - 0"	4

Notes to Table 2103-7A

Note 1. Long leg of the angle shall be placed in a vertical position.

Note 2. Depth of reinforced lintels shall be not less than eight (8) inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than eight (8) inches into the support.

Table 2108-A

DESIGN VALUES FOR JOISTS AND RAFTERS-VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing the "F_b" values should be reduced 13 percent. Values for surfaced dry or surfaced green lumber apply at 19 percent maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F_b" Normal Duration	Snow Loading	7 Day Loading	Modulus of Elasticity "E"
ASPEN (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1300	1500	1620	1,100,000
No. 1 & Appearance		1100	1260	1380	1,100,000
No. 2		900	1040	1120	1,000,000
No. 3		525	600	660	900,000
Stud		525	600	660	900,000
BALSAM FIR (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1350	1550	1690	1,200,000
No. 1 & Appearance		1150	1320	1440	1,200,000
No. 2		950	1090	1190	1,100,000
No. 3		550	630	690	900,000
Stud		550	630	690	900,000
BLACK COTTONWOOD (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1000	1150	1250	1,200,000
No. 1 & Appearance		875	1010	1090	1,200,000
No. 2		700	800	880	1,100,000
No. 3		425	490	530	900,000
Stud		425	490	530	900,000
CALIFORNIA REDWOOD (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	2000	2300	2500	1,400,000
Select Structural, Open grain		1600	1840	2000	1,100,000
No. 1		1700	1960	2120	1,400,000
No. 1, Open grain		1350	1550	1690	1,100,000
No. 2		1400	1610	1750	1,250,000
No. 2, Open grain		1100	1260	1380	1,000,000
No. 3		800	920	1000	1,100,000
No. 3, Open grain		650	750	810	900,000
Stud		650	750	810	900,000
COAST SITKA SPRUCE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1500	1720	1880	1,700,000
No. 1 & Appearance		1250	1440	1560	1,700,000
No. 2		1050	1210	1310	1,500,000
No. 3		600	690	750	1,300,000
Stud		600	690	750	1,300,000
COAST SPECIES (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1500	1720	1880	1,500,000
No. 1 & Appearance		1250	1440	1560	1,500,000
No. 2		1050	1210	1310	1,400,000
No. 3		600	690	750	1,200,000
Stud		600	690	750	1,200,000
DOUGLAS FIR-LARCH (Surfaced dry or surfaced green)					
Dense Select Structural	2x5 and wider	2400	2760	3000	1,900,000
Select Structural		2050	2360	2560	1,800,000
Dense No. 1		2050	2360	2560	1,900,000
No. 1 & Appearance		1750	2010	2190	1,800,000
Dense No. 2		1700	1960	2120	1,700,000
No. 2		1450	1670	1810	1,700,000
No. 3		850	980	1060	1,500,000
Stud		850	980	1060	1,500,000
DOUGLAS FIR SOUTH (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1950	2240	2440	1,400,000
No. 1 & Appearance		1650	1900	2060	1,400,000
No. 2		1350	1550	1690	1,300,000
No. 3		800	920	1000	1,100,000
Stud		800	920	1000	1,100,000

Table 2103-8B

DESIGN VALUES FOR JOISTS AND RAFTERS--VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values should be reduced 13 percent.

Values for surfaced dry or surfaced green lumber apply at 19 percent maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F_b" Normal Duration	Snow Loading	7 Day Loading	Modulus of Elasticity "E"
EASTERN HEMLOCK - TAMARACK (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1750	2010	2190	1,300,000
No. 1 & Appearance		1500	1720	1880	1,300,000
No. 2		1200	1380	1500	1,100,000
No. 3		725	830	910	1,000,000
Stud		725	830	910	1,000,000
EASTERN SPRUCE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1500	1720	1880	1,400,000
No. 1 & Appearance		1250	1440	1560	1,400,000
No. 2		1000	1150	1250	1,200,000
No. 3		600	690	750	1,100,000
Stud		600	690	750	1,100,000
EASTERN WHITE PINE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1350	1550	1690	1,200,000
No. 1 & Appearance		1150	1320	1440	1,200,000
No. 2		950	1090	1190	1,100,000
No. 3		550	630	690	1,000,000
Stud		550	630	690	1,000,000
EASTERN WOODS (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1300	1500	1620	1,100,000
No. 1 & Appearance		1100	1260	1380	1,100,000
No. 2		900	1040	1120	1,000,000
No. 3		525	600	660	900,000
Stud		525	600	660	900,000
ENGELMANN SPRUCE–ALPINE FIR (ENGELMANN SPRUCE–LODGEPOLE PINE)					
Select Structural	2x5 and wider	1350	1550	1690	1,300,000
No. 1 & Appearance		1150	1320	1440	1,300,000
No. 2		950	1090	1190	1,100,000
No. 3		550	630	690	1,000,000
Stud		550	630	690	1,000,000
HEM–FIR (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1650	1900	2060	1,500,000
No. 1 & Appearance		1400	1610	1750	1,500,000
No. 2		1150	1320	1440	1,400,000
No. 3		675	780	840	1,200,000
Stud		675	780	840	1,200,000
IDAHO WHITE PINE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1300	1500	1620	1,400,000
No. 1 & Appearance		1100	1260	1380	1,400,000
No. 2		925	1060	1160	1,300,000
No. 3		550	630	690	1,200,000
Stud		550	630	690	1,200,000
LODGEPOLE PINE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1500	1720	1880	1,300,000
No. 1 & Appearance		1300	1500	1620	1,300,000
No. 2		1050	1210	1310	1,200,000
No. 3		625	720	780	1,000,000
Stud		625	720	780	1,000,000

Table 2108-C

DESIGN VALUES FOR JOISTS AND RAFTERS-VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing the "F_b" values should be reduced 13 percent. Values for surfaced dry or surfaced green lumber apply at 19 percent maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F_b" Normal Duration	Snow Loading	7 Day Loading	Modulus of Elasticity "E"
MOUNTAIN HEMLOCK (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1700	1960	2120	1,300,000
No. 1 & Appearance		1450	1670	1810	1,300,000
No. 2		1200	1380	1500	1,100,000
No. 3		700	800	880	1,000,000
Stud		700	800	880	1,000,000
MOUNTAIN HEMLOCK – HEM-FIR (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1650	1900	2060	1,300,000
No. 1 & Appearance		1400	1610	1750	1,300,000
No. 2		1150	1320	1440	1,100,000
No. 3		675	780	840	1,000,000
Stud		675	780	840	1,000,000
NORTHERN PINE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1600	1840	2000	1,400,000
No. 1 & Appearance		1400	1610	1750	1,400,000
No. 2		1100	1260	1380	1,300,000
No. 3		650	750	810	1,100,000
Stud		650	750	810	1,100,000
NORTHERN SPECIES (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1300	1500	1620	1,100,000
No. 1 & Appearance		1150	1320	1440	1,100,000
No. 2		925	1060	1160	1,000,000
No. 3		550	630	690	900,000
Stud		550	630	690	900,000
NORTHERN WHITE CEDAR (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1150	1320	1440	800,000
No. 1 & Appearance		1000	1150	1250	800,000
No. 2		825	950	1030	700,000
No. 3		475	550	590	600,000
Stud		475	550	590	600,000
PONDEROSA PINE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1400	1610	1750	1,200,000
No. 1 & Appearance		1200	1380	1500	1,200,000
No. 2		975	1120	1220	1,100,000
No. 3		575	660	720	1,000,000
Stud		575	660	720	1,000,000
PONDEROSA PINE–SUGAR PINE (PONDEROSA PINE–LODGEPOLE PINE) (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1400	1610	1750	1,200,000
No. 1 & Appearance		1200	1380	1500	1,200,000
No. 2		975	1120	1220	1,100,000
No. 3		575	660	720	1,000,000
Stud		575	660	720	1,000,000
RED PINE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1350	1550	1690	1,300,000
No. 1 & Appearance		1150	1320	1440	1,300,000
No. 2		950	1090	1190	1,200,000
No. 3		550	630	690	1,000,000
Stud		550	630	690	1,000,000

Table 2108-D

DESIGN VALUES FOR JOISTS AND RAFTERS-VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing the "F_b" values should be reduced 13 percent. Values for surfaced dry or surfaced green lumber apply at 19 percent maximum moisture content in use.

Species and Grade	Size	Design Value In Bending "F_b" Normal Duration	Snow Loading	7 Day Loading	Modulus of Elasticity "E"
SITKA SPRUCE (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1550	1780	1940	1,500,000
No. 1 & Appearance		1300	1500	1620	1,500,000
No. 2		1050	1210	1310	1,300,000
No. 3		600	690	750	1,200,000
Stud		600	690	750	1,200,000
SOUTHERN PINE (Surfaced dry)					
Select Structural	2x5 and wider	2000	2300	2500	1,700,000
Dense Select Structural		2350	2700	2940	1,800,000
No. 1		1700	1960	2120	1,700,000
No. 1 Dense		2000	2300	2500	1,800,000
No. 2		1400	1610	1750	1,600,000
No. 2 Dense		1650	1900	2060	1,600,000
No. 3		800	920	1000	1,400,000
No. 3 Dense		925	1060	1160	1,500,000
Stud		850	980	1060	1,400,000
SOUTHERN PINE (Surfaced at 15 percent moisture content KD)					
Select Structural	2x5 and wider	2150	2470	2690	1,800,000
Dense Select Structural		2500	2880	3120	1,900,000
No. 1		1850	2130	2310	1,800,000
No. 1 Dense		2150	2470	2690	1,900,000
No. 2		1500	1720	1880	1,600,000
No. 2 Dense		1750	2010	2190	1,700,000
No. 3		875	1010	1090	1,500,000
No. 3 Dense		1000	1150	1250	1,500,000
Stud		900	1040	1120	1,500,000
SPRUCE-PINE-FIR (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1450	1670	1810	1,500,000
No. 1 & Appearance		1200	1380	1500	1,500,000
No. 2		1000	1150	1250	1,300,000
No. 3		575	660	720	1,200,000
Stud		575	660	720	1,200,000
WESTERN CEDARS (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1500	1720	1880	1,100,000
No. 1 & Appearance		1300	1500	1620	1,100,000
No. 2		1050	1210	1310	1,000,000
No. 3		625	720	780	900,000
Stud		625	720	780	900,000
WESTERN CEDARS (NORTH) (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1450	1670	1810	1,100,000
No. 1 & Appearance		1250	1440	1560	1,100,000
No. 2		1000	1150	1250	1,000,000
No. 3		600	690	750	900,000
Stud		600	690	750	900,000

Table 2108-E

DESIGN VALUES FOR JOISTS AND RAFTERS-VISUAL GRADING

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing the "F_b" values should be reduced 13 percent. Values for surfaced dry or surfaced green lumber apply at 19 percent maximum moisture content in use.

Species and Grade	Size	Design Value in Bending "F_b" Normal Duration	Snow Loading	7 Day Loading	Modulus of Elasticity "E"
SPRUCE-PINE-FIR (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1450	1670	1810	1,500,000
No. 1 & Appearance		1200	1380	1500	1,500,000
No. 2		1000	1150	1250	1,300,000
No. 3		575	660	720	1,200,000
Stud		575	660	720	1,200,000
WESTERN CEDARS (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1500	1720	1880	1,100,000
No. 1 & Appearance		1300	1500	1620	1,100,000
No. 2		1050	1210	1310	1,000,000
No. 3		625	720	780	900,000
Stud		625	720	780	900,000
WESTERN CEDARS (NORTH) (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1450	1670	1810	1,100,000
No. 1 & Appearance		1250	1440	1560	1,100,000
No. 2		1000	1150	1250	1,000,000
No. 3		600	690	750	900,000
Stud		600	690	750	900,000
EASTERN HEMLOCK (Surfaced dry or surfaced green)					
Select Structural	2x5 and wider	1750	2010	2190	1,200,000
No. 1 & Appearance		1500	1720	1880	1,200,000
No. 2		1250	1440	1560	1,100,000
No. 3		725	830	910	1,000,000
Stud		725	830	910	1,000,000

Table 2103-9

DESIGN VALUES FOR JOISTS AND RAFTERS– MACHINE STRESS RATED LUMBER

These "F_b" values are for use where repetitive members are spaced not more than 24 inches. For wider spacing, the "F_b" values should be reduced 13 percent.

Values apply at 19 percent maximum moisture content in use.

Grade Designation	Grading Rules Agency (see footnotes 1,2,3,4)	Size Classification	Design Value in Bending "F_b"			Modulus of Elasticity "E"
			Normal Duration	Snow Loading	7-Day Loading	
900f-1.0E	3	Machine rated lumber, 2x4 and wider	1050	1210	1310	1,000,000
1200f-1.2E	1,2,3,4		1400	1610	1750	1,200,000
1350f-1.3E	2,4		1550	1780	1940	1,300,000
1450f-1.3E	1,3,4		1650	1900	2060	1,300,000
1500f-1.4E	1,2,3,4		1750	2010	2190	1,400,000
1650f-1.5E	1,2,3,4		1900	2180	2380	1,500,000
1800f-1.6E	1,2,3,4		2050	2360	2560	1,600,000
1950f-1.7E	1,2,4		2250	2590	2810	1,700,000
2100f-1.8E	1,2,3,4		2400	2760	3000	1,800,000
2250f-1.9E	1,2,4		2600	2990	3250	1,900,000
2400f-2.0E	1,2,3,4		2750	3160	3440	2,000,000
2550f-2.1f	1,2,4		2950	3390	3690	2,100,000
2700f-2.2E	1,2,3,4		3100	3570	3880	2,200,000
2850f-2.3E	2,4		3300	3800	4130	2,300,000
3000f-2.4E	1,2,4		3450	3970	4310	2,400,000
3150f-2.5E	2,4		3600	4140	4500	2,500,000
3300f-2.6E	2,4		3800	4370	4750	2,600,000
900f-1.0E	1,2,3,4	See footnotes	1050	1210	1310	1,000,000
900f-1.2E	1,2,3,4		1050	1210	1310	1,200,000
1200f-1.5E	1,2,3,4		1400	1610	1750	1,500,000
1350f-1.8E	1,2,4		1550	1780	1940	1,800,000
1500f-1.8E	3		1750	2010	2190	1,800,000
1800f-2.1E	1,2,3,4		2050	2360	2560	2,100,000

1. National Lumber Grades Authority (see Footnote 2, Table W-1) Machine Rated Lumber, 2x4 and wider.

2. Southern Pine Inspection Bureau; Machine Rated Lumber, 2x4 and wider.

3. West Coast Lumber Inspection Bureau; Machine Rated Lumber, 2x4 and wider; Machine Rated Joists, 2x6 and wider.

4. Western Wood Products Association; Machine Rated Lumber, 2x4 and wider.

SECTION 2104.0 WALL COVERING

2104.1 General: Interior and exterior wall covering shall conform to the requirements of this section.

2104.1.1 Compliance: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

2104.2 Interior coverings

2104.2.1 General: Interior coverings shall be installed in accordance with this section and Table 2104-6.

2104.2.2 Vertical assemblies: Vertical support for lath or gypsum wallboard shall be not less than two (2) inches nominal in least dimension. Wood stripping for furring shall be not less than two (2) inches nominal thickness in the least dimension except that furring strips not less than one (1) inch by two (2) inch dimension may be used over solid backing.

2104.2.3 Moisture protection: Where wood frame walls and partitions are covered on the interior with plaster or tile or similar material and subject to water splash, the framing shall be protected with an approved moisture barrier.

2104.2.3.1 Lath application: Gypsum lath shall be applied with the long dimension perpendicular to supports, and with end joints staggered in successive courses. End joints may occur on one support where lath is applied the full length of the joint.

2104.2.3.2 Attachment: The type and weight of metal lath, the gauge and spacing of nails and staples, the spacing of supports, and the methods of attachment to wood supports shall be as set forth in the reference standards, except that gypsum veneer plaster may be applied in one (1) coat.

2104.2.4 Interior plaster: Plastering with gypsum plaster or portland cement plaster shall be not less than three (3) coats when applied over metal lath or wire lath and shall be not less than two (2) coats when applied over other bases permitted by this section except that veneer plaster may be applied in one (1) coat, not to exceed three-sixteenths (3/16) inch thickness.

2104.2.5 Gypsum wallboard: All gypsum wallboard shall be installed in accordance with the provisions of this section.

2104.2.5.1 Installation protection: Gypsum wallboard shall not be installed until weather protection is provided.

2104.2.5.2 Supports: Supports shall be spaced not to exceed the spacing as set forth in Table 2104-6 for single-ply application.

2104.2.5.3 Spacing: All edges and ends of gypsum wallboard shall occur on the framing members, except those edges and ends which are perpendicular to the framing members.

2104.2.5.4 Fastening: The size and spacing of fasteners shall comply with Table 2104-6.

2104.2.6 Shower and bath compartments: Shower and bath stalls and compartments shall be finished in accordance with the requirements of 105 CMR 410.000 (Article II State Sanitary Code, Minimum Standards of Fitness for Human Habitation).

2104.2.7 Other interior finishes: All approved interior finishes shall conform to the applicable reference standards of this article.

2104.3 Exterior coverings

2104.3.1 General: Exterior coverings shall be installed in accordance with this section, Table 2104-7 and manufacturer's recommendations.

2104.3.2 Exterior lath: All lath and lath attachments shall be of corrosion-resistant materials.

2104.3.2.1 Backing: Backing for vertical surfaces shall consist of sheathing or of not less than No. 18 U.S. gauge steel wire stretched taut horizontally and spaced not more than six (6) inches apart vertically.

2104.3.2.2 Backing support: Where lath on vertical surfaces extends between rafters, or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

2104.3.2.3 Gypsum lath: Gypsum lath shall not be used, except that on horizontal supports of ceilings or roof soffits, it may be used as backing for metal lath or wire lath and portland cement plaster.

2104.3.2.4 Required backing: Backing is not required under metal lath or paperbacked wire lath.

2104.3.3 Exterior plaster: Plastering with portland cement plaster shall be not less than three (3) coats when applied over metal lath or wire lath and shall be not less than two (2) coats

when applied over masonry, concrete, or gypsum backing. If plaster surface is completely covered by veneer or other facing material, or is completely concealed, plaster application need only be two (2) coats provided the total thickness is as set forth by manufacturer's recommendations.

2104.3.4 Masonry veneer

2104.3.4.1 General: All masonry veneer shall be installed in accordance with this section and manufacturer's recommendations.

2104.3.4.2 Veneer support: Masonry veneer shall not support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported upon lintels of noncombustible material and the allowable span shall not exceed the values set forth in Table 2103-7. The lintels shall have a bearing of not less than four (4) inches.

2104.3.4.3 Metal ties: Masonry veneer shall be attached to the supporting wall with corrosion-resistant metal ties. Veneer ties, if strand wire, shall be not less in thickness than No. 6 U.S. gauge wire and shall have a hook embedded in the mortar joint, or if sheet metal, not less than No. 22 U.S. gauge corrugated. Each tie shall be spaced not more than twenty-four (24) inches on center horizontally and shall support not more than three and one-quarter (3-1/4) square feet of wall area.

Exception: In wind areas of more than thirty (30) pounds per square foot, each tie shall support not more than two (2) square feet of wall area.

2104.3.4.4 Other method: In lieu of such wire ties, an approved method of grouting the veneer to a paperbacked reinforcement attached directly to the studs may be used.

2104.3.5 Weather protection

2104.3.5.1 Wall protection: Exterior walls shall be covered with a weather-resistant siding and/or membrane.

2104.3.5.2 Weather-resistant membrane: Asphalt-saturated felt free from holes and breaks and weighing not less than fourteen (14) pounds per one hundred (100) square feet or other approved weather-resistant membrane shall be applied over studs or sheathing of all exterior walls as required by Table 2104-7. Such felt or membrane shall be applied weatherboard fashion, lapped not less than two (2) inches at horizontal joints and not less than six (6) inches at vertical joints.

Exception: Such felt or membrane may be omitted in the following cases:
1. Under weather-resistant siding as per Table 2104-7.
2. In accessory buildings.
3. Under approved paperbacked metal or wire fabric lath.
4. Under metal lath, wire lath or wire fabric lath on noncombustible construction.
5. Under insulated sheathing boards.

2104.3.5.3 Flashing: Approved corrosion-resistive flashing shall be provided at top and sides of all exterior window and door openings in such manner as to be leakproof. Similar flashings shall be installed at the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings; under and at the ends of masonry, wood or metal copings and sills; continuously above all projecting wood trim; at wall and roof intersections; under built-in gutters; at junction of chimneys and roofs; in all roof valleys and around all roof openings.

2104.3.6 Sheathing

2104.3.6.1 Plywood application: Exterior plywood joints shall occur over framing members, unless wood or plywood sheathing is used underneath, or joints are lapped horizontally a minimum of one and one-half (1-1/2) inches, or battens are applied, or tongue and groove or ship lap sheets are used, or otherwise made waterproof to the satisfaction of the building official.

2104.3.6.2 Sheathing insulation board: Insulation boards are approved for sheathing when recognized for this use by an accredited authoritative agency listed in Appendix A of the basic code.
1. Each board shall be clearly marked with a model code approval, recognized testing laboratory label, or as approved by the Massachusetts State Building Code Commission.
2. Insulation-sheathing boards are to be fastened at each stud. When square edged boards are used, vertical joints must be over framing members. When tongue and groove edged boards are used, vertical joints may fall between studs when the boards above and below the joint are continuous across that wall area.

   Fasteners may be seven-sixteenths (7/16) inch head roofing nails or three-quarters (3/4) inch crown staples on eight (8) inch centers, one (1) inch head nails or one (1) inch crown staples on twelve (12) inch centers, or any other fastener approved by the building official.

   All fasteners shall be long enough to penetrate the studs a minimum of one-half (1/2) inch.

Exterior finish-siding fasteners must go through the sheathing and into the studs a minimum of three-quarters (3/4) inch.

3. A membrane under the siding is not required when insulation-sheathing boards are used.

Table 2104-6
APPLICATION OF GYPSUM WALLBOARD

THICKNESS OF GYPSUM WALLBOARD (Inch)	PLANE OF FRAMING SURFACE	LONG DIMENSION OF GYPSUM WALLBOARD SHEETS IN RELATION TO DIRECTION OF FRAMING MEMBERS	MAXIMUM SPACING OF FRAMING MEMBERS (center-to-center) (In Inches)	MAXIMUM SPACING OF FASTENERS (center-to-center) (In Inches)		NAILS[1] — TO WOOD
				NAILS[1,2]	SCREWS[3]	
1/2	Horizontal	Either Direction	16		12	No.13 gauge, 1-3/8" long, 19/64" head No. .098 gauge, 1-1/4" long, Annular ringed 5d, cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical		24	8	12	
5/8	Horizontal	Either Direction	16	7	12	No. 13 gauge, 1-5/8" long, 19/64" head No. .098 gauge, 1-3/8" long, Annular ringed 6d, cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either Direction	24		12	
Fastening Required with Adhesive Application						
1/2 or 5/8	Horizontal	Either Direction	16	16	16	As required for 1/2" and 5/8" gypsum wallboard, see above
		Perpendicular	24	12	16	
	Vertical	Either Direction	24	24	24	
2-3/8 (3/4 total)	Horizontal	Perpendicular	24	16	16	Base ply nailed as required for 1/2" gypsum wallboard and face ply placed with adhesive
	Vertical	Either Direction	24	24	24	

Notes to Table 2104-6

Note 1. Where the metal framing has a clinching design formed to receive the nails by two (2) edges of metal, the nails shall be not less than five-eighths (5/8) inch longer than the wallboard thickness, and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, No. 13 1/2 gauge, one and five-eighths (1 5/8) inches long, fifteen-sixty-fourths (15/64) inch head for one-half (1/2) inch gypsum wallboard; 6d, No. 13 gauge, one and seven-eighths (1 7/8) inches long, fifteen-sixty-fourths (15/64) inch head for five-eighths (5/8) inch gypsum wallboard.

Note 2. Two (2) nails spaced not less than two (2) inches apart, nor more than two and one-half (2 1/2) inches apart and pairs of nails spaced not more than twelve (12) inches center-to-center may be used.

Note 3. Screws shall be No. 6 with tapered head and long enough to penetrate into wood framing not less than five-eighths (5/8) inch and metal framing not less than one-quarter (1/4) inch.

Table 2104-7
WEATHER-RESISTANT SIDING ATTACHMENT

Siding Material		Nominal[1] Thickness (Inches)	Joint Treatment	Weather Resistance Membrane Required	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS[9]				
					Wood or Plywood Sheathing	Fiberboard Sheathing into Stud	Gypsum Sheathing into Stud	Direct to Studs	Number of Spacing of Fasteners
Horiz. Alum.[8]	Without Insulation	.019[10]	Lap	No	.120-Nail-1½"	.120-Nail-2"	.120-Nail-2"	Not Allowed	Same as Stud Spacing
		.024	Lap	No	.120-Nail 1½" long	.120-Nail 2" long	.120-Nail 2" long	Not Allowed	
	With Insul.	.019	Lap	No	.120-Nail-1½"	.120-Nail-2½"	.120-Nail-2½"	.120-Nail-1½"	
Horizontal Asbestos Cement Boards Shingles[7]		5/32 1/8	(2) Lap	(2) Yes	.113-Nail-1½"	.113-Nail-2"	.113-Nail-1 3/4"	.113-Nail-1 3/8"	2 Nails per Shingle
Brick Veneer Clay Tile Veneer Concrete Veneer		2 1/4 to 1 2	Sec. 2103.3	Yes	-See Sec. 2103.3 and Figure 2103-1				
Horizontal Fiberboard[3]		1/2	Sec. 2103.3	No	.099-Nail-2" Staple 1 3/4"	.113-Nail-2 3/4" Staple 2½"	.113-Nail-2½" Staple 2½"	.099-Nail-2" Staple 1 3/4"	Same as Stud Spacing
Hardboard[3] Board and Batten Vertical		1/4	(2)	(2)	.099-Nail-2" Staple 1½"	.099-Nail-2½" Staple 2"	.099-Nail-2" Staple 1 3/4"	.099-Nail-1 3/4" Staple 1½"	6"Panel Edges 8"Inter. Sup.
Hardboard[3] Lap Siding Horizontal		7/16	(2)	(2)	.099-Nail-2" Staple 1 7/8"	.099-Nail-2½" Staple 2½"	.099-Nail-2½" Staple 2½"	.099-Nail-2" Staple 1 7/8"	Same as Stud Spacing 2 per Bearing
Vertical Panel Siding		7/16	(2)	(2)	.099-Nail-2" Staple 1½"	.099-Nail-2½" Staple 2½"	.099-Nail-2" Staple 2"	.080-Nail-1 3/4" Staple 1½"	6"Panel Edges 12"Inter.Sup.
Steel[3]		29 ga.	Lap	No	.113-Nail-1 3/4" Staple 1 3/4"	.113-Nail-2 3/4" Staple 2½"	.113-Nail-2½" Staple 2½"	Not Allowed	Same as Stud Spacing
Stone Veneer		2	Sec. 2103.3	Yes	-See Sec. 2103.3 and Figure 2103-3-				
Particleboard Panels		3/8	(2)	(2)	.113-NG 1-2" Staple 1 3/8"	.113-Nail-2½" Staple 2½"	.113-Nail 1-2" Staple 2"	Not Allowed	6" on Edges 8" Inter.Sup.
		5/8	(2)	(2)	.113-Nail-2" Staple 1 7/8"	.113-Nail-2½" Staple 2½"	.113-Nail-2½" Staple 2½"	.113-Nail-2" Staple 1 5/8"	6"on Edges 8"Inter.Sup.
Plywood Panels[11] (Exterior Grade)		3/8	(2)	(2)	.099-Nail-2" Staple 1 3/8"	.113-Nail-2½" Staple 2½"	.099-Nail-2" Staple 2"	.099-Nail-2" Staple 1 3/8"	6"on Edges 12" Inter Sup.
Wood Rustic,Drop Shiplap		3/8 19/32 Av.	Lap	No	Fastener Penetration Into Stud—1"			.113-Nail 2½" Staple 2"	Face Nailing up to 6" Widths, 1 Nail per bearing. 8"Widths and over, 2 Nails per Bearing
Bevel Butt		7/16	Lap	No					
Tipp		3/16	Lap	No					
Shakes[7]		3/8	Lap	Yes	.0915-Nail-2" Staple 2"				
Shingles[7]		3/8	Lap	Yes	16" and 18" Shingles		.076-Nail-1¼"		2 Fasteners per Shingle or Shake
							Staple - 1¼"		
					24" Shingles		.080-Nail-1½"		
							Staple - 1½"		

Notes to Table 2104-7

Note 1. Based on stud spacing of sixteen (16) inches o.c. Where studs are spaced twenty-four (24) inches siding may be applied to sheathing approved for that spacing.

Note 2. If boards are applied over sheathing or weather-resistant membrane joints need not be treated. Otherwise, vertical joints must occur at studs and covered with batts.

Note 3. Shall be of approved type.

Note 4. Nail is a general description and may be T-head, modified round head, or round head with smooth or deformed shanks.

Note 5. Staples shall have a minimum crown width of seven-sixteenths (7/16) inch o.d. and be manufactured of minimum sixteen (16) gauge wire.

Note 6. All attachments shall be coated with a corrosion-resistive coating.

Note 7. Shingles and shakes applied over regular density fiberboard or gypsum sheathing shall be fastened to horizontal wood nailers or fiberboard shingle backer.

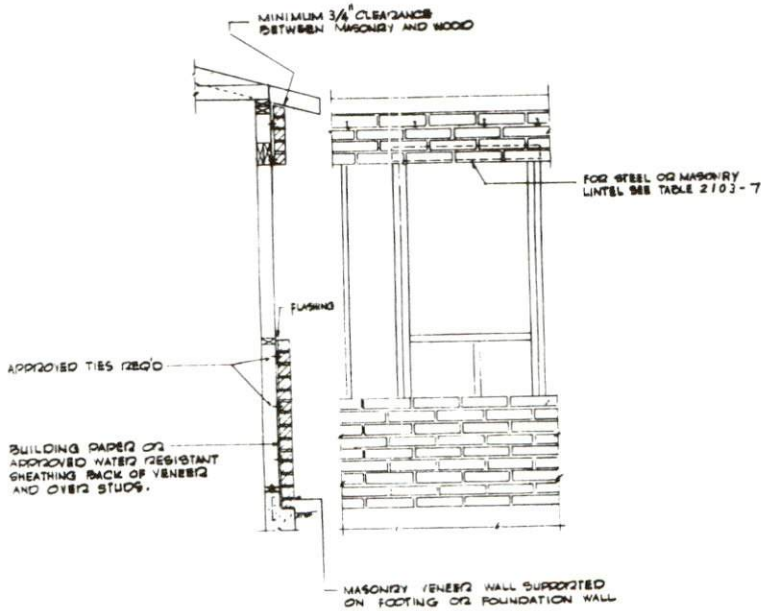
Note 8. Aluminum nails shall be used to attach aluminum siding.

Note 9. Nails or staples must be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs for fiberboard or gypsum backing.

Note 10. Aluminum (0.19-inch) may be unbacked only when the flat areas are five (5) inches or less in the narrow dimension.

Note 11. Three-eighths (3/8) inch plywood may be applied direct to studs spaced sixteen (16) inches on center. One-half (1/2) inch plywood may be applied direct to studs spaced twenty-four (24) inches on center.

Figure 2104-7
MASONRY VENEERED WALL



SECTION 2105.0 FLOORS

2105.1 General: Design of floors shall be based on a first floor live load of forty (40) pounds per square foot and a second floor live load of thirty (30) pounds per square foot, with twenty (20) pounds per square foot for nonusable attics. Floors shall be constructed in accordance with the requirements of this article and Figures 2103-1 and 2103-2, Tables 2105-1 through 2105-6, and nailed in accordance with Table 2103-2, or shall comply with the reference standards of this article.

2105.1.1 Compliance: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be accepted as providing compliance with the requirements of this article.

2105.2 Wood

2105.2.1 Identification: All load-bearing lumber, plywood and particle-board shall conform to applicable standards or grading rules and shall be so identified by a grade mark, or certificate of inspection issued by an approved lumber grading or inspection bureau or agency.

2105.2.2 Grade: All joists and beams shall be of at least No. 3 or Standard Grade lumber or equivalent. Blocking and sheathing may be of Utility or No. 4 Grade lumber or equivalent.

Exception: Native lumber - Items 2105.2.1 Identification and 2105.2.2 Grade of this section shall be subject to the provisions of Section 2103.3 for native lumber.

2105.2.3 Allowable spans: The unsupported spans of floor joists shall not exceed the values set forth in Tables 2105-1 and 2105-2. The modulus of elasticity, "E", and the actual stress in bending, "F_b", shown in the Tables shall not exceed the values given.

2105.2.3.1 Girder spans: The allowable spans of girders shall be designed in accordance with Table 2105-6 and accepted engineering practice.

2105.2.3.2 Floor sheathing span: The allowable spans and minimum grades for plywood floor sheathing shall conform to the requirements set forth in Tables 2105-3 and 2105-4. The allowable spans for floor sheathing shall conform to the requirements set forth in Table 2105-5.

2105.2.4 Bearing: The ends of each joist shall have not less than one and one-half (1-1/2) inches of bearing on wood or

metal and not less than three (3) inches on masonry except where supported on a one (1) inch by four (4) inch ribbon strip and nailed to the adjacent stud.

2105.2.5 Lateral support: Joists shall be supported laterally at the ends.

2105.3 Concrete floors (on ground)

2105.3.1 General: Concrete slab-on-ground floors shall be constructed according to accepted engineering practice. The concrete shall conform to the requirements of Section 2102.2 and only approved air-entraining agents shall be used where required. When part of heated space, perimeter insulation is required according to Section 2120.5.

2105.3.1.1 Contraction joints: Slabs shall be constructed with contraction joints, having a depth of at least one-fourth (1/4) the slab thickness, and joints shall be spaced at intervals not more than thirty (30) feet in each direction and slabs not rectangular in shape shall have contraction joints across the slab at points of offset, if offset exceeds ten (10) feet.

Exception: Contraction joints are not required where 6 x 6--6/6 welded wire fabric or equivalent is placed at mid-depth of the slab.

2105.3.2 Site preparation: The area within the foundation walls shall have all vegetation, top soil and foreign material removed and the fill material shall be free of vegetation and foreign material.

2105.3.2.1 Soil compaction: The fill shall be compacted to assure uniform support of the slab and except where otherwise approved the fill depths shall not exceed twenty-four (24) inches for clean sand or gravel and eight (8) inches for earth.

2105.3.2.2 Base course: A four (4) inch thick base course shall be placed on the prepared subgrade, consisting of clean graded sand, gravel, crushed stone or crushed blast-furnace slag passing a two (2) inch sieve and retained on a one-quarter (1/4) inch sieve. An approved vapor barrier with joints lapped six (6) inches shall be placed between the base course and the concrete floor slab.

Exception: The vapor barrier may be omitted where approved by the building official, based upon local site condition.

2105.4 Metal: Steel structural elements in floors may be either hot-rolled structural steel shapes or members cold formed

to shape from steel sheet strip or plate, or a fabricated combination thereof. Members shall be straight and free of any defects which would significantly affect their structural performance.

2105.4.1 Span: The allowable span for steel girders or beams and the tributary area for steel columns in floors shall not exceed the values set forth in Tables 2105-6.

2105.4.2 Structural elements: Aluminum structural elements in floors shall be constructed of materials and designed in accordance with Reference Standard RS-21-5.

2105.5 Particleboard: Particleboard floor underlayment shall conform to Type 1-B-1 of the standards set forth in Standard RS-21-5. Underlayment shall be not less than one-quarter (1/4) inch in thickness and shall be identified by the grade mark of an approved inspection agency. Underlayment shall be installed in accordance with this code and as recommended by the manufacturer.

NON-TEXT PAGE

Table 2105-1
ALLOWABLE SPANS FOR FLOOR JOISTS

JOIST SIZE	SPACING (IN)	Modulus of Elasticity, "E", in 1,000,000 psi									
		0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2x6	12.0	7-5 440	8-0 510	8-6 570	8-11 640	9-4 700	9-9 750	10-1 810	10-5 860	10-9 910	11-0 960
	13.7	7-1 460	7-8 530	8-2 600	8-7 670	8-11 730	9-4 790	9-8 840	10-0 900	10-3 950	10-6 1010
	16.0	6-9 480	7-3 560	7-9 630	8-2 700	8-6 770	8-10 830	9-2 890	9-6 950	9-9 1000	10-0 1060
	19.2	6-4 510	6-10 600	7-3 670	7-8 740	8-0 810	8-4 880	8-8 940	8-11 1010	9-2 1070	9-5 1130
	24.0	5-11 550	6-4 640	6-9 720	7-1 800	7-5 880	7-9 950	8-0 1020	8-3 1080	8-6 1150	8-9 1210
	32.0					6-9 960	7-0 1040	7-3 1110	7-6 1190	7-9 1270	7-11 1330
2x8	12.0	9-10 440	10-7 510	11-3 570	11-10 640	12-4 700	12-10 750	13-4 810	13-9 860	14-2 910	14-6 960
	13.7	9-4 460	10-1 530	10-9 600	11-4 670	11-10 730	12-3 790	12-9 840	13-2 900	13-6 950	13-11 1010
	16.0	8-11 480	9-7 560	10-2 630	10-9 700	11-3 770	11-8 830	12-1 890	12-6 950	12-10 1000	13-2 1060
	19.2	8-5 510	9-0 600	9-7 670	10-1 740	10-7 810	11-0 880	11-4 940	11-9 1010	12-1 1070	12-5 1130
	24.0	7-9 550	8-5 640	8-11 720	9-4 800	9-10 880	10-2 950	10-7 1020	10-11 1080	11-3 1150	11-6 1210
	32.0					8-11 970	9-3 1040	9-7 1120	9-11 1200	10-2 1260	10-6 1340
2x10	12.0	12-6 440	13-6 510	14-4 570	15-1 640	15-9 700	16-5 750	17-0 810	17-6 860	18-0 910	18-6 960
	13.7	11-11 460	12-11 530	13-8 600	14-5 670	15-1 730	15-8 790	16-3 840	16-9 900	17-3 950	17-9 1010
	16.0	11-4 480	12-3 560	13-0 630	13-8 700	14-4 770	14-11 830	15-5 890	15-11 950	16-5 1000	16-10 1060
	19.2	10-8 510	11-6 600	12-3 670	12-11 740	13-6 810	14-0 880	14-6 940	15-0 1010	15-5 1070	15-10 1130
	24.0	9-11 550	10-8 640	11-4 720	11-11 800	12-6 880	13-0 950	13-6 1020	13-11 1080	14-4 1150	14-8 1210
	32.0					11-4 960	11-10 1050	12-3 1120	12-8 1200	13-0 1260	13-4 1330
2x12	12.0	15-2 440	16-5 510	17-5 570	18-4 640	19-2 700	19-11 750	20-8 810	21-4 860	21-11 910	22-6 960
	13.7	14-7 460	15-8 530	16-8 600	17-6 670	18-4 730	19-1 790	19-9 840	20-5 900	21-0 950	21-7 1010
	16.0	13-10 480	14-11 560	15-10 630	16-8 700	17-5 770	18-1 830	18-9 890	19-4 950	19-11 1000	20-6 1060
	19.2	13-0 510	14-0 600	14-11 670	15-8 740	16-5 810	17-0 880	17-8 940	18-3 1010	18-9 1070	19-3 1130
	24.0	12-1 550	13-0 640	13-10 720	14-7 800	15-2 880	15-10 950	16-5 1020	16-11 1080	17-5 1150	17-11 1210
	32.0					13-10 970	14-4 1040	14-11 1130	15-4 1190	15-10 1270	16-3 1340

Note: The extreme fiber stress in bending, "F_b", in pounds per square inch is shown below each span.

(All rooms used for sleeping areas and attic floors)
Strength - Live load of 30 lbs. per sq. ft. plus dead load of 10 lbs. per sq. ft. determines the fiber stress value shown
DESIGN CRITERIA: Deflection - For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

Table 2105-1 (cont.)

JOIST SIZE (IN)	SPACING (IN)	Modulus of Elasticity, "E", in 1,000,000 psi								
		1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
2x6	12.0	11-3 1010	11-7 1060	11-10 1100	12-0 1150	12-3 1200	12-6 1240	12-9 1280	13-1 1370	13-6 1450
	13.7	10-10 1060	11-1 1110	11-3 1160	11-6 1200	11-9 1250	11-11 1300	12-2 1340	12-7 1430	12-11 1510
	16.0	10-3 1110	10-6 1160	10-9 1220	10-11 1270	11-2 1320	11-4 1360	11-7 1410	11-11 1500	12-3 1590
	19.2	9-8 1180	9-10 1240	10-1 1290	10-4 1350	10-6 1400	10-8 1450	10-10 1500	11-3 1600	11-7 1690
	24.0	8-11 1270	9-2 1330	9-4 1390	9-7 1450	9-9 1510	9-11 1560	10-1 1620	10-5 1720	10-9 1820
	32.0	8-2 1410	8-4 1470	8-6 1530	8-8 1590	8-10 1650	9-0 1710	9-2 1780	9-6 1910	9-9 2010
2x8	12.0	14-11 1010	15-3 1060	15-7 1100	15-10 1150	16-2 1200	16-6 1240	16-9 1280	17-4 1370	17-10 1450
	13.7	14-3 1060	14-7 1110	14-11 1160	15-2 1200	15-6 1250	15-9 1300	16-0 1340	16-7 1430	17-0 1510
	16.0	13-6 1110	13-10 1160	14-2 1220	14-5 1270	14-8 1320	15-0 1360	15-3 1410	15-9 1500	16-2 1590
	19.2	12-9 1180	13-0 1240	13-4 1290	13-7 1350	13-10 1400	14-1 1450	14-4 1500	14-9 1600	15-3 1690
	24.0	11-10 1270	12-1 1330	12-4 1390	12-7 1450	12-10 1510	13-1 1560	13-4 1620	13-9 1720	14-2 1820
	32.0	10-9 1410	11-0 1470	11-3 1540	11-5 1590	11-8 1660	11-11 1730	12-1 1780	12-6 1900	12-10 2010
2x10	12.0	19-0 1010	19-5 1060	19-10 1100	20-3 1150	20-8 1200	21-0 1240	21-5 1280	22-1 1370	22-9 1450
	13.7	18-2 1060	18-7 1110	19-0 1160	19-4 1200	19-9 1250	20-1 1300	20-5 1340	21-1 1430	21-9 1510
	16.0	17-3 1110	17-8 1160	18-0 1220	18-5 1270	18-9 1320	19-1 1360	19-5 1410	20-1 1500	20-8 1590
	19.2	16-3 1180	16-7 1240	17-0 1290	17-4 1350	17-8 1400	18-0 1450	18-3 1500	18-10 1600	19-5 1690
	24.0	15-1 1270	15-5 1330	15-9 1390	16-1 1450	16-5 1510	16-8 1560	17-0 1620	17-6 1720	18-0 1820
	32.0	13-8 1400	14-0 1470	14-4 1540	14-7 1590	14-11 1660	15-2 1720	15-5 1780	15-11 1890	16-5 2020
2x12	12.0	23-1 1010	23-7 1060	24-2 1100	24-8 1150	25-1 1200	25-7 1240	26-0 1280	26-10 1370	27-8 1450
	13.7	22-1 1060	22-7 1110	23-1 1160	23-7 1200	24-0 1250	24-5 1300	24-10 1340	25-8 1430	26-5 1510
	16.0	21-0 1110	21-6 1160	21-11 1220	22-5 1270	22-10 1320	23-3 1360	23-7 1410	24-5 1500	25-1 1590
	19.2	19-9 1180	20-2 1240	20-8 1290	21-1 1350	21-6 1400	21-10 1450	22-3 1500	22-11 1600	23-7 1690
	24.0	18-4 1270	18-9 1330	19-2 1390	19-7 1450	19-11 1510	20-3 1560	20-8 1620	21-4 1720	21-11 1820
	32.0	16-8 1400	17-0 1460	17-5 1530	17-9 1590	18-1 1650	18-5 1720	18-9 1780	19-4 1890	19-11 2010

HOW TO USE TABLES: Enter Table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

Table 2105-2
ALLOWABLE SPANS FOR FLOOR JOISTS
40 Lbs. Per Sq. Ft. Live Load

JOIST SIZE	SPACING (IN)	Modulus of Elasticity, "E", in 1,000,000 psi									
		0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3
2x6	12.0	6-9 450	7-3 520	7-9 590	8-2 660	8-6 720	8-10 780	9-2 830	9-6 890	9-9 940	10-0 990
	13.7	6-6 470	7-0 550	7-5 620	7-9 690	8-2 750	8-6 810	8-9 870	9-1 930	9-4 980	9-7 1040
	16.0	6-2 500	6-7 580	7-0 650	7-5 720	7-9 790	8-0 860	8-4 920	8-7 980	8-10 1040	9-1 1090
	19.2	5-9 530	6-3 610	6-7 690	7-0 770	7-3 840	7-7 910	7-10 970	8-1 1040	8-4 1100	8-7 1160
	24.0	5-4 570	5-9 660	6-2 750	6-6 830	6-9 900	7-0 980	7-3 1050	7-6 1120	7-9 1190	7-11 1250
	32.0					6-2 1010	6-5 1090	6-7 1150	6-10 1230	7-0 1300	7-3 1390
2x8	12.0	8-11 450	9-7 520	10-2 590	10-9 660	11-3 720	11-8 780	12-1 830	12-6 890	12-10 940	13-2 990
	13.7	8-6 470	9-2 550	9-9 620	10-3 690	10-9 750	11-2 810	11-7 870	11-11 930	12-3 980	12-7 1040
	16.0	8-1 500	8-9 580	9-3 650	9-9 720	10-2 790	10-7 850	11-0 920	11-4 980	11-8 1040	12-0 1090
	19.2	7-7 530	8-2 610	8-9 690	9-2 770	9-7 840	10-0 910	10-4 970	10-8 1040	11-0 1100	11-3 1160
	24.0	7-1 570	7-7 660	8-1 750	8-6 830	8-11 900	9-3 980	9-7 1050	9-11 1120	10-2 1190	10-6 1250
	32.0					8-1 990	8-5 1080	8-9 1170	9-0 1230	9-3 1300	9-6 1370
2x10	12.0	11-4 450	12-3 520	13-0 590	13-8 660	14-4 720	14-11 780	15-5 830	15-11 890	16-5 940	16-10 990
	13.7	10-10 470	11-8 550	12-5 620	13-1 690	13-8 750	14-3 810	14-9 870	15-3 930	15-8 980	16-1 1040
	16.0	10-4 500	11-1 580	11-10 650	12-5 720	13-0 790	13-6 850	14-0 920	14-6 980	14-11 1040	15-3 1090
	19.2	9-9 530	10-6 610	11-1 690	11-8 770	12-3 840	12-9 910	13-2 970	13-7 1040	14-0 1100	14-5 1160
	24.0	9-0 570	9-9 660	10-4 750	10-10 830	11-4 900	11-10 980	12-3 1050	12-8 1120	13-0 1190	13-4 1250
	32.0					10-4 1000	10-9 1080	11-1 1150	11-6 1240	11-10 1310	12-2 1380
2x12	12.0	13-10 450	14-11 520	15-10 590	16-8 660	17-5 720	18-1 780	18-9 830	19-4 890	19-11 940	20-6 990
	13.7	13-3 470	14-3 550	15-2 620	15-11 690	16-8 750	17-4 810	17-11 870	18-6 930	19-1 980	19-7 1040
	16.0	12-7 500	13-6 580	14-4 650	15-2 720	15-10 790	16-5 860	17-0 920	17-7 980	18-1 1040	18-7 1090
	19.2	11-10 530	12-9 610	13-6 690	14-3 770	14-11 840	15-6 910	16-0 970	16-7 1040	17-0 1100	17-6 1160
	24.0	11-0 570	11-10 660	12-7 750	13-3 830	13-10 900	14-4 980	14-11 1050	15-4 1120	15-10 1190	16-3 1250
	32.0					12-7 1000	13-1 1080	13-6 1150	13-11 1220	14-4 1300	14-9 1380

Note: The extreme fiber stress in bending, "F_b", in pounds per square inch is shown below each span.

(All rooms except those used for sleeping areas and attic floors)
Strength - Live load of 40 lbs. per sq. ft. plus dead load of 10 lbs. per sq. ft. determines the fiber stress value shown.
DESIGN CRITERIA: Deflection - For 40 lbs. per sq. ft. live load. Limited to span in inches divided by 360.

Table 2105-2 (cont.)

JOIST SIZE (IN)	SPACING (IN)	Modulus of Elasticity, "E", in 1,000,000 psi								
		1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4
2x6	12.0	10-3 1040	10-6 1090	10-9 1140	10-11 1190	11-2 1230	11-4 1280	11-7 1320	11-11 1410	12-3 1490
	13.7	9-10 1090	10-0 1140	10-3 1190	10-6 1240	10-8 1290	10-10 1340	11-1 1380	11-5 1470	11-9 1560
	16.0	9-4 1150	9-6 1200	9-9 1250	9-11 1310	10-2 1360	10-4 1410	10-6 1460	10-10 1550	11-2 1640
	19.2	8-9 1220	9-0 1280	9-2 1330	9-4 1390	9-6 1440	9-8 1500	9-10 1550	10-2 1650	10-6 1750
	24.0	8-2 1310	8-4 1380	8-6 1440	8-8 1500	8-10 1550	9-0 1610	9-2 1670	9-6 1780	9-9 1880
	32.0	7-5 1450	7-7 1520	7-9 1590	7-11 1660	8-0 1690	8-2 1760	8-4 1840	8-7 1950	8-10 2060
2x8	12.0	13-6 1040	13-10 1090	14-2 1140	14-5 1190	14-8 1230	15-0 1280	15-3 1320	15-9 1410	16-2 1490
	13.7	12-11 1090	13-3 1140	13-6 1190	13-10 1240	14-1 1290	14-4 1340	14-7 1380	15-0 1470	15-6 1560
	16.0	12-3 1150	12-7 1200	12-10 1250	13-1 1310	13-4 1360	13-7 1410	13-10 1460	14-3 1550	14-8 1640
	19.2	11-7 1220	11-10 1280	12-1 1330	12-4 1390	12-7 1440	12-10 1500	13-0 1550	13-5 1650	13-10 1750
	24.0	10-9 1310	11-0 1380	11-3 1440	11-5 1500	11-8 1550	11-11 1610	12-1 1670	12-6 1780	12-10 1880
	32.0	9-9 1450	10-0 1520	10-2 1570	10-5 1650	10-7 1700	10-10 1790	11-0 1840	11-4 1950	11-8 2070
2x10	12.0	17-3 1040	17-8 1090	18-0 1140	18-5 1190	18-9 1230	19-1 1280	19-5 1320	20-1 1410	20-8 1490
	13.7	16-6 1090	16-11 1140	17-3 1190	17-7 1240	17-11 1290	18-3 1340	18-7 1380	19-2 1470	19-9 1560
	16.0	15-8 1150	16-0 1200	16-5 1250	16-9 1310	17-0 1360	17-4 1410	17-8 1460	18-3 1550	18-9 1640
	19.2	14-9 1220	15-1 1280	15-5 1330	15-9 1390	16-0 1440	16-4 1500	16-7 1550	17-2 1650	17-8 1750
	24.0	13-8 1310	14-0 1380	14-4 1440	14-7 1500	14-11 1550	15-2 1610	15-5 1670	15-11 1780	16-5 1880
	32.0	12-5 1440	12-9 1520	13-0 1580	13-3 1640	13-6 1700	13-9 1770	14-0 1830	14-6 1970	14-11 2080
2x12	12.0	21-0 1040	21-6 1090	21-11 1140	22-5 1190	22-10 1230	23-3 1280	23-7 1320	24-5 1410	25-1 1490
	13.7	20-1 1090	20-6 1140	21-0 1190	21-5 1240	21-10 1290	22-3 1340	22-7 1380	23-4 1470	24-0 1560
	16.0	19-1 1150	19-6 1200	19-11 1250	20-4 1310	20-9 1360	21-1 1410	21-6 1460	22-2 1550	22-10 1640
	19.2	17-11 1220	18-4 1280	18-9 1330	19-2 1390	19-6 1440	19-10 1500	20-2 1550	20-10 1650	21-6 1750
	24.0	16-8 1310	17-0 1380	17-5 1440	17-9 1500	18-1 1550	18-5 1610	18-9 1670	19-4 1780	19-11 1880
	32.0	15-2 1450	15-6 1520	15-10 1580	16-2 1650	16-5 1700	16-9 1770	17-0 1830	17-7 1950	18-1 2070

HOW TO USE TABLES: Enter Table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

Table 2105-3
ALLOWABLE SPANS FOR PLYWOOD FLOOR AND ROOF SHEATHING
CONTINUOUS OVER TWO OR MORE SPANS AND FACE GRAIN
PERPENDICULAR TO SUPPORTS (1) (SPAN IN INCHES)

Panel Identification Index(2) Roof Span, Roof/Floor Span	Thickness (inches)	Roof				Floor
		Maximum Span (inches)		Load (psf)		Maximum Span(5) (Inches)
		Edges Blocked(3)	Edges Unblocked	Total Load	Live Load	
12/0	5/16	12	12	155	150	0
16/0	5/16,3/8	16	16	95	75	0
20/0	5/16,3/8	20	20	75	65	0
24/0	3/8	24	20	65	50	0
24/0	1/2	24	24	65	50	0
30/12	5/8	30	26	70	50	12(6)
32/16	1/2,5/8	32	28	55	40	16(7)
36/16	3/4	36	30	55	50	16(7)
42/20	5/8,3/4, 7/8	42	32	40(4)	35(4)	20(7)
48/24	3/4,7/8	48	36	40(4)	35(4)	24

Notes to Table 2105-3

Note 1. These values apply for C-D and C-C, Structural I and II grades only. Spans shall be limited to values shown because of possible effect of concentrated loads.

Note 2. Identification Index appears on all panels in the construction grades listed in footnote (1). Allowable uniform roof load deflection limitation: 1/180th of the span under live load plus dead load, 1/240th under live load only.

Note 3. Edges may be blocked with lumber or other approved type of edge support.

Note 4. For roof live load of forty (40) psf or total load of fifty-five (55) psf, decrease spans by thirteen (13) percent or use panel with next greater Identification Index.

Note 5. Plywood edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32 inch wood strip. Allowable uniform load based on deflection of 1/360 of span is one hundred sixty-five (165) psf.

Note 6. May be sixteen (16) inches, if 25/32 inch wood strip flooring is installed at right angles to joists.

Note 7. May be twenty-four (24) inches if 25/32 inch wood strip flooring is installed at right angles to joists.

Table 2105-4
PLYWOOD COMBINATION SUBFLOOR-UNDERLAYMENT

ALLOWABLE SPAN FOR PLYWOOD COMBINATION SUBFLOOR-UNDERLAYMENT (1)

PLYWOOD CONTINUOUS OVER TWO (2) OR MORE SPANS AND FACE GRAIN PERPENDICULAR TO SUPPORTS (THICKNESS IN INCHES)

Species Groups	Maximum Spacing of Joists (Inches)		
	16	20	24
1	1/2	5/8	3/4
2,3	5/8	3/4	7/8
4	3/4	7/8	1

Notes to Table 2105-4

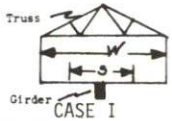
Note 1. Applicable to Underlayment Grade, C-C (Plugged) and all grades of sanded exterior type plywood. Spans limited to values shown because of possible effect of concentrated loads. Allowable uniform load based on deflection of 1/360 of span is one hundred twenty-five (125) psf. Plywood edges shall have approved tongue-and-groove joint* or shall be supported with blocking, unless one-fourth (1/4) inch minimum thickness underlayment is installed, or finish floor is 25/32 inch wood strip. If wood strips are perpendicular to supports, thicknesses showin for sixteen (16) inch and twenty (20) inch spans may be used on twenty-four (24) inch span. Except for one-half (1/2) inch, underlayment grade and C-C (Plugged) panels may be of nominal thickness 1/32 inch less than the nominal thicknesses shown when marked with the reduced thickness.

Table 2105-5
MINIMUM THICKNESS OF FLOOR SHEATHING

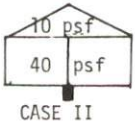
Joist Spacing (Inches)	Minimum Net Thickness (Inches)	
	Perpendicular to Joist	Diagonal to Joist
24	11/16	3/4
16	5/8	5/8

TABLE 2105-6

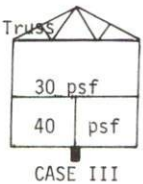
COLUMN SPACINGS UNDER GIRDERS
COLUMN SIZES - 4 X 4 or 31/2" O STL.
FOOTING SIZE - 2'-6" X 2' - 6" X 10" d



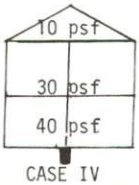
CASE I



CASE II



CASE III



CASE IV

GIRDER SIZE	S = 13				S = 14				S = 15				S = 16			
CASE I																
f_b =	1000	1200	1400	1600	1000	1200	1400	1600	1000	1200	1400	1600	1000	1200	1400	1600
4 x 10, 3-2 x 8	6-4	7-0	7-6	8-0	6-1	6-8	7-3	7-8	5-10	6-5	7-0	7-5	5-8	6-3	6-9	7-3
4 x 12, 3-2 x 10	8-1	8-9	9-6	10-3	7-9	8-6	9-3	9-10	7-6	8-3	8-10	9-6	7-3	8-0	8-8	9-3
6 x 12, 3-2 x 12	9-9	10-9	11-7	12-5	9-6	10-4	11-4	12-0	9-1	10-0	10-9	11-7	8-9	9-8	10-6	11-3
CASE II																
4 x 10, 3-2 x 8	5-6	6-0	6-6	7-0	5-4	5-9	6-4	6-8	5-1	5-7	6-1	6-6	5-0	5-6	5-10	6-4
4 x 12, 3-2 x 10	7-0	7-9	8-5	9-0	6-9	7-6	8-1	8-8	6-7	7-3	7-9	8-3	6-4	7-0	7-6	8-1
6 x 12, 3-2 x 12	8-8	9-5	10-3	10-10	8-4	9-1	9-9	10-6	8-0	8-9	9-6	10-1	7-9	8-6	9-2	9-9
CASE III																
4 x 10, 3-2 x 8	4-8	5-1	5-7	6-0	4-6	5-0	5-3	5-8	4-3	4-9	5-2	5-6	4-3	4-8	5-0	5-3
4 x 12, 3-2 x 10	6-0	6-7	7-1	7-7	5-9	6-4	6-9	7-4	5-7	6-1	6-8	7-1	5-5	5-10	6-5	6-9
6 x 12, 3-2 x 12	7-4	8-0	8-8	9-3	7-0	7-8	8-4	8-10	6-9	7-6	8-0	8-8	6-7	7-3	7-9	8-4
CASE IV																
4 x 10, 3-2 x 8	4-4	4-9	5-1	5-6	4-2	4-7	5-0	5-4	4-0	4-4	4-9	5-1	3-10	4-4	4-8	5-0
4 x 12, 3-2 x 10	5-6	6-1	6-8	7-0	5-3	5-10	6-4	6-9	5-2	5-8	6-1	6-6	5-0	5-6	5-10	6-4
6 x 12, 3-2 x 12	6-9	7-5	8-0	8-7	6-6	7-1	7-8	8-3	6-4	6-10	7-6	8-0	6-1	6-8	7-3	7-9
STEEL GIRDER SPAN BETWEEN SUPPORTS (A-36 STL.)																
8'-0"	6W8.5				6W8.5				6W8.5				6W8.5			
10'-0"	8W10				8W10				8W10				8W15			
12'-0"	8W15				8W15				10W15				10W15			
14'-0"	10W15				10W15				10W17				10W17			

SECTION 2106.0 ROOF-CEILING CONSTRUCTION

2106.1 General: Roofs shall be constructed in accordance with Tables 2106-1 through 2106-6, the energy requirements in Table 2123-1, and nailed in accordance with Table 2103-2.

2106.1.1 Specifications: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

2106.2 Wood

2106.2.1 Identification: All load-bearing lumber, plywood and particleboard shall conform to applicable standards or grading rules and be identified by a grade mark, or certificate or inspection issued by an approved lumber grading or inspection bureau or agency.

Exception: Native lumber - Items 2106.2.1 Identification and 2106.2.2 Grade of this section shall be subject to the provisions of Section 2103.3 for native lumber.

2106.2.2 Grade: All rafters and ceiling joists shall be of No. 3 or Standard Grade lumber or equivalent. Blocking and sheathing may be of No. 4 or Utility Grade lumber or equivalent.

2106.2.3 Allowable spans: The unsupported spans of rafters and ceiling joists shall not exceed the values set forth in Tables 2106-1, 2106-2, 2106-3, 2106-4, 2106-5 and 2106-6. The modulus of elasticity, "E", and the actual stress in bearing, "F_b", shall not exceed the values given in the tables.

2106.2.3.1 Other criteria: The allowable spans and minimum grades for plywood roof sheathing shall not exceed the values set forth in Table 2105-5. The allowable span for board type roof sheathing shall not exceed twenty-four (24) inches and shall be five-eighths (5/8) inch minimum net thickness for solid sheathing and three-quarter (3/4) inch minimum net thickness for spaced sheathing.

2106.2.4 Framing: Rafters shall be framed directly opposite each other at the ridge or there shall be a ridge board at least one (1) inch nominal thickness at all ridges and not less in depth than the size of the rafter. At all valleys and hips there shall be a single valley or hip rafter not less than two (2) inches nominal thickness and not less in depth than the size of the rafter.

2106.3 Metal: Steel structural elements in roof-ceiling construction may be either hot-rolled structural steel shapes or

members cold formed to shape from steel strip or plate or a fabricated combination thereof. Members shall be straight and free of any defects which would significantly affect their structural performance. Steel girders, trusses or beams in roof-ceiling construction shall be designed in accordance with the applicable standards in this article.

2106.3.1 Aluminum elements: Aluminum structural elements in roof-ceiling systems shall be constructed of materials and designed in accordance with the applicable reference standards of this article.

2106.4 Ceiling finishes: Ceilings shall be installed in accordance with recommended engineering practice and applicable reference standards.

2106.5 Attic access: An accessible attic opening not less than twenty-two (22) inches by thirty (30) inches shall be provided to any attic area with clear headroom of three (3) feet or more.

NON-TEXT PAGE

Table 2106-1
ALLOWABLE SPANS FOR CEILING JOISTS
20 lbs. per sq. ft. Live Load
(Limited attic storage where development of future rooms is not possible)
(Drywall Ceiling)

DESIGN CRITERIA:
Deflection - for 20 lbs. per sq. ft. live load. Limited to span in inches divided by 240.
Strength - Live load of 20 lbs. per sq. ft. plus dead load of 10 lbs. per sq. ft. determines required fiber stress value.

HOW TO USE TABLES: Enter Table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

JOIST SIZE	SPACING (IN)	Modulus of Elasticity, "E", in 1,000,000 psi													
		0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2
2x4	12.0	7-10 900	8-1 970	8-5 1040	8-8 1110	8-11 1170	9-2 1240	9-5 1300	9-8 1360	9-10 1420	10-0 1480	10-3 1540	10-5 1600	10-7 1650	10-11 1760
	13.7	7-6 940	7-9 1010	8-1 1090	8-4 1160	8-7 1230	8-9 1300	9-0 1360	9-3 1420	9-5 1490	9-7 1550	9-9 1610	10-0 1670	10-2 1730	10-6 1840
	16.0	7-1 990	7-5 1070	7-8 1140	7-11 1220	8-1 1290	8-4 1360	8-7 1430	8-9 1500	8-11 1570	9-1 1630	9-4 1690	9-6 1760	9-8 1820	9-11 1940
	19.2	6-8 1050	6-11 1130	7-2 1220	7-5 1300	7-8 1370	7-10 1450	8-1 1520	8-3 1590	8-5 1660	8-7 1730	8-9 1800	8-11 1870	9-1 1930	9-4 2060
	24.0	6-2 1130	6-5 1220	6-8 1310	6-11 1400	7-1 1480	7-3 1560	7-6 1640	7-8 1720	7-10 1790	8-0 1870	8-1 1940	8-3 2010	8-5 2080	8-8 2220
2x6	12.0	12-3 900	12-9 970	13-3 1040	13-8 1110	14-1 1170	14-5 1240	14-9 1300	15-2 1360	15-6 1420	15-9 1480	16-1 1540	16-4 1600	16-8 1650	17-2 1760
	13.7	11-9 940	12-3 1010	12-8 1090	13-1 1160	13-5 1230	13-10 1300	14-2 1360	14-6 1420	14-9 1490	15-1 1550	15-5 1610	15-8 1670	15-11 1730	16-5 1840
	16.0	11-2 990	11-7 1070	12-0 1140	12-5 1220	12-9 1290	13-1 1360	13-5 1430	13-9 1500	14-1 1570	14-4 1630	14-7 1690	14-11 1760	15-2 1820	15-7 1940
	19.2	10-6 1050	10-11 1130	11-4 1220	11-8 1300	12-0 1370	12-4 1450	12-8 1520	12-11 1590	13-3 1660	13-6 1730	13-9 1800	14-0 1870	14-3 1930	14-8 2060
	24.0	9-9 1130	10-2 1220	10-6 1310	10-10 1400	11-2 1480	11-5 1560	11-9 1640	12-0 1720	12-3 1790	12-6 1870	12-9 1940	13-0 2010	13-3 2080	13-8 2220
2x8	12.0	16-2 900	16-10 970	17-5 1040	18-0 1110	18-6 1170	19-0 1240	19-6 1300	19-11 1360	20-5 1420	20-10 1480	21-2 1540	21-7 1600	21-11 1650	22-8 1760
	13.7	15-6 940	16-1 1010	16-8 1090	17-2 1160	17-9 1230	18-2 1300	18-8 1360	19-1 1420	19-6 1490	19-11 1550	20-3 1610	20-8 1670	21-0 1730	21-8 1840
	16.0	14-8 990	15-3 1070	15-10 1140	16-4 1220	16-10 1290	17-3 1360	17-9 1430	18-2 1500	18-6 1570	18-11 1630	19-3 1690	19-7 1760	19-11 1820	20-7 1940
	19.2	13-10 1050	14-5 1130	14-11 1220	15-5 1300	15-10 1370	16-3 1450	16-8 1520	17-1 1590	17-5 1660	17-9 1730	18-2 1800	18-5 1870	18-9 1930	19-5 2060
	24.0	12-10 1130	13-4 1220	13-10 1310	14-3 1400	14-8 1480	15-1 1560	15-6 1640	15-10 1720	16-2 1790	16-6 1870	16-10 1940	17-2 2010	17-5 2080	18-0 2220
2x10	12.0	20-8 900	21-6 970	22-3 1040	22-11 1110	23-8 1170	24-3 1240	24-10 1300	25-5 1360	26-0 1420	26-6 1480	27-1 1540	27-6 1600	28-0 1650	28-11 1760
	13.7	19-9 940	20-6 1010	21-3 1090	21-11 1160	22-7 1230	23-3 1300	23-9 1360	24-4 1420	24-10 1490	25-5 1550	25-10 1610	26-4 1670	26-10 1730	27-8 1840
	16.0	18-9 990	19-6 1070	20-2 1140	20-10 1220	21-6 1290	22-1 1360	22-7 1430	23-2 1500	23-8 1570	24-1 1630	24-7 1690	25-0 1760	25-5 1820	26-3 1940
	19.2	17-8 1050	18-4 1130	19-0 1220	19-7 1300	20-2 1370	20-9 1450	21-3 1520	21-9 1590	22-3 1660	22-8 1730	23-2 1800	23-7 1870	23-11 1930	24-9 2060
	24.0	16-5 1130	17-0 1220	17-8 1310	18-3 1400	18-9 1480	19-3 1560	19-9 1640	20-2 1720	20-8 1790	21-1 1870	21-6 1940	21-10 2010	22-3 2080	22-11 2220

Note: The required extreme fiber stress in bending, "F_b", in pounds per square inch is shown below each span.

Table 2106-2
ALLOWABLE SPANS FOR CEILING JOISTS
10 lbs. per sq. ft. Live Load
(No attic storage and roof slope not steeper than 3 in 12)
(Drywall Ceiling)

DESIGN CRITERIA:
Deflection - for 10 lbs. per sq. ft. live load. Limited to span in inches divided by 240.
Strength - Live load of 10 lbs. per sq. ft. plus dead load of 5 lbs. per sq. ft. determines required fiber stress value.

HOW TO USE TABLES: Enter Table with span of joists (upper figure in each square). Determine size and spacing (first column) based on stress grade (lower figure in each square) and modulus of elasticity (top row) of lumber to be used.

JOIST SIZE	SPACING (IN)	Modulus of Elasticity, "E", in 1,000,000 psi													
(IN)		0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2
2x4	12.0	9-10 710	10-3 770	10-7 830	10-11 880	11-3 930	11-7 980	11-10 1030	12-2 1080	12-5 1130	12-8 1180	12-11 1220	13-2 1270	13-4 1310	13-9 1400
	13.7	9-5 740	9-9 800	10-2 860	10-6 920	10-9 970	11-1 1030	11-4 1080	11-7 1130	11-10 1180	12-1 1230	12-4 1280	12-7 1320	12-9 1370	13-2 1460
	16.0	8-11 780	9-4 850	9-8 910	9-11 970	10-3 1030	10-6 1080	10-9 1140	11-0 1190	11-3 1240	11-6 1290	11-9 1340	11-11 1390	12-2 1440	12-6 1540
	19.2	8-5 830	8-9 900	9-1 970	9-4 1030	9-8 1090	9-11 1150	10-2 1210	10-4 1270	10-7 1320	10-10 1380	11-0 1430	11-3 1480	11-5 1530	11-9 1630
	24.0	7-10 900	8-1 970	8-5 1040	8-8 1110	8-11 1170	9-2 1240	9-5 1300	9-8 1360	9-10 1420	10-0 1480	10-3 1540	10-5 1600	10-7 1650	10-11 1760
2x6	12.0	15-6 710	16-1 770	16-8 830	17-2 880	17-8 930	18-2 980	18-8 1030	19-1 1080	19-6 1130	19-11 1180	20-3 1220	20-8 1270	21-0 1310	21-8 1400
	13.7	14-9 740	15-5 800	15-11 860	16-5 920	16-11 970	17-5 1030	17-10 1080	18-3 1130	18-8 1180	19-0 1230	19-5 1280	19-9 1320	20-1 1370	20-9 1460
	16.0	14-1 780	14-7 850	15-2 910	15-7 970	16-1 1030	16-6 1080	16-11 1140	17-4 1190	17-8 1240	18-1 1290	18-5 1340	18-9 1390	19-1 1440	19-8 1540
	19.2	13-3 830	13-9 900	14-3 970	14-8 1030	15-2 1090	15-7 1150	15-11 1210	16-4 1270	16-8 1320	17-0 1380	17-4 1430	17-8 1480	17-11 1530	18-6 1630
	24.0	12-3 900	12-9 970	13-3 1040	13-8 1110	14-1 1170	14-5 1240	14-9 1300	15-2 1360	15-6 1420	15-9 1480	16-1 1540	16-4 1600	16-8 1650	17-2 1760
2x8	12.0	20-5 710	21-2 770	21-11 830	22-8 880	23-4 930	24-0 980	24-7 1030	25-2 1080	25-8 1130	26-2 1180	26-9 1220	27-2 1270	27-8 1310	28-7 1400
	13.7	19-6 740	20-3 800	21-0 860	21-8 920	22-4 970	22-11 1030	23-6 1080	24-0 1130	24-7 1180	25-1 1230	25-7 1280	26-0 1320	26-6 1370	27-4 1460
	16.0	18-6 780	19-3 850	19-11 910	20-7 970	21-2 1030	21-9 1080	22-4 1140	22-10 1190	23-4 1240	23-10 1290	24-3 1340	24-8 1390	25-2 1440	25-11 1540
	19.2	17-5 830	18-2 900	18-9 970	19-5 1030	19-11 1090	20-6 1150	21-0 1210	21-6 1270	21-11 1320	22-5 1380	22-10 1430	23-3 1480	23-8 1530	24-5 1630
	24.0	16-2 900	16-10 970	17-5 1040	18-0 1110	18-6 1170	19-0 1240	19-6 1300	19-11 1360	20-5 1420	20-10 1480	21-2 1540	21-7 1600	21-11 1650	22-8 1760
2x10	12.0	26-0 710	27-1 770	28-0 830	28-11 880	29-9 930	30-7 980	31-4 1030	32-1 1080	32-9 1130	33-5 1180	34-1 1220	34-8 1270	35-4 1310	36-5 1400
	13.7	24-10 740	25-10 800	26-10 860	27-8 920	28-6 970	29-3 1030	30-0 1080	30-8 1130	31-4 1180	32-0 1230	32-7 1280	33-2 1320	33-9 1370	34-10 1460
	16.0	23-8 780	24-7 850	25-5 910	26-3 970	27-1 1030	27-9 1080	28-6 1140	29-2 1190	29-9 1240	30-5 1290	31-0 1340	31-6 1390	32-1 1440	33-1 1540
	19.2	22-3 830	23-2 900	23-11 970	24-9 1030	25-5 1090	26-2 1150	26-10 1210	27-5 1270	28-0 1320	28-7 1380	29-2 1430	29-8 1480	30-2 1530	31-2 1630
	24.0	20-8 900	21-6 970	22-3 1040	22-11 1110	23-8 1170	24-3 1240	24-10 1300	25-5 1360	26-0 1420	26-6 1480	27-1 1540	27-6 1600	28-0 1650	28-11 1760

Note: The required extreme fiber stress in bending "F_b", in pounds per square inch is shown below each span.

Table 2106-3
ALLOWABLE SPANS FOR "CATHEDRAL" ROOF RAFTERS
No Attic Space

DESIGN CRITERIA:
Strength - 15 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines required fiber stress.
Deflection - For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 240.

RAFTER SIZE (IN)	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi).								
		500	600	700	800	900	1000	1100	1200	1300
2x6	12.0	7-6 0.27	8-2 0.36	8-10 0.45	9-6 0.55	10-0 0.66	10-7 0.77	11-1 0.89	11-7 1.01	12-1 1.14
	13.7	7-0 0.25	7-8 0.33	8-3 0.42	8-10 0.52	9-5 0.61	9-11 0.72	10-5 0.83	10-10 0.95	11-3 1.07
	16.0	6-6 0.24	7-1 0.31	7-8 0.39	8-2 0.48	8-8 0.57	9-2 0.67	9-7 0.77	10-0 0.88	10-5 0.99
	19.2	5-11 0.22	6-6 0.28	7-0 0.36	7-6 0.44	7-11 0.52	8-4 0.61	8-9 0.70	9-2 0.80	9-6 0.90
	24.0	5-4 0.19	5-10 0.25	6-3 0.32	6-8 0.39	7-1 0.46	7-6 0.54	7-10 0.63	8-2 0.72	8-6 0.81
2x8	12.0	9-10 0.27	10-10 0.36	11-8 0.45	12-6 0.55	13-3 0.66	13-11 0.77	14-8 0.89	15-3 1.01	15-11 1.14
	13.7	9-3 0.25	10-1 0.33	10-11 0.42	11-8 0.52	12-5 0.61	13-1 0.72	13-8 0.83	14-4 0.95	14-11 1.07
	16.0	8-7 0.24	9-4 0.31	10-1 0.39	10-10 0.48	11-6 0.57	12-1 0.67	12-8 0.77	13-3 0.88	13-9 0.99
	19.2	7-10 0.22	8-7 0.28	9-3 0.36	9-10 0.44	10-6 0.52	11-0 0.61	11-7 0.70	12-1 0.80	12-7 0.90
	24.0	7-0 0.19	7-8 0.25	8-3 0.32	8-10 0.39	9-4 0.46	9-10 0.54	10-4 0.63	10-10 0.72	11-3 0.81
2x10	12.0	12-7 0.27	13-9 0.36	14-11 0.45	15-11 0.55	16-11 0.66	17-10 0.77	18-8 0.89	19-6 1.01	20-4 1.14
	13.7	11-9 0.25	12-11 0.33	13-11 0.42	14-11 0.52	15-10 0.61	16-8 0.72	17-6 0.83	18-3 0.95	19-0 1.07
	16.0	10-11 0.24	11-11 0.31	12-11 0.39	13-9 0.48	14-8 0.57	15-5 0.67	16-2 0.77	16-11 0.88	17-7 0.99
	19.2	9-11 0.22	10-11 0.28	11-9 0.36	12-7 0.44	13-4 0.52	14-1 0.61	14-9 0.70	15-5 0.80	16-1 0.90
	24.0	8-11 0.19	9-9 0.25	10-6 0.32	11-3 0.39	11-11 0.46	12-7 0.54	13-2 0.63	13-9 0.72	14-4 0.81
2x12	12.0	15-4 0.27	16-9 0.36	18-1 0.45	19-4 0.55	20-6 0.66	21-8 0.77	22-8 0.89	23-9 1.01	24-8 1.14
	13.7	14-4 0.25	15-8 0.33	16-11 0.42	18-1 0.52	19-3 0.61	20-3 0.72	21-3 0.83	22-2 0.95	23-1 1.07
	16.0	13-3 0.24	14-6 0.31	15-8 0.39	16-9 0.48	17-9 0.57	18-9 0.67	19-8 0.77	20-6 0.88	21-5 0.99
	19.2	12-1 0.22	13-3 0.28	14-4 0.36	15-4 0.44	16-3 0.52	17-1 0.61	17-11 0.70	18-9 0.80	19-6 0.90
	24.0	10-10 0.19	11-10 0.25	12-10 0.32	13-8 0.39	14-6 0.46	15-4 0.54	16-1 0.63	16-9 0.72	17-5 0.81

Note: The required modulus of elasticity, "E", in 1,000,000 pounds per square inch is shown below each span.

30 lbs. Per Sq. Ft. Live Load
(Supporting Drywall Ceiling)

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi). 1400	1500	1600	1700	1800	1900
2x6	12.0	12-6 1.28	13-0 1.41	13-5 1.56	13-10 1.71	14-2 1.86	14-7 2.02
	13.7	11-9 1.19	12-2 1.32	12-6 1.46	12-11 1.60	13-3 1.74	13-8 1.89
	16.0	10-10 1.10	11-3 1.22	11-7 1.35	11-11 1.48	12-4 1.61	12-8 1.75
	19.2	9-11 1.01	10-3 1.12	10-7 1.23	10-11 1.35	11-3 1.47	11-6 1.59
	24.0	8-10 0.90	9-2 1.00	9-6 1.10	9-9 1.21	10-0 1.31	10-4 1.43
2x8	12.0	16-6 1.28	17-1 1.41	17-8 1.56	18-2 1.71	18-9 1.86	19-3 2.02
	13.7	15-5 1.19	16-0 1.32	16-6 1.46	17-0 1.60	17-6 1.74	18-0 1.89
	16.0	14-4 1.10	14-10 1.22	15-3 1.35	15-9 1.48	16-3 1.61	16-8 1.75
	19.2	13-1 1.01	13-6 1.12	13-11 1.23	14-5 1.35	14-10 1.47	15-2 1.59
	24.0	11-8 0.90	12-1 1.00	12-6 1.10	12-10 1.21	13-3 1.31	13-7 1.43
2x10	12.0	21-1 1.28	21-10 1.41	22-6 1.56	23-3 1.71	23-11 1.86	24-6 2.02
	13.7	19-8 1.19	20-5 1.32	21-1 1.46	21-9 1.60	22-4 1.74	22-11 1.89
	16.0	18-3 1.10	18-11 1.22	19-6 1.35	20-1 1.48	20-8 1.61	21-3 1.75
	19.2	16-8 1.01	17-3 1.12	17-10 1.23	18-4 1.35	18-11 1.47	19-5 1.59
	24.0	14-11 0.90	15-5 1.00	15-11 1.10	16-5 1.21	16-11 1.31	17-4 1.43
2x12	12.0	25-7 1.28	26-6 1.41	27-5 1.56	28-3 1.71	29-1 1.86	29-10 2.02
	13.7	24-0 1.19	24-10 1.32	25-7 1.46	26-5 1.60	27-2 1.74	27-11 1.89
	16.0	22-2 1.10	23-0 1.22	23-9 1.35	24-5 1.48	25-2 1.61	25-10 1.75
	19.2	20-3 1.01	21-0 1.12	21-8 1.23	22-4 1.35	23-0 1.47	23-7 1.59
	24.0	18-1 0.90	18-9 1.00	19-4 1.10	20-0 1.21	20-6 1.31	21-1 1.43

Table 2106-4
ALLOWABLE SPANS FOR "CATHEDRAL" ROOF RAFTERS
No Attic Space

DESIGN CRITERIA:
Strength - 10 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines required fiber stress.
Deflection - For 30 lbs. per sq. ft. live load, Limited to span in inches divided by 240.

RAFTER SIZE (IN)	SPACING (IN)	Allowable Extreme Fiber Stress In Bending, "F_b" (psi).								
		500	600	700	800	900	1000	1100	1200	1300
2x6	12.0	7-11 0.32	8-8 0.43	9-5 0.54	10-0 0.66	10-8 0.78	11-3 0.92	11-9 1.06	12-4 1.21	12-10 1.36
	13.7	7-5 0.30	8-2 0.40	8-9 0.50	9-5 0.61	10-0 0.73	10-6 0.86	11-0 0.99	11-6 1.13	12-0 1.27
	16.0	6-11 0.28	7-6 0.37	8-2 0.47	8-8 0.57	9-3 0.68	9-9 0.80	10-2 0.92	10-8 1.05	11-1 1.18
	19.2	6-3 0.26	6-11 0.34	7-5 0.43	7-11 0.52	8-5 0.62	8-11 0.73	9-4 0.84	9-9 0.95	10-1 1.08
	24.0	5-7 0.23	6-2 0.30	6-8 0.38	7-1 0.46	7-6 0.55	7-11 0.65	8-4 0.75	8-8 0.85	9-1 0.96
2x8	12.0	10-6 0.32	11-6 0.43	12-5 0.54	13-3 0.66	14-0 0.78	14-10 0.92	15-6 1.06	16-3 1.21	16-10 1.36
	13.7	9-9 0.30	10-9 0.40	11-7 0.50	12-5 0.61	13-2 0.73	13-10 0.86	14-6 0.99	15-2 1.13	15-9 1.27
	16.0	9-1 0.28	9-11 0.37	10-9 0.47	11-6 0.57	12-2 0.68	12-10 0.80	13-5 0.92	14-0 1.05	14-7 1.18
	19.2	8-3 0.26	9-1 0.34	9-9 0.43	10-6 0.52	11-1 0.62	11-8 0.73	12-3 0.84	12-10 0.95	13-4 1.08
	24.0	7-5 0.23	8-1 0.30	8-9 0.38	9-4 0.46	9-11 0.55	10-6 0.65	11-0 0.75	11-6 0.85	11-11 0.96
2x10	12.0	13-4 0.32	14-8 0.43	15-10 0.54	16-11 0.66	17-11 0.78	18-11 0.92	19-10 1.06	20-8 1.21	21-6 1.36
	13.7	12-6 0.30	13-8 0.40	14-9 0.50	15-10 0.61	16-9 0.73	17-8 0.86	18-6 0.99	19-4 1.13	20-2 1.27
	16.0	11-7 0.28	12-8 0.37	13-8 0.47	14-8 0.57	15-6 0.68	16-4 0.80	17-2 0.92	17-11 1.05	18-8 1.18
	19.2	10-7 0.26	11-7 0.34	12-6 0.43	13-4 0.52	14-2 0.62	14-11 0.73	15-8 0.84	16-4 0.95	17-0 1.08
	24.0	9-5 0.23	10-4 0.30	11-2 0.38	11-11 0.46	12-8 0.55	13-4 0.65	14-0 0.75	14-8 0.85	15-3 0.96
2x12	12.0	16-3 0.32	17-9 0.43	19-3 0.54	20-6 0.66	21-9 0.78	23-0 0.92	24-1 1.06	25-2 1.21	26-2 1.36
	13.7	15-2 0.30	16-8 0.40	18-0 0.50	19-3 0.61	20-5 0.73	21-6 0.86	22-6 0.99	23-6 1.13	24-6 1.27
	16.0	14-1 0.28	15-5 0.37	16-8 0.47	17-9 0.57	18-10 0.68	19-11 0.80	20-10 0.92	21-9 1.05	22-8 1.18
	19.2	12-10 0.26	14-1 0.34	15-2 0.43	16-3 0.52	17-3 0.62	18-2 0.73	19-0 0.84	19-11 0.95	20-8 1.08
	24.0	11-6 0.23	12-7 0.30	13-7 0.38	14-6 0.46	15-5 0.55	16-3 0.65	17-0 0.75	17-9 0.85	18-6 0.96

Note: The required modulus of elasticity, "E", in 1,000,000 pounds per square inch is shown below each span.

30 lbs. Per Sq. Ft. Live Load
(No Finished Ceiling)

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE (IN)	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi). 1400	1500	1600	1700	1800	1900
2x6	12.0	13-3 1.52	13-9 1 69	14-2 1.86	14-8 2.04	15-1 2.22	15-6 2.41
	13.7	12-5 1.42	12-10 1.58	13-3 1.74	13-8 1.90	14-1 2.08	14-6 2.25
	16.0	11-6 1.32	11-11 1.46	12-4 1.61	12-8 1.76	13-1 1.92	13-5 2.08
	19.2	10-6 1.20	10-10 1.33	11-3 1.47	11-7 1.61	11-11 1.75	12-3 1.90
	24.0	9-5 1.08	9-9 1.19	10-0 1.31	10-4 1.44	10-8 1.57	10-11 1.70
2x8	12.0	17-6 1.52	18-2 1.69	18-9 1.86	19-4 2.04	19-10 2.22	20-5 2.41
	13.7	16-5 1.42	16-11 1.58	17-6 1.74	18-1 1.90	18-7 2.08	19-1 2.25
	16.0	15-2 1.32	15-8 1.46	16-3 1.61	16-9 1.76	17-2 1.92	17-8 2.08
	19.2	13-10 1.20	14-4 1.33	14-10 1.47	15-3 1.61	15-8 1.75	16-2 1.90
	24.0	12-5 1.08	12-10 1.19	13-3 1.31	13-8 1.44	14-0 1.57	14-5 1.70
2x10	12.0	22-4 1.52	23-2 1.69	23-11 1.86	24-7 2.04	25-4 2.22	26-0 2.41
	13.7	20-11 1.42	21-8 1.58	22-4 1.74	23-0 1.90	23-8 2.08	24-4 2.25
	16.0	19-4 1.32	20-0 1.46	20-8 1.61	21-4 1.76	21-11 1.92	22-6 2.08
	19.2	17-8 1.20	18-3 1.33	18-11 1.47	19-6 1.61	20-0 1.75	20-7 1.90
	24.0	15-10 1.08	16-4 1.19	16-11 1.31	17-5 1.44	17-11 1.57	18-5 1.70
2x12	12.0	27-2 1.52	28-2 1.69	29-1 1.86	29-11 2.04	30-10 2.22	31-8 2.41
	13.7	25-5 1.42	26-4 1.58	27-2 1.74	28-0 1.90	28-10 2.08	29-7 2.25
	16.0	23-6 1.32	24-4 1.46	25-2 1.61	25-11 1.76	26-8 1.92	27-5 2.08
	19.2	21-6 1.20	22-3 1.33	23-0 1.47	23-8 1.61	24-4 1.75	25-0 1.90
	24.0	19-3 1.08	19-11 1.19	20-6 1.31	21-2 1.44	21-9 1.57	22-5 1.70

Table 2106-5
ALLOWABLE SPANS FOR ROOF RAFTERS
Over Attic Space
30 lbs. Per Sq. Ft. Live Load
(Tile, Slate, Conc. Roof Covering)

DESIGN CRITERIA:
Strength - 15 lbs. per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines required fiber stress.
Deflection - For 30 lbs. per sq. ft. live load. Limited to span in inches divided by 180.

RAFTER SIZE	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi).								
		500	600	700	800	900	1000	1100	1200	1300
2x4	12.0	4-9 0.20	5-3 0.27	5-8 0.34	6-0 0.41	6-5 0.49	6-9 0.58	7-1 0.67	7-5 0.76	7-8 0.86
	13.7	4-5 0.19	4-11 0.25	5-3 0.32	5-8 0.39	6-0 0.46	6-4 0.54	6-7 0.62	6-11 0.71	7-2 0.80
	16.0	4-1 0.18	4-6 0.23	4-11 0.29	5-3 0.36	5-6 0.43	5-10 0.50	6-1 0.58	6-5 0.66	6-8 0.74
	19.2	3-9 0.16	4-1 0.21	4-5 0.27	4-9 0.33	5-1 0.39	5-4 0.46	5-7 0.53	5-10 0.60	6-1 0.68
	24.0	3-4 0.14	3-8 0.19	4-0 0.24	4-3 0.29	4-6 0.35	4-9 0.41	5-0 0.47	5-3 0.54	5-5 0.61
2x6	12.0	7-6 0.20	8-2 0.27	8-10 0.34	9-6 0.41	10-0 0.49	10-7 0.58	11-1 0.67	11-7 0.76	12-1 0.86
	13.7	7-0 0.19	7-8 0.25	8-3 0.32	8-10 0.39	9-5 0.46	9-11 0.54	10-5 0.62	10-10 0.71	11-3 0.80
	16.0	6-6 0.18	7-1 0.23	7-8 0.29	8-2 0.36	8-8 0.43	9-2 0.50	9-7 0.58	10-0 0.66	10-5 0.74
	19.2	5-11 0.16	6-6 0.21	7-0 0.27	7-6 0.33	7-11 0.39	8-4 0.46	8-9 0.53	9-2 0.60	9-6 0.68
	24.0	5-4 0.14	5-10 0.19	6-3 0.24	6-8 0.29	7-1 0.35	7-6 0.41	7-10 0.47	8-2 0.54	8-6 0.61
2x8	12.0	9-10 0.20	10-10 0.27	11-8 0.34	12-6 0.41	13-3 0.49	13-11 0.58	14-8 0.67	15-3 0.76	15-11 0.86
	13.7	9-3 0.19	10-1 0.25	10-11 0.32	11-8 0.39	12-5 0.46	13-1 0.54	13-8 0.62	14-4 0.71	14-11 0.80
	16.0	8-7 0.18	9-4 0.23	10-1 0.29	10-10 0.36	11-6 0.43	12-1 0.50	12-8 0.58	13-3 0.66	13-9 0.74
	19.2	7-10 0.16	8-7 0.21	9-3 0.27	9-10 0.33	10-6 0.39	11-0 0.46	11-7 0.53	12-1 0.60	12-7 0.68
	24.0	7-0 0.14	7-8 0.19	8-3 0.24	8-10 0.29	9-4 0.35	9-10 0.41	10-4 0.47	10-10 0.54	11-3 0.61
2x10	12.0	12-7 0.20	13-9 0.27	14-11 0.34	15-11 0.41	16-11 0.49	17-10 0.58	18-8 0.67	19-6 0.76	20-4 0.86
	13.7	11-9 0.19	12-11 0.25	13-11 0.32	14-11 0.39	15-10 0.46	16-8 0.54	17-6 0.62	18-3 0.71	19-0 0.80
	16.0	10-11 0.18	11-11 0.23	12-11 0.29	13-9 0.36	14-8 0.43	15-5 0.50	16-2 0.58	16-11 0.66	17-7 0.74
	19.2	9-11 0.16	10-11 0.21	11-9 0.27	12-7 0.33	13-4 0.39	14-1 0.46	14-9 0.53	15-5 0.60	16-1 0.68
	24.0	8-11 0.14	9-9 0.19	10-6 0.24	11-3 0.29	11-11 0.35	12-7 0.41	13-2 0.47	13-9 0.54	14-4 0.61

Note: The required modulus of elasticity, "E", in 1,000,000 pounds per square inch is shown below each span.

Table 2106-5 (cont.)

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

RAFTER SIZE (IN)	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi).					
		1400	1500	1600	1700	1800	1900
2x4	12.0	8-0 0.96	8-3 1.06	8-6 1.17	8-9 1.28	9-0 1.39	9-3 1.51
	13.7	7-5 0.89	7-9 0.99	8-0 1.09	8-3 1.20	8-5 1.30	8-8 1.41
	16.0	6-11 0.83	7-2 0.92	7-5 1.01	7-7 1.11	7-10 1.21	8-0 1.31
	19.2	6-4 0.76	6-6 0.84	6-9 0.92	6-11 1.01	7-2 1.10	7-4 1.20
	24.0	5-8 0.68	5-10 0.75	6-0 0.83	6-3 0.90	6-5 0.99	6-7 1.07
2x6	12.0	12-6 0.96	13-0 1.06	13-5 1.17	13-10 1.28	14-2 1.39	14-7 1.51
	13.7	11-9 0.89	12-2 0.99	12-6 1.09	12-11 1.20	13-3 1.30	13-8 1.41
	16.0	10-10 0.83	11-3 0.92	11-7 1.01	11-11 1.11	12-4 1.21	12-8 1.31
	19.2	9-11 0.76	10-3 0.84	10-7 0.92	10-11 1.01	11-3 1.10	11-6 1.20
	24.0	8-10 0.68	9-2 0.75	9-6 0.83	9-9 0.90	10-0 0.99	10-4 1.07
2x8	12.0	16-6 0.96	17-1 1.06	17-8 1.17	18-2 1.28	18-9 1.39	19-3 1.51
	13.7	15-5 0.89	16-0 0.99	16-6 1.09	17-0 1.20	17-6 1.30	18-0 1.41
	16.0	14-4 0.83	14-10 0.92	15-3 1.01	15-9 1.11	16-3 1.21	16-8 1.31
	19.2	13-1 0.76	13-6 0.84	13-11 0.92	14-5 1.01	14-10 1.10	15-2 1.20
	24.0	11-8 0.68	12-1 0.75	12-6 0.83	12-10 0.90	13-3 0.99	13-7 1.07
2x10	12.0	21-1 0.96	21-10 1.06	22-6 1.17	23-3 1.28	23-11 1.39	24-6 1.51
	13.7	19-8 0.89	20-5 0.99	21-1 1.09	21-9 1.20	22-4 1.30	22-11 1.41
	16.0	18-3 0.83	18-11 0.92	19-6 1.01	20-1 1.11	20-8 1.21	21-3 1.31
	19.2	16-8 0.76	17-3 0.84	17-10 0.92	18-4 1.01	18-11 1.10	19-5 1.20
	24.0	14-11 0.68	15-5 0.75	15-11 0.83	16-5 0.90	16-11 0.99	17-4 1.07

Table 2106-6
ALLOWABLE SPANS FOR ROOF RAFTERS
Over Attic Space
30 lbs. Per Sq. Ft. Live Load
(Light Roof Coverings)
(Wood, Asphalt, etc.)

DESIGN CRITERIA:
Strength - 7 lbs per sq. ft. dead load plus 30 lbs. per sq. ft. live load determines required fiber stress.
Deflection - For 30 lbs per sq. ft. live load. Limited to span in inches divided by 180.

RAFTER SIZE (IN)	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi).								
		500	600	700	800	900	1000	1100	1200	1300
2x4	12.0	5-3 0.27	5-9 0.36	6-3 0.45	6-8 0.55	7-1 0.66	7-5 0.77	7-9 0.89	8-2 1.02	8-6 1.15
	13.7	4-11 0.26	5-5 0.34	5-10 0.42	6-3 0.52	6-7 0.62	6-11 0.72	7-3 0.84	7-7 0.95	7-11 1.07
	16.0	4-7 0.24	5-0 0.31	5-5 0.39	5-9 0.48	6-1 0.57	6-5 0.67	6-9 0.77	7-1 0.88	7-4 0.99
	19.2	4-2 0.22	4-7 0.28	4-11 0.36	5-3 0.44	5-7 0.52	5-10 0.61	6-2 0.71	6-5 0.80	6-8 0.91
	24.0	3-9 0.19	4-1 0.25	4-5 0.32	4-8 0.39	5-0 0.47	5-3 0.55	5-6 0.63	5-9 0.72	6-0 0.81
2x6	12.0	8-3 0.27	9-1 0.36	9-9 0.45	10-5 0.55	11-1 0.66	11-8 0.77	12-3 0.89	12-9 1.02	13-4 1.15
	13.7	7-9 0.26	8-5 0.34	9-2 0.42	9-9 0.52	10-4 0.62	10-11 0.72	11-5 0.84	12-0 0.95	12-5 1.07
	16.0	7-2 0.24	7-10 0.31	8-5 0.39	9-1 0.48	9-7 0.57	10-1 0.67	10-7 0.77	11-1 0.88	11-6 0.99
	19.2	6-6 0.22	7-2 0.28	7-9 0.36	8-3 0.44	8-9 0.52	9-3 0.61	9-8 0.71	10-1 0.80	10-6 0.91
	24.0	5-10 0.19	6-5 0.25	6-11 0.32	7-5 0.39	7-10 0.47	8-3 0.55	8-8 0.63	9-1 0.72	9-5 0.81
2x8	12.0	10-11 0.27	11-11 0.36	12-10 0.45	13-9 0.55	14-7 0.66	15-5 0.77	16-2 0.89	16-10 1.02	17-7 1.15
	13.7	10-2 0.26	11-2 0.34	12-1 0.42	12-10 0.52	13-8 0.62	14-5 0.72	15-1 0.84	15-9 0.95	16-5 1.07
	16.0	9-5 0.24	10-4 0.31	11-2 0.39	11-11 0.48	12-8 0.57	13-4 0.67	14-0 0.77	14-7 0.88	15-2 0.99
	19.2	8-7 0.22	9-5 0.28	10-2 0.36	10-11 0.44	11-6 0.52	12-2 0.61	12-9 0.71	13-4 0.80	13-10 0.91
	24.0	7-8 0.19	8-5 0.25	9-1 0.32	9-9 0.39	10-4 0.47	10-11 0.55	11-5 0.63	11-11 0.72	12-5 0.81
2x10	12.0	13-11 0.27	15-2 0.36	16-5 0.45	17-7 0.55	18-7 0.66	19-8 0.77	20-7 0.89	21-6 1.02	22-5 1.15
	13.7	13-0 0.26	14-3 0.34	15-4 0.42	16-5 0.52	17-5 0.62	18-4 0.72	19-3 0.84	20-1 0.95	20-11 1.07
	16.0	12-0 0.26	13-2 0.34	14-3 0.43	15-2 0.53	16-2 0.63	17-0 0.74	17-10 0.85	18-7 0.97	19-5 1.09
	19.2	11-0 0.22	12-0 0.28	13-0 0.36	13-11 0.44	14-9 0.52	15-6 0.61	16-3 0.71	17-0 0.80	17-8 0.91
	24.0	9-10 0.19	10-9 0.25	11-7 0.32	12-5 0.39	13-2 0.47	13-11 0.55	14-7 0.63	15-2 0.72	15-10 0.81

Note: The required modulus of elasticity, "E", in 1,000,000 pounds per square inch is shown below each span.

RAFTERS: Spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.

HOW TO USE TABLES: Enter table with span of rafters (upper figure in each square). Determine size and spacing (first column) based on stress grade (top row) and modulus of elasticity (lower figure in each square) of lumber to be used.

RAFTER SIZE	SPACING (IN)	Allowable Extreme Fiber Stress in Bending, "F_b" (psi).					
		1400	1500	1600	1700	1800	1900
2x4	12.0	8-9 1.28	9-1 1.42	9-5 1.57	9-8 1.72	10-0 1.87	10-3 2.03
	13.7	8-3 1.20	8-6 1.33	8-9 1.47	9-1 1.61	9-4 1.75	9-7 1.90
	16.0	7-7 1.11	7-11 1.23	8-2 1.36	8-5 1.49	8-8 1.62	8-10 1.76
	19.2	6-11 1.01	7-2 1.12	7-5 1.24	7-8 1.36	7-11 1.48	8-1 1.60
	24.0	6-3 0.91	6-5 1.01	6-8 1.11	6-10 1.21	7-1 1.32	7-3 1.43
2x6	12.0	13-10 1.28	14-4 1.42	14-9 1.57	15-3 1.72	15-8 1.87	16-1 2.03
	13.7	12-11 1.20	13-4 1.33	13-10 1.47	14-3 1.61	14-8 1.75	15-1 1.90
	16.0	12-0 1.11	12-5 1.23	12-9 1.36	13-2 1.49	13-7 1.62	13-11 1.76
	19.2	10-11 1.01	11-4 1.12	11-8 1.24	12-0 1.36	12-5 1.48	12-9 1.60
	24.0	9-9 0.91	10-1 1.01	10-5 1.11	10-9 1.21	11-1 1.32	11-5 1.43
2x8	12.0	18-2 1.28	18-10 1.42	19-6 1.57	20-1 1.72	20-8 1.87	21-3 2.03
	13.7	17-0 1.20	17-8 1.33	18-2 1.47	18-9 1.61	19-4 1.75	19-10 1.90
	16.0	15-9 1.11	16-4 1.23	16-10 1.36	17-4 1.49	17-11 1.62	18-4 1.76
	19.2	14-5 1.01	14-11 1.12	15-5 1.24	15-10 1.36	16-4 1.48	16-9 1.60
	24.0	12-10 0.91	13-4 1.01	13-9 1.11	14-2 1.21	14-7 1.32	15-0 1.43
2x10	12.0	23-3 1.28	24-1 1.42	24-10 1.57	25-7 1.72	26-4 1.87	27-1 2.03
	13.7	21-9 1.20	22-6 1.33	23-3 1.47	23-11 1.61	24-8 1.75	25-4 1.90
	16.0	20-1 1.22	20-10 1.35	21-6 1.49	22-2 1.63	22-10 1.78	23-5 1.93
	19.2	18-4 1.01	19-0 1.12	19-8 1.24	20-3 1.36	20-10 1.48	21-5 1.60
	24.0	16-5 0.91	17-0 1.01	17-7 1.11	18-1 1.21	18-7 1.32	19-2 1.43

SECTION 2107.0 ROOF COVERINGS

2107.1 General: Conformity with applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

2107.1.1 Coverings: Roofs shall be covered with Class A, B, or C roof covering.

Exception: The roof coverings set forth in Sections 2107.3, 2107.8, 2107.9 and 2107.10 may be used provided the building is located in areas designated by law as permitting their use and not less than ten (10) feet are provided between buildings.

2107.1.2 Class A materials: The roofing materials set forth in Sections 2107.4, 2107.5, 2107.6 and 2107.7 and concrete slabs may be accepted as Class A roof covering.

2107.1.3 Other roof systems: Material used as part of an integral roof solar collector system shall be acceptable so long as it is properly flashed and caulked with silicone or similar sealant to be waterproofed and provided it is used in combination with a metal absorber plate beneath the surface. (See 2107.11.)

2107.2 Base sheet application: Base sheets shall be applied only to solid surface roofs and shall be cemented to a suitable deck using not less than twenty-five (25) pounds of hot asphalt or not less than two (2) gallons of cold bituminous compound in accordance with the manufacturer's published specifications or thirty (30) pounds of hot coal tar pitch per roofing square, or nailed to a roof sheathing using not less than one (1) nail to each one and one-third (1-1/3) square feet, or may be spot-cemented to a non-nailable deck using not less than ten (10) pounds of hot asphalt per roofing square.

2107.2.1 Cementing: Successive layers shall be cemented to the base sheets using no less cementing material than that specified for solidly cemented base sheets.

2107.3 Composition asphalt organic felt shingles

2107.3.1 General: Composition shingles shall be applied only to solidly sheathed roofs.

2107.3.2 Slope criteria: Composition shingles shall not be installed on a roof having a slope of less than four (4) in twelve (12) unless approved by the building official.

2107.3.3 Other requirements: Composition shingles shall be fastened according to manufacturer's printed instructions.

2107.3.4 Flashing: Roof valley flashing shall be provided of not less than No. 28 galvanized sheet gauge corrosion-resistant metal and shall extend at least eight (8) inches from the center line each way, and shall have a splash diverter rib not less than three-quarter (3/4) inch high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four (4) inches.

2107.3.5 Other material: Roof valley flashing may be of laced composition shingles, applied in an approved manner, with an underlay of not less than thirty (30) pound felt extending ten (10) inches from the center line each way, or shall be of two (2) layers of ninety (90) pound mineral surfaced cap sheet cemented together with the bottom layer not less than twelve (12) inches wide laid face down, and the top layer not less than twenty-four (24) inches wide laid face up.

2107.4 Slate shingles

2107.4.1 General: Slate shingles shall be applied in an approved manner and securely fastened with corrosion-resistant nails or corrosion-resistant nails and wire.

2107.4.2 Underlay: Slate shingle roofs shall have an underlay of not less than two (2) layers of fifteen (15) pound felt or one (1) layer of thirty (30) pound felt, applied as required for a base sheet.

2107.4.3 Installation: Roof valley flashing shall be provided of not less than No. 28 gauge galvanized sheet corrosion-resistant metal and shall extend at least eleven (11) inches from the center line each way and shall have a splash diverter rib not less than one (1) inch high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four (4) inches.

2107.5 Asbestos cement shingles

2107.5.1 General: Asbestos-cement roofing shall be applied in an approved manner. Asbestos-cement roofing shall have an underlay of not less than fifteen (15) pound felt, applied as required for a base sheet. The underlay may be omitted where the asbestos-cement shingles or sheets are applied over an existing roof covering.

2107.5.2 Slope criteria: Asbestos-cement roofing shall not be installed on a roof having a slope of less than three (3) in twelve (12) unless approved by the building official.

2107.5.3 Thickness: Corrugated asbestos-cement roofing not less than five-sixteenths (5/16) inch thick may be used wherever No. 24 galvanized sheet gauge corrugated steel is permitted.

2107.5.4 Installation: Roof valley flashing shall be the same as required for slate shingles. See Section 2107.3.3.

2107.6 Metal

2107.6.1 General: Flat sheets or shingles shall be applied only to solidly sheathed roofs.

2107.6.2 Metal roofing shall be applied in an approved manner, consistent with manufacturer's recommendations.

2107.6.3 Sloping criteria: Metal shingles shall not be installed on a roof having a slope of less than three (3) in twelve (12) unless approved by the building official.

2107.6.4 Installation: Metal shingles shall be applied over an underlay of not less than thirty (30) pound felt, applied as required for a base sheet.

2107.7 Tile, clay or concrete shingles

2107.7.1 General: All roof tile shall be securely fastened with corrosion-resistant nails or nails and wire, or other approved means.

2107.7.2 Slope criteria: Tile shall be installed on a roof having a slope of less than three (3) in twelve (12) unless approved by the building official.

2107.7.3 Anchor lugs: Tile with projection anchor lugs at the bottom of the tile shall be held in position by means of one (1) inch by two (2) inch wood stripping, treated to resist moisture deterioration, nailed to the roof sheathing over the underlay, or other approved means.

2107.7.4 Underlay: Tile roofs shall have an underlay of not less than two (2) layers of fifteen (15) pound felt or one (1) layer of thirty (30) pound felt, applied as required for a base sheet.

2107.7.5 Valley flashing: Valley flashing shall be the same as required for slate shingles.

2107.8 Built-up roofing

2107.8.1 General: Mineral aggregate surfaced built-up roofing shall consist of three (3) layers of fifteen (15) pound fiber felt installed in accordance with this section on roofs having slopes not greater than three (3) in twelve (12).

2107.8.2 Roof surface: Built-up roofing shall be applied only to solid surface roofs.

2107.8.3 Base sheets: Base sheets shall be cemented to a suitable deck using not less than twenty-five (25) pounds of hot asphalt or not less than two (2) gallons of cold bituminous compound in accordance with manufacturer's published specifications or thirty (30) pounds of hot coal tar pitch per roofing square, or nailed to roof sheathing using not less than one (1) nail to each one and one-third (1-1/3) square feet, or may be spot-cemented to a non-nailable deck using not less than ten (10) pounds of hot asphalt per roofing square.

2107.8.4 Successive layering: Successive layers shall be cemented to the base sheets using no less cementing material than that specified for solidly cemented base sheets.

2107.8.5 Aggregate surfaced roofs: Mineral aggregate surfaced roofs shall be surfaced with not less than fifty (50) pounds of hot asphalt or other cementing material in which is embedded not less than three hundred (300) pounds of gravel or other approved surfacing materials or two hundred fifty (250) pounds of crushed slag per roofing square.

2107.8.6 Cap sheets: Cap sheets shall be cemented to the base sheets using no less cementing material than that specified for solidly cemented base sheets.

2107.8.7 Application temperatures: Hot asphalt shall be applied at a temperature of not less than 375° F. nor more than 450° F. for high melt types. Low melt types shall not be applied at a temperature of less than 350° F. nor more than 400° F. Coal tar pitch shall not be heated to a temperature above 375° F.

2107.9 Wood shingles

2107.9.1 General: Wood shingles may be applied to roofs with solid or spaced sheathing. The spaced sheathing shall be spaced not to exceed four (4) inches clear nor more than the width of the sheathing board. Spaced sheathing shall be not less than one (1) inch by three (3) inches nominal dimensions.

2107.9.2 Application: Shingles shall be laid with a side lap of not less than one and one-half (1-1/2) inches between joints in adjacent courses, and one-half (1/2) inch in alternate courses. Spaces between shingles shall be not less than one-quarter (1/4) inch nor more than three-eighths (3/8) inch. Each wood shingle shall be fastened to the sheathing with two (2) nails only.

2107.9.3 Slope criteria: Shingles shall not be installed on a roof having a slope less than four (4) in twelve (12) unless they are installed over an underlay of not less than fifteen (15) pound felt, applied as required for a base sheet.

2107.9.4 Valley flashing: Roof valley flashing shall be provided of not less than No. 28 gauge galvanized sheet corrosion-resistant metal and shall extend eight (8) inches from the center line each way. Sections of flashing shall have an end lap of not less than four (4) inches.

2107.9.5 Weathering: Weather exposures shall not exceed those set forth in Reference Standard RS-21-9. Hip and ridge weather exposures shall not exceed those permitted for the field of the roof.

2107.10 Wood shakes

2107.10.1 General: Wood shakes may be applied to roofs with solid or spaced sheathing. The spaced sheathing shall be spaced not to exceed four (4) inches clear nor more than the width of the sheathing board. Spaced sheathing shall be not less than one (1) inch by four (4) inches nominal size. In snow areas, sheathing shall be solid and the shakes shall be applied over an underlay of not less than fifteen (15) pound felt, applied as required for a base sheet.

2107.10.2 Spacing: Shakes may be laid in straight or staggered courses with a side lap of not less than one and one-half (1-1/2) inches between joints in adjacent courses. Spacing between shakes shall be not more than one-half (1/2) inch.

2107.10.3 Fastening: Each wood shake shall be fastened to the sheathing with two (2) nails. The starter course at the eaves shall be doubled and the bottom layer shall be either fifteen (15) or eighteen (18) inch wood shakes or wood shingles. Fifteen (15) inch or eighteen (18) inch shakes may be used for the final course at the ridge.

2107.10.4 Underlay: Shakes shall be laid with not less than eighteen (18) inch wide strips of not less than fifteen (15) pound felt shingled between each course in such manner that no felt is exposed to the weather below the shake butts.

2107.10.5 Slope criteria: Shakes shall not be installed on a roof having a slope less than four (4) in twelve (12) unless they are installed over an underlay of not less than thirty (30) pound felt, applied as required for a base sheet.

2107.10.6 Valley flashing: Roof valley flashing shall be provided of not less than No. 28 gauge galvanized sheet corrosion-resistant metal and shall extend at least eleven (11) inches from the center line each way and shall have a splash diverter rib not less than one (1) inch high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four (4) inches.

2107.10.7 Weathering: Weather exposures shall not exceed those set forth in Reference Standard RS-21-9. Hip and ridge weather exposures shall not exceed those permitted for the field of the roof.

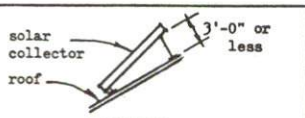
2107.11 Solar collectors: All solar collectors attached to but mounted above a finished roof shall be firmly anchored to the roof structure or solid blocking connecting structural elements and all the roof penetrations sealed to prevent water leakage. All solar collectors integral with the roof shall be designed for roof loads specified in Section 710.0, sealed to prevent water leakage and have an approved cover plate. Refer to allowable spans for roof rafters supporting solar collectors as contained in table 2107-11.

Table 2107-11

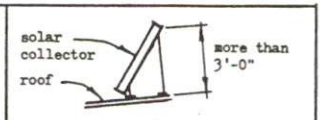
ALLOWABLE SPANS FOR ROOF RAFTERS SUPPORTING SOLAR COLLECTORS

HOW TO USE TABLES

1. Check to determine that none of the maximum conditions listed below are exceeded.
   a. maximum pitch of collector--20:12 (60°) (See Notes)
   b. maximum collector weight--7 lbs. per sq. ft.
   c. maximum length of collector--9 ft.
2. Determine whether Condition A or Condition B applies.
3. Inspect roof rafters and determine their size, spacing and type of wood. (Most are hemfir or better.)
4. Determine whether light roof construction (LRC-asphalt, wood shingles, etc.) or heavy roof construction (HRC--slate, tile shingles, etc.) applies.
5. Read allowable span from tables. Rafter spans are measured along the horizontal projection and loads are considered as applied on the horizontal projection.



CONDITION A



CONDITION B

MEMBER	800psi(spruce or better) LRC max.span	800psi(spruce or better) HRC max.span	1200psi(hemfir or better) LRC max.span	1200psi(hemfir or better) HRC max.span	800psi(spruce or better) LRC max.span	800psi(spruce or better) HRC max.span	1200psi(hemfir or better) LRC max.span	1200psi(hemfir or better) HRC max.span
2 x 6								
12"o.c.	9- 1	8- 8	11- 3	10- 8	7- 0	6- 9	8-10	8- 6
16"o.c.	7-11	7- 5	9- 9	9- 3	6- 0	5-10	7- 6	7- 3
24"o.c.	6- 4	6- 0	7-11	7- 5	4-10	4- 9	6- 0	5-10
2 x 8								
12"o.c.	12- 2	11- 7	15- 1	14- 4	9- 7	9- 3	12- 0	11- 7
16"o.c.	10- 6	10- 0	13- 0	12- 4	8- 2	7-11	10- 3	9-11
24"o.c.	8- 6	8- 1	10- 6	10- 0	6- 5	6- 3	8- 2	7-11
2 x 10								
12"o.c.	15- 9	14-11	19- 6	18- 5	12- 7	12- 1	15- 9	15- 2
16"o.c.	13- 6	12-10	16- 9	15- 10	10- 9	10- 4	13- 5	12-11
24"o.c.	10-11	10- 5	13- 6	12-10	8- 6	8- 3	10- 8	10- 4
2 x 12								
12"o.c.	19- 4	18- 4	23-11	22- 7	15- 8	15- 0	19- 7	18-10
16"o.c.	16- 8	15- 9	20- 6	19- 5	13- 4	12-10	16- 9	16- 1
24"o.c.	13- 5	12- 9	16- 7	15- 9	10- 8	10- 3	13- 4	12-10

NOTES: Provide solid blocking between each panel connection to roof. Lag bolt or through bolt panel connection to rafters or blocking.

For situations exceeding any maximum condition listed above or not shown in Condition A or B, the structure shall be approved by a licensed professional engineer or registered architect.

DESIGN CRITERIA Strength: 10 lbs. per sq. ft. (light roof construction-LRC) or 15 lbs. per sq. ft. (heavy roof construction-HRC) as noted plus 30 lbs. per sq. ft. live load plus load of drifting snow plus loads of solar collectors determine fiber stress. Deflection: For 30 lbs. per sq. ft. live load, limited to span in inches divided by 180.

SECTION 2108.0 CHIMNEYS, FIREPLACES AND CONNECTOR PIPES

2108.1 Types of chimneys

2108.1.1 Factory-built chimneys: Factory-built chimneys are factory-made chimneys tested to U.L. 103 and shall be installed in strict accordance with the terms of their approval and listing and the manufacturer's instructions.

2108.1.2 Masonry chimneys: Masonry chimneys shall be field constructed to meet the requirements of Sections 2108.2 and 2108.3.

2108.2 Masonry chimneys, general requirements

2108.2.1 Foundations: Masonry chimneys shall be supported on properly designed foundations of masonry or reinforced concrete or on noncombustible material having a fireresistance rating of not less than three (3) hours, provided such supports are independent of the building construction, and the load is transferred to the ground.

2108.2.2 Structural design: Chimneys shall be designed, anchored, supported and reinforced as required in this article. Chimneys shall not support any structural load other than their own weight unless designed to act as supporting members. Chimneys in wood-frame buildings shall be anchored laterally at the ceiling lines and at each floor line which is more than six (6) feet above grade, except when entirely within the framework of the building.

2108.2.3 Area: Chimney passageways shall not be smaller in area than the vent connection on the appliance attached thereto, nor less than as set forth in Table 2108-2 unless alternate approved engineering methods have been used to design the system.

Table 2108-2
MINIMUM PASSAGE AREAS FOR MASONRY CHIMNEYS

Type of Masonry Chimney[1]	Minimum cross-sectional area	
	Round	Square or rectangle
Residential appliances	50 sq. in.	50 sq. in.
Fireplace[2]	1/12 of opening Minimum 50 sq. in.	1/10 of opening Minimum 64 sq. in.
Solid fuel burning appliances	50 sq. in.	57 sq. in.

Note 1. Areas for chimneys shall be determined using accepted engineering methods and as approved by the department.

Note 2. Where fireplaces open on more than one side, the fireplace opening shall be measured along the greatest dimension.

2108.2.4 Corbeling: Masonry chimneys shall not be corbeled from a wall more than six (6) inches nor shall a masonry chimney be corbeled from a wall which is less than twelve (12) inches in thickness, unless it projects equally on each side of the wall. In the second story of a two-story building corbeling of masonry chimneys on the exterior of the enclosing walls may equal the exterior wall thickness. In any case, the corbeling shall not exceed one (1) inch projection for each course of brick.

2108.2.5 Change in size or shape: Changes in the size or shape of a masonry chimney, where the chimney passes through the roof, shall not be permitted within a distance of six (6) inches above or below the roof joists or rafters.

2108.2.6 Inlets: Every connector inlet to any masonry chimney shall enter the side thereof and shall be of metal not less than No. 24 Manufacturer's Standard Gauge (0.024 inch) or five-eighths (5/8) inch thick refractory material (see Section 2108.6

for chimney connectors).

2108.2.7 Cleanouts: Every chimney flue shall be provided with an approved cleanout having a tight-fitting cover. Such cleanouts shall be installed at least twelve (12) inches below the lowest chimney inlet opening.

2108.2.8 Firestopping: All spaces between chimneys and floors and ceilings through which chimneys may pass shall be firestopped with noncombustible material. The firestopping of spaces between chimneys and wood joists, beams or headers shall be to a depth of one (1) inch only placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

2108.2.9 Smoke test: Masonry chimneys shall be proved tight by a smoke test after erection and before being put into use.

2108.3 Masonry chimneys

2108.3.1 Construction: Masonry chimneys shall be constructed of solid masonry units or reinforced concrete with walls not less than four (4) inches thick or rubble stone masonry not less than twelve (12) inches thick. Masonry shall be constructed with full bed and head mortar joints (see Figure 2108.3).

2108.3.2 Lining: Masonry chimneys shall be lined with fire-clay flue lining (ASTM C315), or the equivalent, not less than five-eighths (5/8) of an inch thick, or with liner of other approved material that will resist corrosion, softening or cracking from flue gases at temperatures up to seventeen hundred (1700) degrees F.

2108.3.2.1 Liner installation: Fire-clay flue liner shall be installed ahead of the construction of the chimney as it is carried up and carefully bedded one on the other in refractory mortar (ASTM C105, medium duty), or the equivalent, with close fitting joints left smooth on the inside.

2108.3.2.2 Clearances: Liners shall be separate from the chimney wall by one inch clearance and the space between the liner and masonry shall not be filled; only enough mortar shall be used to make a good joint and hold the liners in position.

2108.3.2.3 Starting point: Flue liners shall start from a point not less than eight (8) inches below the lowest vent connector entrance. The lining shall extend, as nearly vertical as possible, for the entire height of the chimney.

2108.3.2.4 Adjoining flues: Where two (2) adjoining flues in the same chimney are separated only by flue liners, the joints of the adjacent flue liners shall be staggered at least seven (7) inches.

2108.3.2.5 Flue partitions: Where more than two (2) flues are located in the same chimney, masonry wythes (partitions) at least four (4) inches wide and bonded into the masonry walls of the chimney shall be built at such points between adjacent flue linings that there are not more than two (2) flues in any group of adjoining flues without such wythe separation.

2108.3.2.6 Termination (height): Masonry chimneys shall extend at least three (3) feet above the highest point where they pass through the roof of a building and at least two (2) feet higher than any portion of a building within ten (10) feet.

2108.3.2.7 Multiple flue connections: A solid fuel burning heating appliance may be vented into a common flue of a masonry chimney with a liquid fuel burning device provided that:

1. the flue does not also vent a working fireplace;

2. the solid fuel burning appliance's connector, if separate, shall enter at a minimum of six (6) inches below the liquid fueled appliance's connector pipe;

3. all appliances shall be approved by the appropriate state agencies; and

4. the flue shall be of sufficient size to serve all the units connected to it if operated simultaneously (see Table 2108.3.2.7).

2108.3.3 Clearance from combustible material

2108.3.3.1 General: All wood beams, joists and studs shall be trimmed away from chimneys. Headers, beams, joists and studs shall not be less than two (2) inches from the outside face of a chimney or from masonry enclosing a flue. Ends of wood girders may be supported on a corbeled shelf of a masonry chimney, provided there is not less than eight (8) inches of solid masonry between the ends and the flue liner.

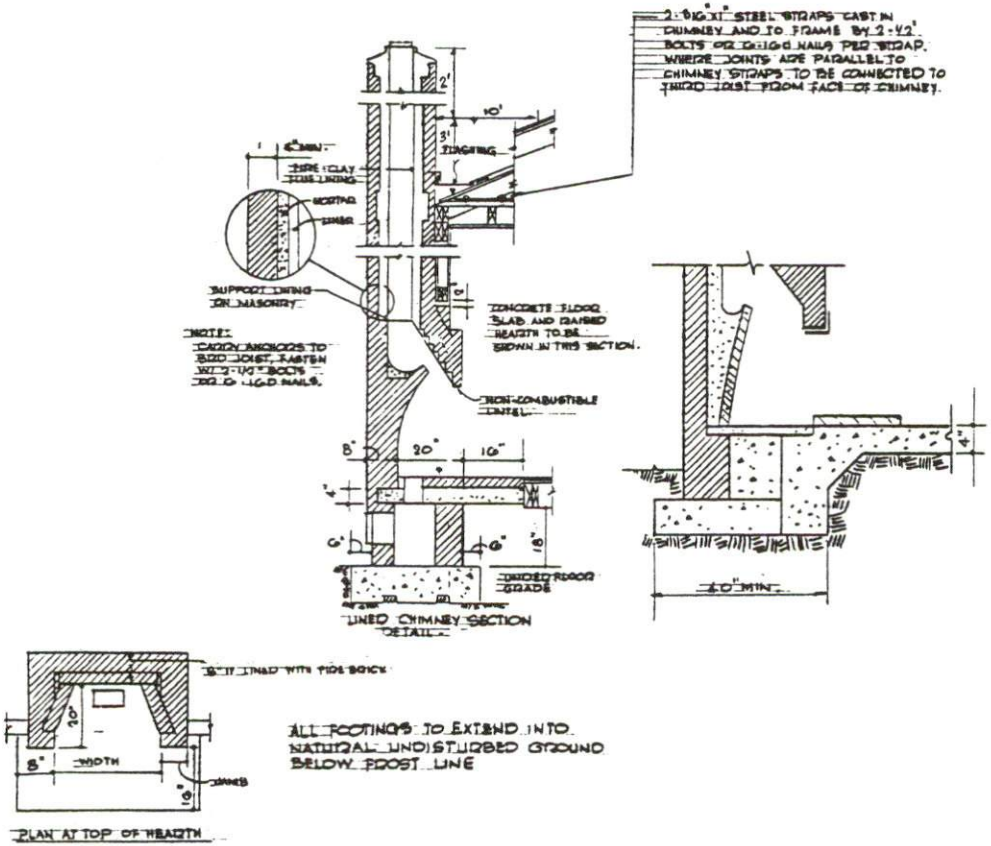
2108.3.3.2 Other material: Combustible lathing, furring or plaster grounds shall not be placed against a chimney at any point more than one and one-half (1-1/2) inches from the corner of the chimney, but this shall not prevent plastering directly on the masonry or on metal lath and metal furring, nor shall it

prevent placing chimneys for low-heat appliances entirely on the exterior of a building against the sheathing.

Table 2108.3.2.7
CAPACITY OF A MASONRY CHIMNEY SERVING TWO APPLIANCES

Total Vent Height (feet) of Not Less Than	Combined Appliance Input Rating of Not Greater Than (Thousands of Btu's per Hour)				
8	81	118	162	277	405
10	89	129	175	300	450
15	105	150	210	360	540
20	120	170	240	415	640
30	135	195	275	490	740
50	-	-	325	600	910
	Liner Dimensions with Equivalents				
nominal liner size (in.) (sq./rect.)	4x8	4x8	8x8	8x12	12x16
inside dimension of liner (in.)	2½x6½	2½x6½	6 3/4 x 6 3/4	6½x10½	9½x13½
inside diameter (in.) (circular)	6	7	8	10	12
equivalent area (square in.)	28.3	38.5	50.3	78.5	113.0

Figure 2108-3
FIRE PLACE CONSTRUCTION DETAILS



NOTES:

1. WHERE PLATES ARE CUT ANCHOR TO CHIMNEY BY 3/16" x 1" STEEL STRAPS HOOKED INTO CHIMNEY AND ATTACHED TO PLATES BY 2 3/8" x 3" LAG SCREWS, 2 1/2" BOLTS OR 6-16d NAILS.

2. WHERE DAMPERS ARE USED THEY SHALL NOT BE LESS THAN NO. 12 GA. METAL AND WHEN FULLY OPEN THE DAMPER OPENING SHALL BE NOT LESS THAN 90% OF THE REQUIRED FLUE AREA

NOTE: THE FIREPLACE ASH PIT AND CLEANOUT SHOWN IS OPTIONAL.

2108.4 Factory-built chimneys, general requirements

2108.4.1 Prohibited installation

2108.4.1.1 Single wall: Single wall metal chimneys shall not be used in one- and two-family dwellings; connector pipe may be single wall (refer to 2108.5).

2108.4.2 Clearances: Factory-built exterior and interior chimneys shall have a clearance of not less than two (2") inches from combustible construction, or shall be installed to manufacturers' recommended clearances, whichever are more stringent. Factory-built chimneys shall be tested to U.L. Std. 103.

2108.4.3 Support: Metal chimneys shall be supported on properly designed supports of noncombustible material.

2108.4.4 Cleanouts: Cleanout openings shall be provided at the base of every metal chimney.

2108.5 Termination (height)

2108.5.1 General: All chimneys shall extend at least three (3) feet above the highest point where they pass through the roof of a building and at least two (2) feet higher than any portion of a building within ten (10) feet.

2108.5.2 Outlet: The outlet of a metal chimney equipped with an exhauster may terminate at a location not less than three (3) feet from an adjacent building or building opening and at least ten (10) feet above grade or walkways. In any case, the outlet shall be so arranged that the flue gases are not directed so as to jeopardize people, overheat combustible structures or enter building openings in the vicinity of the outlet.

2108.5.3 Ventilation thimble: Where a non-insulated metal chimney connector passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion-resistant metal, extending not less than nine (9) inches below and nine (9) inches above the roof construction, and of a size to provide not less than six (6) inches clearance on all sides of the chimney, or the combustible material in the roof construction shall be cut away so as to provide not less than eighteen (18) inches clearance on all sides of the chimney with the opening closed up with noncombustible material.

2108.6 Chimney connector pipe

2108.6.1 Materials: Single wall chimney connector pipe shall be constructed of not less than the following gauge galvanized metal specified in Table 2108-6.

Table 2108-6
MINIMUM CHIMNEY CONNECTOR GAUGES

Diameter of connector	Inch thickness	Birmingham or Stubs Gauge
Less than 6"	0.022 in.	24
6" to less than 10"	0.028 in.	22
10" to 12"	0.034 in.	20
13" to 16"	0.040 in.	18
greater than 16"	0.064 in.	16

Note: The corrosive resistance shall be equivalent to or better than galvanized metal.

2108.6.2 Single wall metal pipe:

1. shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. A pipe passing through a roof shall extend without interruption through roof flashing, roof jack or roof thimble.
2. shall not originate in any unoccupied attic or concealed space, and shall not pass through any attic, inside wall, concealed space, or through any floor.

2108.6.3 Size: The size of the chimney connector shall be not less than the size of the smoke outlet from the appliance.

2108.6.4 Fastening: Connector sections shall be securely fastened together and into the chimney but in a way that they can be readily dissassembled for cleaning.

2108.6.5 Clearances: Single wall chimney connectors shall be installed with the clearances to combustible materials specified in Table 2108.6.2. Reduced clearances shall be used with double wall or insulated connector pipe.

2108.6.6 Slope: Horizontal runs of chimney connectors shall have a continuous rise toward the chimney of not less than one quarter (1/4) inch per foot.

2108.6.7 Offsets: Chimney connectors shall have not more than two (2) offsets.

2108.6.8 Combustible walls: Chimney connectors may pass through combustible walls and partitions when protected by approved thimbles or by providing the required clearances.

2108.7 Fireplaces

2108.7.1 General: Fireplaces, barbecues, smoke chambers and fireplace chimneys shall be of solid masonry or reinforced concrete or other approved materials, and shall conform to requirements of this section.

2108.7.2 Construction: Structural walls of fireplaces shall be at least eight (8) inches thick. Where a lining of low duty refractory brick (ASTM C64) or the equivalent, at least two (2) inches thick laid in fire clay mortar (ASTM C105, medium duty), or the equivalent, or other approved lining is provided, the total thickness of back and sides, including the lining, shall be not less than eight (8) inches. Where such lining is not provided, the thickness of back and sides shall be not less than twelve (12) inches. The firebox shall be twenty (20) inches in depth and will be permitted to be open on all sides, provided all fireplace openings are located entirely within one (1) room. All fireplaces shall have a tight fitting flue damper with a readily accessible control.

Exception: When the functional design of a fireplace requires a firebox depth of less than twenty (20) inches, hearth extensions as outlined in Section 2108.7.7 shall be increased. The combined dimension of firebox and hearth extension shall not be less than thirty-six (36) inches.

Table 2108.6.2
CHIMNEY CONNECTOR PIPE CLEARANCES

DIAMETER Inches	CLEARANCE Inches	REDUCED Clearance
0-12	18	9
1236	20	10
36+	36	18

2108.7.3 Lining: The lining shall extend from the throat of the fireplace to a point at least four (4) inches above the top of the enclosing masonry walls.

2108.7.4 Clearance

2108.7.4.1 Distance: The distance between fireplace and combustibles shall be at least four (4) inches, and such combustibles shall not be placed within six (6) inches of the fireplace opening. Wood facings or trim normally placed around the fireplace opening may be permitted when conforming to the requirements of this section; however, such facing or trim shall be furred out from the fireplace wall at least four (4) inches and attached to noncombustible furring strips. The edges of such facings or trim shall be covered with a noncombustible material. Where the walls of the fireplace are twelve (12) inches thick, the facings or trim may be directly attached to the fireplace.

2108.7.4.2 Metal hoods: Metal hoods used as part of a fireplace or barbecue shall be at least eighteen (18) inches from combustible material unless approved for reduced clearances.

2108.7.4.3 Metal: Metal hoods used as a part of a fireplace or barbecue shall be at least No. 18 B&S (0.0403 inch) Gauge sheet copper, No. 18 Galvanized Steel Gauge (0.052 in.) galvanized steel or other equivalent corrosion-resistant ferrous metal with all seams and connections of smokeproof unsoldered construction. The hoods shall be sloped at an angle of forty-five (45) degrees or less from the vertical and shall extend horizontally at least six (6) inches beyond the limits of the firebox.

2108.7.4.4 Metal heat circulators: Approved metal heat circulators may be installed in fireplaces, provided the thickness of the fireplace walls is not reduced.

2108.7.4.5 Smoke chamber: All walls, including back walls, shall be at least eight (8) inches in thickness.

2108.7.5 Areas of flues, throats and dampers: The net cross-sectional area of the flue and of the throat between the firebox and the smoke chamber of a fireplace shall be at least that required in Table 2108.2. When dampers are used, damper openings shall be at least, when fully opened, equal to the required flue area and shall be of No. 12 Galvanized Steel Gauge (0.018 in.) metal.

2108.7.6 Lintel: Masonry over the fireplace opening shall be supported by a noncombustible lintel.

2108.7.7 Hearth: Every fireplace shall be constructed with a hearth of brick, stone, tile or other noncombustible material. For fireplaces with an opening of less than six (6) square feet, the hearth shall extend not less than sixteen (16) inches in

front and not less than eight (8) inches on each side of the fireplace opening. For fireplaces with an opening of six (6) square feet or more, the hearth shall extend not less than twenty (20) inches in front and not less than twelve (12) inches on each side of the fireplace opening. Such hearths shall be properly supported or reinforced to carry their own weight and all imposed loads. Combustible forms and centers used during the construction of hearth and hearth extension shall be removed after the construction is complete.

2108.7.8 Firestopping: Firestopping between chimneys and wooden construction shall meet the requirements specified in Section 2108.2.8.

2108.7.9 Support: Fireplaces shall be supported on foundations designed in conformity with Section 2108.2.1.

2108.7.10 Screens: Screens or other acceptable protection devices shall be provided for all fireplace openings.

2108.7.11 Imitation fireplaces: Imitation fireplaces shall not be used for the burning of gas, solid or liquid fuel.

2108.7.12 Factory-built fireplaces: A product which is defined as a fire chamber, its chimney, and related parts consisting entirely of factory-made parts designed for unit assembly without requiring field construction and enclosed in a wall, shall be tested by an approved testing agency to Underwriters Laboratories (U.L.) Standard U.L. 127 and installed in accordance with manufacturer's recommendations not in conflict with the basic code.

UL
(8-89)
Non Combustible

2108.7.12.1 Hearth extensions: Hearth extensions shall comply with the dimensions of Section 2108.7.7 but may be placed on combustible subflooring or finish flooring and shall be readily distinguished from the surrounding floor.

2108.7.12.2 Air duct construction: An air duct system portion of a circulating warm air type fireplace, is intended for installation in accordance with the National Fire Protection Association Standard (NFiPA No. 90B).

2108.7.12.3 Fixed blowers: Fixed blowers and other electrical accessories for factory-built fireplaces shall conform to the Massachusetts State Electrical Code, 527 CMR 12.00.

2108.7.13 Steel fireplace liners: Steel fireplace units incorporating a firebox liner of not less than one-quarter (1/4) inch steel in thickness and an air chamber may be installed with masonry to provide a total thickness at the back and sides of

not less than eight (8) inches, of which not less than four (4) inches shall be of solid masonry. Warm air ducts employed with steel fireplace units of the circulating air type shall be constructed of metal or masonry. A noncombustible, fire chamber bottom, should be provided if not included with the liner.

SECTION 2109.0 SOLID FUEL BURNING HEATING APPLIANCES

2109.1 General: Solid fuel burning heating appliances shall be tested and labeled in accordance with this code, the applicable standards listed in RS-21-14 and the applicable Rules and Regulations listed in Appendix Q. These units are for attachment to a residential type chimney (see Section 2108.0).

2109.2 Definitions:

1. Central heating appliance: A solid or solid/liquid fueled boiler or warm air furnace tested to the applicable standards listed in Appendix B and contained in the applicable Rules and Regulations listed in Appendix Q.

2. Circulating: A solid fuel burning heating appliance in which the fire chamber is surrounded by a jacket so that air flows past the fire chamber by convection or by forced circulation, or a radiant stove with a heat shield.

3. Fireplace insert: A piece of heating equipment inserted entirely and sealed into a completed masonry fire place fire chamber to adapt the fireplace for circulating warm air use and designed solely for that purpose.

   Notes:
   a. Door assemblies, grills, duct work or mechanical blowers need not be entirely confined to the fire chamber so long as they do not serve as direct sources of radiant heat.
   b. There are no test standards or labeling requirements for this type of fireplace insert.
   c. A building permit is required for the installation of this type of fireplace insert.

4. Radiant: A solid fuel burning heating appliance in which the exterior wall of the fire chamber directly radiates the heat to the room.

5. Room heater: A freestanding fire chamber assembly of the circulating or direct radiation type tested to UL 1482 and/or ANSI/UL 737 as applicable. A room heater shall not be connected to duct work or other heat distribution equipment which would make it function as a central heating appliance.

2109.3 Hearth: For a solid fuel low heat appliance the floor shall be of masonry or other noncombustible construction with not less than one (1) hour fireresistance and shall extend twelve (12) inches beyond the appliance on all sides and at least eighteen (18) inches on the fuel and ash access side.

2109.4 Appliance clearance: Clearance shall be provided from combustible construction adjacent to heating appliances and equipment not less than thirty-six (36) inches at the top, twelve (12) to thirty-six (36) inches at the sides and rear, and twenty-four (24) to thirty-six (36) inches at the front (clearance dependent on whether appliance is circulating or radiant type). The clearance from material may be decreased when exposed construction is protected with noncombustible materials to afford the fire protection resistance (see Tables 2109-4 and 2110-2) or may be reduced to manufacturer's tested clearances.

2109.5 Combustion air source: Combustion air may be obtained from interior spaces when volume in cubic feet is equal to one-twentieth (1/20) of the output Btu rating of all solid fuel burning heating appliances in the space.

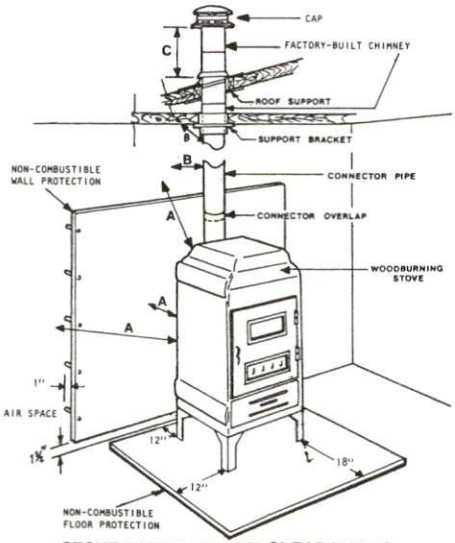
2109.6 Solid fuel burning room heater installed in fireplaces: If a solid fuel burning room heater is set in front of a fireplace to use the existing chimney, the stove pipe must be connected either into the open damper through a snug fitting noncombustible seal or through a noncombustible fireplace opening closure which seals off the fireplace. Both methods of installation must have access for cleanout.

2109.7 Used solid fuel burning room heaters: Used solid fuel burning room heaters which are not labeled after July 1, 1979 must be inspected and approved prior to installation by the local building official or fire official and installed in accordance with the provisions of this code.

2109.8 Solid fuelburning room heater labeling: Every solid fuelburning room heater shall bear a permanent and legible factory-applied label supplied to the manufacturer and controlled by an approved testing laboratory containing the following:

1. Manufacturer's name and trademark
2. Model and/or identification number of the appliance
3. Type of fuel(s) approved
4. Testing laboratory's name or trademark and location
5. Date tested
6. Clearance to combustibles
   a. Side
   b. Rear
7. Test standard
8. Label serial number

Figure 2109-4
CLEARANCES FOR SOLID FUEL BURNING APPLIANCES



STOVE INSTALLATION CLEARANCES

Stove Components	Combustible Material	¼" Asbestos Millboard Spaced Out 1" 3.	Concrete/Masonry Foundation Wall	4"Brick Veneer Spaced Out 1"
Radiant Stove 1. —Front	36"	—	—	—
Circulating Stove 1. —Front	24"	—	—	—
A. Radiant Stove 4. —Side/Back	36"	18"	6"	18"
A. Circulating Stove —Side/Back	12"	6"	6"	6"
B. Single Wall 2. Connector Pipe	18"	12"	6"	8"
B. Insulated Connector Pipe	2"	2"	2"	2"
C. Chimney Height (Metal or Masonry)	Three (3) feet above adjacent roof and two (2) feet above any roof ridge within 10 feet			
D. Damper	If a damper is not included in the stove construction, it must be installed in the connector pipe.			

1. Front: Fuel or ash access side.
2. Thimble required for passage through combustible construction.
3. Non-combustible spacers required.
4. Clearances on each side of a radiant stove with a heat shield shall be measured as if a circulating type.

2109.9 Central heating appliance installation: Solid or solid/liquid fueled heating (central heating) appliances installed into an existing liquid or gas-fueled central heating system shall be positioned downstream of the existing appliance. Clearances to combustible materials shall be provided in accordance with the requirements specified on the label affixed to the central heating appliance (see Section 2109.3.2.7).

2109.10 Ducts for solid or solid/liquid fueled central heating appliances.

2109.10.1 Supply ducts: Supply ducts conveying heated conditioned air shall be fabricated of noncumbustible material.

2109.10.2 Hot air ducts: Hot air ducts shall have a clearance of not less than twelve (12) inches from combustibles for the first ten (10) feet of distance from the appliance plenum/bonnet.

21.09.10.3 Ducts: All ducts shall be otherwise constructed, installed, supported and insulated as required by this code.

2109.11 Central heating appliance labeling: Every solid or solid/liquid fueled boiler or warm air furnace shall bear a permanent and legible factory applied label, supplied to the manufacturer and controlled by an approved testing laboratory, containing the following information:

1. Manufacturer's name or trademark
2. Model/identification name or number of the appliance
3. Types of fuel(s) approved
4. Testing laboratory's name or trademark and location
5. Date tested
6. Clearance to combustibles:
   a. side
   b. rear
   c. top
   d. front
7. Test standard(s)
8. Label serial number
9. Type of appliance (boiler or warm air furnace)

10. Every boiler, pressure vessel, or pressure relief device must be stamped in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. ASME stamping shall also be required for boilers, pressure vessels and pressure relief devices produced outside the United States of America. Where required by the ASME Boiler and Pressure Vessel Code, ASME stamping may be affixed directly to the appliance in lieu of on the data plate.

    Note: Additional information as required by the applicable test standard(s) may be affixed separately.

2109.11.1 Exceptions: Prior to January 1, 1981, the following exceptions shall apply:

1. ASME stamping shall not be required.

2. Solid or solid/liquid fueled central heating appliances shall be considered acceptable only if they have been tested and labeled by a laboratory accredited by the Commission to test other comfort heating appliances; or any nationally recognized laboratory.

SECTION 2110.0 MECHANICAL EQUIPMENT GENERAL

2110.1 General: Conformity with the applicable material, test, construction and design standards specified in the reference standards of this article shall be acceptable as providing compliance with the requirements of this article.

2110.2 Commonwealth of Massachusetts regulations: All installation of gas appliances must comply with 248 CMR 3.00 - 8.00 (Massachusetts Fuel Gas Code). The construction, installation and operation of oil burning equipment is subject to the provisions of 527 CMR 4.00 established in accordance with Chapter 148, Section 10 of the MGLA, as amended. The construction, installation, testing and inspection of boilers, air tanks, ammonia compressor valves, and refrigeration and air-conditioning systems of twenty (20) tons or more capacity are subject to the Rules and Regulations issued by the Board of Boiler Rules under authority of Chapter 146 of the MGLA, as amended.

2110.3 Cooperating agencies: Nothing herein contained shall be deemed to nullify the provisions of other legal statutes or regulations of the Commonwealth of Massachusetts governing the operation and maintenance of boilers and other heating appliances and equipment.

2110.4 Labeled heating and cooking appliances: Approved oil-fired warm air furnaces, floor furnaces, unit heaters, domestic incinerators, cooking and heating stoves and ranges and other heating equipment, inspected and approved by approved agencies shall be accepted by the building official when installed with the clearances provided in Table 2110-1 and in accordance with their listings.

2110.5 Type of fuel: Each comfort heating appliance shall be designed for use with the type of fuel to which it will be connected. Appliances shall not be converted from the fuel specified on the rating plate for use with a different fuel without securing reapproval from the building official and as recommended by the manufacturer of either the original equipment or the conversion equipment.

2110.6 Shutoff valve: A readily accessible approved shutoff valve shall be installed ahead of the union or other connection in the fuel piping outside and within three (3) feet of the appliance.

Exception: Shutoff valves may be accessibly located inside or under an appliance provided the appliance can be removed without removal of the shutoff valve.

2110.7 Appliance installation: Except as otherwise provided in this article or the basic code, the installation of comfort heating appliances shall conform to the conditions of their listing. The manufacturer's installation and operating instructions shall remain attached to the appliance.

2110.8 Appliance access: Comfort heating appliances shall be accessible for inspection, service, repair and replacement without removing permanent construction. Not less than thirty (30) inches working space and platform shall be provided in front of the appliance firebox opening of fuel burning appliances except unit and room heaters which must have a minimum of eighteen (18) inches.

2110.9 Control devices: Automatic gas-burning comfort heating appliances shall be equipped with listed devices which will shut off the gas to the main burner or burners in the event of pilot failure.

Exception: The listed shutoff devices shall not be required on range or cooking tops, log lighters, or other open burner manually operated appliances, or listed appliances not requiring such devices.

2110.9.1 Safety controls: Liquid fuelburning appliances shall be equipped with primary safety controls which will shut off flow of fuel to the burners in the event of ignition failure.

2110.9.2 Remote controls: Comfort heating fuelburning appliances whose manual fuel controls are not readily accessible from the main portion of the building being heated shall be equipped with remote controls.

2110.9.3 Temperature limit control: Forced-air and gravity-type warm-air furnaces shall be equipped with a listed air outlet temperature limit control which cannot be set for temperatures higher than 250° F. The controls shall be located in the bonnet or plenum, within two (2) feet of the discharge side of the heating element of gravity furnaces or in accordance with the conditions of listing.

2110.10 Ranges--vertical clearance above cooking top: Domestic freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than thirty (30) inches to unprotected combustible material. When the underside of such combustible material is protected with asbestos millboard at least one-quarter (1/4) inch thick covered with sheet metal of not less than No. 28 U.S. gauge or a metal ventilating hood, the distance shall be not less than twenty-four (24) inches.

2110.11 Ranges--horizontal clearance to built-in top cooking units: The minimum horizontal distance from the center of the burner head(s) of a top (or surface) cooking unit to surrounding top or surface shall be not less than that distance specified by the permanent marking on the unit.

2110.12 Open top broiler units: Listed open top broiler units and hoods shall be installed in accordance with their listing and the manufacturer's instructions.

2110.13 Domestic clothes dryers

2110.13.1 General: Where a clothes dryer is connected to a moisture exhaust duct, it shall be installed in accordance with manufacturer's instructions and recommendations.

1. A clothes dryer moisture exhaust duct shall not be connected into any vent connector, gas vent or chimney.
2. Ducts for exhausting moisture from clothes dryers shall not be constructed with sheet metal screws or other fastening means which extend into the duct.
3. In no case shall the moisture exhaust terminate beneath the building or in the attic.
4. Domestic clothes dryers shall be moisture exhausted to the outside when located in a habitable room or room containing other fuelburning appliances.

2110.14 Fuel-burning appliance labeling: Every fuelburning comfort heating appliance shall bear a permanent and legible factory applied nameplate on which shall appear:

1. the manufacturer's name or trademark;
2. the model and serial number;
3. instructions for the lighting, operation and shut-down of the appliance;
4. the type of fuel approved for use with the appliance; and
5. a seal indicating approval of the appliance by an approved testing agency, if acceptance is based on such approval.

2110.15 Electrical appliance labeling: Every electric appliance listed in Table 2110-1 shall bear a permanent and legible factory applied nameplate on which shall appear:

1. name or trademark of the manufacturer;
2. the catalog (model) number or equivalent;
3. the electrical rating in volts, amperes and phase;
4. individual marking for each electrical component in amperes or watts, volts and phase shall appear on the nameplate of that component.

2110.16 Appliance protection: Boilers, furnaces, hot water heaters or any other appliances having an open flame or exposed heated surfaces shall not be located in a private garage unless precautions are taken to protect such equipment from

impact by automobiles. This equipment shall have the combustion chamber, ash pit, etc., raised a minimum of eighteen (18) inches above the floor to eliminate a possible source of ignition.

Exception: Sealed combustion system appliances may be installed at floor level.

Table 2110-1

STANDARD INSTALLATION CLEARANCES FOR HEAT-PRODUCING APPLIANCES

These clearances apply unless otherwise shown on listed appliances. Appliances shall not be installed in alcoves or closets unless so listed. For installation on combustible floors see footnote 2.

RESIDENTIAL TYPE APPLIANCES For Installation in Rooms Which Are Large		APPLIANCE					CHIMNEY CONNECTOR (Inches)	VENT CONNECTOR[1] (Inches)
		Above Top of Casing or Appliance (Inches)	From Top and Sides of Warm-Air Bonnet or Plenum (Inches)	From Front[4] (Inches)	From Back (Inches)	From Sides (Inches)		
BOILERS AND WATER HEATERS[5] FUEL								
Steam Boilers–15 p.s.i Water Boilers–250° F. Water Heaters–200° F. All Water Walled or Jacketed	Automatic Oil or Combination Gas and Oil	6	–	24	6	6	18	–
	Automatic Gas	6	–	18	6	6	–	9
	Solid	6	–	48	6	6	18	–
FURNACES–CENTRAL								
Gravity, Upflow, Downflow, Horizontal and duct Warm Air–250° F. maximum Limit Control	Automatic Oil or Combination Gas and Oil	6[7]	6[7]	24	6	6	18	–
	Automatic Gas	6[7]	6[7]	18	6	6	–	9
	Solid	18[8]	18[8]	48	18	18	18	–
	Electric	6[7]	6[7]	18	6	6	–	–
FURNACES–FLOOR								
For Mounting in Combustible Floors Floors	Automatic Oil or Combination Gas and Oil	36	–	12	12	12	18	–
	Automatic Gas	36	–	12	12	12	–	9
HEAT EXCHANGER, SUPPLIED FROM A REMOTE SOURCE								
Steam–15 p.s.i. maximum Hot water–250° F. maximum		1	1	1	1	1	–	–
ROOM HEATERS AND ROOM HEATING STOVES BURNING SOLID FUEL								
Circulating Type Vented or Unvented	Oil or Solid	36	–	24	12	12	18	–
	Gas	36	–	24	12	12	–	9
Radiant or Other Type Vented or Unvented	Oil or Solid	36	–	36	36	36	18	–
	Gas	36	–	36	18	18	–	9
	Gas with Double Metal or Ceramic Back	36	–	36	12	18	–	9
RADIATORS, SELF-CONTAINED[6]								
Steam or Hot Water	Gas	36	–	6	6	6	–	9
RANGES–COOKING STOVES		[9]				Front Side / Other Side		
Vented or Unvented	Oil	30	–	–	9	24 / 18	18	–
	Gas	30	–	–	6	6 / 6	–	6
	Solid–Clay lined Firepot	30	–	–	24	24 / 18	18	–
	Solid unlined Firepot	30	–	–	36	36 / 18	18	–
	Electric	30	–	–	6	6	–	–
CLOTHES DRYERS								
Listed Types	Gas	6	–	24	6	6	–	1
	Electric	6	–	24	0	0 one side	–	–

Notes to Table 2110-1

Note 1. Standard clearances may be reduced in existing construction only by affording protection to combustible material in accordance with Table 2110-2.

Note 2. An appliance may be mounted on a combustible floor if the appliance is listed for such installation or if the floor is protected in an approved manner.

Note 3. Rooms which are large in comparison to the size of the appliance are those having a volume equal to at least twelve (12) times the total volume of a furnace and at least sixteen (16) times the total volume of a boiler. If the actual ceiling height of a room is greater than eight (8) feet, the volume of a room shall be figured on the basis of a ceiling height of eight (8) feet.

Note 4. The minimum dimension shall be that necessary for servicing the appliance including access for cleaning and normal care, tube removal, etc.

Note 5. The minimum dimension shall be eighteen (18) inches for gas appliances not equipped with draft hoods, except clothes dryers. The dimension may be six (6) inches for listed gas appliances equipped with draft hoods and for boilers and furnaces equipped with listed conversion burners and with draft hoods. A vent connector of listed Type B or L venting material may be used with listed gas appliances with draft hoods and may be installed at clearances marked on the material.

Note 6. Steampipes and hot-water heating pipes shall be installed with a clearance of at least one (1) inch to all combustible construction or material, except that at the points where pipes carrying steam or hot water at not over fifteen (15) pounds gauge pressure emerge from a floor, wall, or ceiling, the clearance at the opening through the finish floor boards or wall ceiling boards may be reduced to not less than one-half (1/2) inch. Each such opening shall be covered with a plate of noncombustible material.

Such pipes passing through stock shelving shall be covered with not less than one (1) inch of approved insulation.

Wood boxes or casings enclosing uninsulated steam or hot water heating pipes, or wooden covers to recesses in walls in which such uninsulated pipes are placed, shall be lined with metal or asbestos millboard.

Where the temperature of the boiler piping does not exceed one hundred sixty (160°) degrees F., the provisions of this table shall not apply.

Coverings or insulation used on steam or hot water pipes shall be of noncombustible material.

Note 7. For a listed oil, combination gas-oil, gas or electric furnace, this dimension may be two (2) inches if the furnace limit control cannot be set higher than two hundred fifty (250°) degrees F., or this dimension may be one (1) inch if the limit control cannot be set higher than two hundred (200°) degrees F.

Note 8. The dimension may be six (6) inches for an automatically stoker-fired forced warm-air furnace equipped with two hundred fifty (250°) degrees F. limit control operated by draft intensity of .13-inch water gauge.

Note 9. To combustible material or metal cabinets. If the underside of such combustible material or metal cabinet is protected with asbestos millboard at least one-quarter (1/4) inch thick covered with sheet metal of not less than No. 28 gauge, the distance may be not less than twenty-four (24) inches.

Table 2110-2
MAXIMUM REDUCED CLEARANCES (INCHES) WITH SPECIFIED FORMS OF PROTECTION[1]

TYPE OF PROTECTION Applied to the Combustible Material Unless Otherwise Specified and Covering All Surfaces Within the Distance Specified as the Required Clearance With No Protection (Thicknesses are Minimum)	WHERE THE REQUIRED CLEARANCE WITH NO PROTECTION IS:							
	36 inches			18 inches			12 inches	
	Above	Sides and Rear	Chimney or vent Connector	Above	Sides and Rear	Chimney or vent Connector	Above	Sides and Rear
(a) ¼" asbestos millboard spaced out 1".....	30	18	30	15	9	12	9	6
(b) No. 28 Manufacturers' Standard gage steel sheet on ¼"asbestos millboard.....	24	18	24	12	9	12	9	6
(c) No. 28 Manufacturers' Standard gage steel sheet spaced out 1".....	18	12	18	9	6	9	6	4
(d) No. 28 Manufacturers' Standard gage steel on 1/8" asbestos millboard spaced out 1"...	18	12	18	9	6	9	6	4
(e) ¼" asbestos millboard on 1" mineral fiber batts reinforced with wire mesh or equivalent.....	18	12	18	6	6	6	4	4
(f) No. 22 Manufacturers' Standard gage steel sheet on 1" mineral fiber batts reinforced with wire or equivalent.....	18	12	12	4	3	3	2	2
(g) ¼" asbestos cement board or ¼" asbestos millboard.....	36	36	36	18	18	18	12	12
(h) ¼" cellular asbestos.....	36	36	36	18	18	18	12	12

Note 1: Except for the protection described in (e), all clearances shall be measured from the outer surface of the appliance to the combustible material disregarding any intervening protection applied to the combustible material.

Note 2: Spacers shall be of non-combustible material.

SECTION 2111.0 COMBUSTION AIR

2111.1 General: All fuelburning equipment shall have a sufficient supply of air for fuel combustion, ventilation draft hood dilution.

2111.2 Volume required: Additional combustion air shall be provided for fuelburning appliances if the volume of an appliance room in cubic feet is less than one-twentieth (1/20) of the maximum input Btu rating of all appliances therein.

HOW IS THIS ACHIEVED?

Exception: Sealed combustion system appliances, cooking appliances, refrigerators and clothes dryers.

2111.3 Air supply: Rooms containing fuel-burning appliances and not having the volume required in Section 2111.2 shall be provided with two (2) square inches of combustion air opening for each input of one thousand (1000) Btu rating with a total of not less than two hundred (200) square inches.

Exception: One (1) square inch for each input rating of one thousand (1000) Btu's may be permitted provided the compartment floor area is more than twice the floor area of the appliance and the total area is not less than one hundred (100) square inches.

2111.3.1 Air supply ratio: One-half (1/2) of the required combustion air opening shall extend within the upper twelve (12) inches of the room and the other one-half (1/2) shall extend within the lower twelve (12) inches.

Exception: In any room containing gas or liquid burning appliances which has more than twice the floor area of all such appliances, the required combustion air supply may be reduced fifty (50) per cent, but not less than one hundred (100) square inches and in all rooms larger than fifty (50) square feet the required combustion air opening may be located within the upper twelve (12) inches of the room.

2111.4 Outside combustion air: If required, outside combustion air shall be supplied through openings or ducts of the required cross-sectional area extending to the appliance room. The same duct shall not serve both the upper and lower combustion air supply openings. The duct serving the upper air opening must be level or extended upward from appliance room.

2111.5 Attic combustion air: Combustion air supply may be obtained from an attic area provided:

1. The attic ventilation is sufficient to provide the required volume of combustion air.

2. Circulating air supplies for blower-type furnaces shall not be obtained from the area.

2111.6 Under floor combustion air: The lower combustion air supply required by Section 2111.3 may be obtained from under floor areas having unobstructed openings to the outside equivalent to not less than twice the required combustion air opening between the under floor space and the appliance room.

2111.7 Opening requirements: Outside combustion air openings shall be covered with corrosion-resistant screen of one-quarter (1/4) inch mesh.

2111.8 Combustion air ducts: Combustion air supply ducts shall be of corrosion-resistant material having a cross-sectional dimension of not less than three (3) inches and terminating in a space not less than six (6) inches in depth in front of, or open to, the front or firebox side of the appliance. The space shall extend from the floor to the ceiling of the appliance room.

2111.9 Gravity-type warm-air furnaces: Gravity-type warm-air furnaces shall be provided with combustion air supply specified in section 2111.0.

2111.10 Exhaust and ventilation systems: Air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements.

2111.11 Cold climate: Appliance rooms of unusually tight construction located in areas where temperatures prevail at lower than 20° F., may be provided with combustion air as set forth in Table 2111-1. Openings shall conform to Section 2111.3.

Exception: Sealed combustion systems.

Table 2111-1
APPLIANCE ROOM COMBUSTION AIR REQUIREMENTS
IN COLD CLIMATES (TIGHT CONSTRUCTION)

Type of Openings	Minimum total free area of ducts or openings, where volume of compartment is less than 16 times of the appliance therein	Minimum total free area of ducts or openings, where volume of compartment is more than 16 times of the appliance therein
Direct Opening or Vertical Ducts to Outside	1 square inch for each 4000 Btu's	1 square inch for each 5000 Btu's
Horizontal Ducts to Outside	1 square inch for each 2000 Btu's	1 square inch for each 2500 Btu's
To Inside* of Building	1 square inch for each 1000 Btu's	1 square inch for each 2000 Btu's

*Combustion air shall be taken from other interior areas complying with Section 2110.2.

SECTION 2112.0 WARM-AIR FURNACE

2112.1 Installation: A direct-fired furnace shall not be located downstream from a refrigerant evaporator or other air cooling coil unless the heating equipment is listed for such use.

2112.1.1 A refrigerant evaporator or cooling coil shall not be located in the air discharge of a warm-air furnace except where the furnace is listed for operation at not less than 0.5-inch water column static pressure or for use with a cooling coil.

2112.1.2 Furnace conversion: Conversion of existing furnaces for use with cooling coils shall be permitted only if approved by the building official.

2112.2 Combustion air: Fuelburning warm-air furnaces shall be supplied with adequate combustion air as required by Section 2111.0 of this article.

2112.2.1 Separation: The combustion chamber opening shall be separated from the fan plenum of a forced air furnace by an airtight separation.

2112.3 Working space: A working space not less than thirty (30) inches deep and thirty (30) inches high shall be provided to the front or firebox side of all furnaces.

2112.3.1 Access space: A space not less than twenty-four (24) inches wide and thirty (30) inches high shall be provided to the access panel to the temperature limit control, air filter and where applicable, fuel control valve. A space not less than twenty-four (24) inches wide and eighteen (18) inches high shall be provided to the vent collar of fuelburning furnaces.

2112.4 Prohibited location: Warm-air furnaces shall not be located in a bedroom, bathroom, closet or confined space with access only to such room or space.

Exceptions:
1. Access to attic or underfloor furnaces may be through a closet.
2. Sealed combustion systems.
3. Enclosed furnaces.
4. Electric furnaces.

2112.5 Room access: Any room containing a warm-air furnace shall have access thereto by a door and passageway of not less than two (2) feet by six (6) inches and large enough to permit removal of equipment.

Exception: Underfloor and attic installations.

2112.6 Clearance of warm-air furnaces: Clearances shall be provided for warm-air furnaces in accordance with the requirements of Table 2110-1 or their listing. The clearance of the combustion chamber opening side shall be not less than six (6) inches for fuelburning appliances.

2112.7 Attic furnaces: A warm-air furnace installed in an attic less than five (5) feet in height shall be listed for that location.

2112.7.1 Equipment access: A passageway thirty (30) inches by thirty (30) inches minimum shall be provided from the attic opening to the furnace and its controls. The opening and

passageway shall be large enough to allow replacement of any part and the attic opening shall not be located more than twenty (20) feet from the furnace measured along the center line of the passageway. The passageway shall be unobstructed and have solid flooring not less than twenty-four (24) inches wide.

2112.8 Underfloor furnaces: Warm-air furnaces installed in the underfloor area shall comply with the following requirements:

1. An access opening and passageway shall be provided of sufficient height and width to permit removal of the furnace but not less than thirty (30) inches by thirty (30) inches and which extends to the working space in front of the furnace. The distance from the passageway opening to the heating equipment shall not exceed twenty (20) feet.
2. Furnaces supported on the ground shall rest on concrete or masonry bases extending not less than three (3) inches above the adjoining ground level.
3. Furnaces suspended from the building shall have a clearance of at least six (6) inches from the ground. Furnace excavations shall extend to a depth of not less than six (6) inches below and twelve (12) inches beyond the sides of the furnace, except that the control side shall have a clearance of not less than thirty (30) inches. Walls of excavations exceeding twelve (12) inches in depth shall be lined with concrete masonry extending not less than four (4) inches above the adjoining ground level. In flood plane areas not less than a twelve (12) inch clearance shall be provided between the furnace and finish grade.

2112.9 Exterior furnaces: Warm-air furnaces installed on the exterior of buildings shall be listed accordingly and comply with the following requirements:

1. Unless listed for outside installation, an appliance located on the exterior of a building shall be enclosed in a weather-resistant housing. A weatherproof housing may be constructed of No. 24 gauge galvanized steel or No. 22 gauge aluminum. The enclosure shall have not less than a six (6) inch clearance from the furnace.
2. The appliance shall be installed on a level platform.
3. For ground installations the appliance shall be supported on a concrete or masonry base extending not less than three (3) inches above the adjoining ground level.

2112.10 Circulating air supply--general: The circulating air supply shall be taken from outside the building or from the conditioned area inside the building or from both sources.

2112.10.1 Ducts: The circulating air supply for a forced air comfort heating system shall be conducted through ducts complying with Section 2115.0 or through concealed spaces provided vent or vent connectors do not extend into or through these spaces.

2112.10.2 Volume damper: A volume damper shall not be placed in the circulating air supply inlet so as to reduce the supply to the furnace.

2112.10.3 Screen covering: The outside circulating air supply inlet shall be covered with screen having one-quarter (1/4) inch openings.

2112.11 Circulating air supply--requirement: The unobstructed area of circulating air supply openings to a gravity-type warm-air furnace shall be not less than seven (7) inches for each input of one thousand (1000) Btu rating or as required by the conditions of listing.

2112.11.1 Area: The unobstructed area of circulating air supply opening or ducts to a forced air warm-air furnace shall be not less than two (2) square inches for each input of one thousand (1000) Btu rating or as required by the conditions of listing.

2112.12 Circulating air supply--source: The circulating air supply for a comfort heating system shall not be taken from the following locations:

1. Within ten (10) feet of an appliance or plumbing vent outlet which is located less than three (3) feet above the circulating air supply inlet.
2. Areas having objectionable odors, fumes or flammable vapors.
3. Areas whose volume is less than twenty-five (25) per cent of the volume served by the system and where permanent openings to supplemental areas are not provided in accordance with this section.

Exception: Openings for a warm-air furnace may be reduced to not less than fifty (50) per cent of the required circulating air supply area provided the balance is taken from a room or hall having at least three (3) doors leading to other rooms served by the furnace.

4. Areas having a direct-fired fuelburning appliance.
   Exceptions:
   1. A gravity-type comfort heating system.

2. A blower-type comfort heating system where the circulating air supply is taken from an area having a volume exceeding one (1) cubic foot for each ten (10) Btu's of fuel input rating of all fuelburning appliances therein and at least seventy-five (75) per cent of the conditioned air is discharged back into the area provided the circulating air supply inlet is not located within ten (10) feet of an appliance firebox or draft diverter.

2112.13 Conditioned air supply: The minimum unobstructed total area of the conditioned air ducts from a blower-type warm-air furnace shall be not less than two (2) square inches for each one thousand (1000) Btu approved hourly input rating of the furnace and the minimum unobstructed total area of the conditioned air ducts from a gravity-type warm-air furnace shall be not less than seven (7) square inches for each one thousand (1000) Btu approved hourly input rating or as specified by the conditions of listing of the furnace.

2112.13.1 Duct sizing: In no case need the total area of the conditioned air ducts be larger than the outlet plenum collar opening on the furnace.

2112.13.2 Control: For the purpose of this section a volume damper, grill, or register installed for the purpose of controlling the conditioned air flow shall not be considered an obstruction.

SECTION 2113.0 VENTED DECORATIVE APPLIANCES, FLOOR FURNACES, VENTED WALL FURNACES AND VENTED ROOM HEATERS

2113.1 General: A vented decorative appliance, floor furnace, vented wall furnace, or vented room heater shall not be located under a stairway.

2113.2 Vented decorative appliances: Vented decorative appliances shall comply with the requirements for comfort heating appliances.

2113.3 Prohibited use: Unvented room heaters are prohibited in accordance with M.G.L.A. Chapter 148, Sections 25A and 25B, as amended.

2113.4 Floor furnaces location: Flat floor furnaces shall be installed not less than six (6) inches from walls.

2113.4.1 Wall location: Wall register floor furnaces shall be installed not less than six (6) inches from inside room corners.

Exception: Replacement floor furnaces of the same or lesser input rating may be installed in the original location when approved by the building official.

2113.4.2 Other combustible: Floor furnaces shall not be located where draperies or a door can swing within twelve (12) inches of the warm air outlet.

2113.4.3 Outlet clearances: Floor furnaces warm air outlets shall not be installed less than sixty (60) inches below overhead projections.

2113.4.4 Floor space: A clear floor space of fifteen (15) inches shall be provided along two (2) adjoining sides of flat floor furnaces.

2113.4.5 Furnace projection: The floor furnace burner assembly shall not project into an occupied underfloor area.

2113.5 Floor furnace access: An opening and passageway not less than twenty-four (24) by eighteen (18) inches shall be provided to every floor furnace. The passageway shall be not more than twenty (20) feet in length from the access opening or from an underfloor area thirty (30) inches or more in height.

2113.6 Floor furnace installation: Floor furnaces shall be supported independently of the grill and shall have not less than six (6) inches clearance from grade.

Exception: Sealed furnaces may have a grade clearance of two (2) inches minimum.

2113.6.1 Furnace excavations: Furnace excavations shall extend not less than eighteen (18) inches beyond the control side and twelve (12) inches beyond the sides and back of the furnace. The excavation shall slope outward from the bottom to the natural grade at an angle not greater than forty-five (45) degrees from the horizontal.

2113.6.2 Slab on grade: Floor furnaces shall not be installed on concrete slabs on grade.

2113.7 Wall furnace location: Vented wall furnaces designed to be installed in a nominal four (4) inch wall shall be not less than six (6) inches from inside room corners except where listed for reduced clearances.

Exception: Vented wall furnaces replacements approved by the building official.

2113.7.1 Combustible clearances: Vented wall furnaces shall not be located where a door can swing within twelve (12) inches of the furnace air inlet or outlet and shall not be installed less than eighteen (18) inches below overhead projections.

2113.8 Wall furnace combustion air: Vented wall furnaces shall be provided with combustion air in accordance with Section 2110.0.

Exception: Combustion air openings may be omitted to the area in which a vented wall furnace is installed provided a cased opening or archway leads from that area into other rooms having a minimum combined volume in cubic feet equivalent to one-twentieth (1/20) of the input Btu rating of the furnace.

2113.9 Wall furnace installation: Ducts shall not be attached to a wall furnace. Casing extensions or boots may be installed if listed as part of the appliance.

2113.10 Vented room heaters: Floor mounted type unit heaters shall be installed in accordance with Table 2110-1.

2113.11 Room heaters: Vented room heaters shall be installed in accordance with Table 2110-1 or as listed.

2113.12 Unvented room heaters: No unvented fuelburning room heaters shall be installed.

SECTION 2114.0 VENTING OF APPLIANCES

2114.1 General: All fuelburning comfort heating and comfort cooling appliances shall be vented to the outside. Venting systems shall consist of approved chimneys, approved vents or a venting assembly which is an integral part of a listed appliance or may be designed in accordance with accepted engineering practices.

2114.1.1 Vent systems: Venting systems which are integral parts of vented appliances shall be installed in accordance with the terms of their listing, manufacturer's installation requirements and applicable requirements of this article.

2114.2 Commonwealth of Massachusetts requirements: Gas vents required for appliances or equipment using fuel gases of any kind such as natural gas, manufactured gas, undiluted liquified

petroleum gases, liquified petroleum gas-air mixtures, or mixtures of any of these gases shall comply with the requirements of the Massachusetts Fuel Gas Code, 248 CMR 3.00 - 8.00.

2114.3 Type of venting systems required: Gas appliances shall be vented in conformance with the regulations provided in Section 2114.2. Oil burning appliances may be used with type L vents where so listed.

2114.4 Installation and construction: Manually operated dampers shall not be placed in chimneys, vents or vent connectors of liquid or gasburning appliances. Fixed baffles on the appliance side of draft hoods and draft regulators shall not be classified as dampers.

2114.4.1 Automatically operated dampers: Automatically operated dampers shall be of approved type designed to maintain a safe damper opening and arranged to prevent firing of the burner unless the damper is opened to a safe position.

2114.5 Location: Vents shall not extend into or through an air supply duct or plenum.

Exception: Venting systems may pass through a combustion air duct.

2114.5.1 Multiple connections: Appliances shall not be vented into a fireplace or into a chimney serving a fireplace.

2114.6 Length pitch--clearance: Gravity vents shall not have more than two (2) offsets of more than forty-five (45) degrees from the vertical.

2114.6.1 Horizontal run: The horizontal run of a gravity vent and its connectors shall not be greater than seventy-five (75) per cent of the vertical height of the venting system measured from the appliance outlet.

2114.6.2 Vent connectors: Vent connectors in gravity-type venting systems shall have continuous rises of not less than one-quarter (1/4) inch per foot of length measured from the appliance vent collar to the vent.

2114.6.3 Single wall connectors: Single wall metal vent connectors for an appliance shall be located entirely within the room or area where the appliance is located.

2114.7 Vent termination--general: Vents shall extend above the roof surface, through a flashing and terminate in a listed vent cap.

2114.8 Gravity vent termination: Gravity-type venting systems, other than Type BW or venting systems which are integral with listed appliance, shall terminate not less than five (5) feet above the highest vent collar which they serve.

2114.9 B or BW vent termination: Type B or BW gas vents shall terminate not less than one (1) foot above the roof nor less than four (4) feet from a portion of the building which extends at an angle of more than forty-five (45) degrees upward from the horizontal.

2114.10 L vent termination: Type L venting systems shall terminate not less than two (2) feet above the roof nor less than four (4) feet from a portion of the building which extends at an angle of more than forty-five (45) degrees upward from the horizontal.

2114.11 Special vent requirements: Venting systems shall terminate not less than four (4) feet below, four (4) feet horizontally from or one (1) foot above a door, window or gravity air inlet into a building.

Exception: Venting systems which are integral parts of listed equipment may be located closer provided the door, window or gravity air inlet is serving the same room in which the appliance is located; the venting system does not terminate less than nine (9) inches from the door, window or gravity air inlet; and the appliance does not exceed an input rating of fifty thousand (50,000) Btu's.

2114.11.1 Inlet and property clearance: Venting systems shall terminate not less than three (3) feet above forced air inlets located within ten (10) feet (horizontally); nor less than four (4) feet from private property lines.

2114.12 Vent size: Vent systems shall have internal cross-sectional areas of not less than the area of the vent collars but not less than seven (7) square inches except where the vents are integral parts of listed appliances.

2114.13 Multiple appliance venting systems: Two (2) or more listed appliances may be connected to common gravity-type venting systems provided the appliances are equipped with listed primary safety controls and listed safety shutoff devices for oil and gas fuel respectively and comply with the following requirements:

1. Appliances which are connected to common venting systems shall be located in the same story of the building, except engineered systems as set forth in Section 2114.1.

2. Two (2) or more connectors shall not enter common venting systems unless the inlets are offset so that no portion of an inlet is opposite the other inlets.
3. The venting system shall be not less than the area of the largest vent connector plus fifty (50) per cent of the areas of the additional vent connectors. An oval vent may be used provided its capacity is not less than the capacity of the round vent for which it is substituted.

2114.14 Existing venting systems: Existing venting systems may be connected to replaced appliances in accordance with the following requirements:

1. The venting system shall have been installed in accordance with the code in effect at that time and have no apparent defects.
2. The internal area of the venting systems shall be in accordance with Section 2114.11.

2114.15 Draft hoods: Draft hoods shall be located in the same room or space as the combustion air openings of the appliances and shall be located so that the relief opening is not less than six (6) inches from any surface other than the appliance it serves, measured in a direction ninety (90) degrees to the plane of the relief opening.

SECTION 2115.0 DUCTS

2115.1 Material: Ducts conveying air from outside the building or air from evaporative coolers shall be constructed of galvanized steel or corrosion-resistant metal.

2115.1.1 Other material: Ducts or concealed spaces used for inside circulating air may be of combustible material. Where space between studs in walls or partitions is used as a duct the portions of such space so used shall be cut off from all remaining unused portions by tight-fitting stops of sheet metal or of wood not less than two (2) inches nominal thickness. Not more than one (1) firestop may be crossed.

2115.1.2 Hot air ducts: Ducts conveying heated conditioned air shall be of noncombustible material.

2115.1.3 Other approved ducts: Approved ducts, plenums and fittings constructed of asbestos-cement, concrete or ceramic may be installed in the ground or in a concrete slab.

2115.1.4 Other criteria: Metal ducts shall conform to Table 2115-1.

2115.1.5 Temperature: Ducts constructed of gypsum products shall not be subject to air temperatures of more than 125° F.

2115.2 Construction: Duct work shall be constructed in accordance with the criteria contained in Appendix B of the code.

2115.3 Installation: Metal ducts shall be securely fastened in accordance with Table 2115.3.

2115.3.1 Metal ducts shall not be installed within four (4) inches of the ground except when encased in not less than two (2) inches of concrete.

2115.3.2 Duct Supports: Rectangular metal duct supports set forth in Table 2115.3 shall be riveted, bolted or screwed to each side of the duct.

2115.3.3 Other supports: Horizontal round duct supports set forth in Table 2115-3 shall consist of one (1) hanger installed in accordance with the following requirements:

1. The hanger shall be attached to one (1) inch wide circular bands of same gauge as duct extending around and supporting ducts exceeding ten (10) inches in diameter.
2. The ducts shall be braced to prevent lateral displacement.

2115.4 Insulation: Ducts shall be insulated, when required, according to Section 2128.1.

Exception: Ducts need not be insulated in an unheated basement or cellar when foundation walls are insulated.

Table 2115-1

GAGES OR METAL DUCTS AND PLENUMS USED FOR COMFORT HEATING OR COOLING FOR A DWELLING UNIT

	COMFORT HEATING OR COOLING		
	GALVANIZED STEEL		
	Nominal Thickness (in inches)	Equivalent Galvanized Sheet Gage Number	Approximate Aluminum B & S Gage
Round Ducts and Enclosed Rectangular Ducts			
14" or less	0.016	30	26
Over 14"	0.019	28	24
Exposed Rectangular Ducts			
14" or less	0.019	28	24
Over 14"	0.022	26	23

Table 2115-3

METAL DUCT SUPPORTS

DUCT TYPE	MAX. SIDE OR DIA.	DUCT POSITION	HANGER OR STRAP SIZE AND SPACING
CIRCULAR	10'	Vertical	No. 18 gage galvanized steel x 2" @ 12' o.c.
		Horizontal	No. 30 gage galvanized steel x 1" or No. 18 steel wire @ 10' o.c.
	20	Vertical	No. 16 gage galvanized steel x 2" @ 12' o.c.
		Horizontal	No. 28 gage galvanized steel x 1" or No. 18 steel wire @ 10' o.c.
RECTANGULAR	24	Vertical	1" x 1/8" steel galvanized strap @ 12' o.c.
		Horizontal	No. 18 gage galvanized steel x 1" @ 10' o.c.
	36	Vertical	1" x 1-1/8" steel galvanized angle @ 12' o.c.
		Horizontal	1" x 1/8" steel strap galvanized @ 10' o.c.

SECTION 2116.0 COMFORT COOLING

2116.1 Commonwealth of Massachusetts Rules and Regulations: All installations of gas appliances shall be subject to and must comply with the Massachusetts Fuel Gas Code, 248 CMR 4.00 - 8.00. All oilburning appliances shall be subject to the provisions of 527 CMR 4.00 established in accordance with Chapter 148, Section 10 of the MGLA, as amended, which govern the construction, installation and operation of oilburning equipment. Also, compliance shall be required with the provisions of the rules and regulations issued by the Board of Boiler Rules under the authority of Chapter 146 of the MGLA, as amended, governing the construction, installation, testing and inspection of boilers, air tanks, ammonia compressor safety valves, and refrigeration and air-conditioning systems of twenty (20) tons or more capacity.

2116.2 Cooperating agencies: Nothing herein contained shall be deemed to nullify the federal, state or municipal rules and regulations governing the storage and use of flammable and explosive gases and chemicals, or the requirements of the Interstate Commerce Commission or other federal statutes governing the transportation and use of hazardous gases, explosives and other flammable substances.

2116.3 Permits: One- and two-family dwellings shall not be required to have permits unless the refrigeration systems contain more than ten (10) pounds of refrigerants or are actuated by motors or engines of one and one-half (1-1/2) horsepower or larger.

2116.4 Installation: Group 2 refrigerants shall not be used in direct refrigerating systems.

2116.4.1 Condensate: An approved means shall be provided for the collection and disposal of condensate from the air cooling coil to outside the building or other approved locations.

2116.4.2 Location: Comfort cooling equipment, other than ducts and piping, shall be located not less than three (3) inches above the ground.

2116.4.3 Lighting: Electric lighting shall be provided for equipment located inside a building.

2116.5 Access: Equipment requiring servicing shall be accessible by means of passageway two (2) feet by six (6) feet six (6) inches minimum.

Exception: An access opening to the attic or underfloor area may be reduced to a thirty (30) inch dimension provided the equipment can be replaced.

2116.5.1 Work space: Equipment shall be provided with an unobstructed space thirty (30) inches by six (6) feet six (6) inches minimum on the service side.

Exception: The height of the working space may be reduced to thirty (30) inches for an air handling unit, air filter or refrigerant and brine control valves. Fan coils in drop ceilings may be serviced through combination return air grills.

2116.6 Circulating air supply source: A positive separation shall be provided between the combustion air and the circulating air supply (see Section 2112.10).

2116.7 Return air limitation: Comfort cooling systems shall be arranged so that the circulating air from one (1) dwelling unit does not discharge into another dwelling unit.

2116.8 Screen: Exterior circulating air supply inlets shall be covered with screen having one-quarter (1/4) inch openings.

2116.9 Refrigerant piping: All refrigerant pipe and fittings installed within a building or structure and which may reach surface temperatures that will result in condensation forming on the piping shall be insulated.

SECTION 2117.0 ABSORPTION UNITS AND ABSORPTION SYSTEMS FOR COMFORT COOLING AND COMFORT HEATING

2117.1 General: Absorption units used for comfort heating or comfort cooling systems shall conform to the requirements of Sections 2110.0, 2111.0 and 2115.0.

2117.2 Identification: Fuelburning absorption units shall bear a label containing the following information:

1. Manufacturer's name
2. Model number
3. Amount and type of refrigerant
4. Factory test pressures or pressures applied
5. Normal Btu input rating
6. Cooling capacity in Btu's
7. Type of fuel
8. Symbol of the organization certifying the approval of the equipment

9. Instructions for the lighting, operation and shutdown of the system

SECTION 2118.0 FUEL SUPPLY SYSTEMS

2118.1 General: New fuel supply systems, except parts thereof controlled and maintained by a public utility, shall conform to the requirements of this section and shall not be made operative until first approved by the building official. Fuel supply system design, construction and workmanship shall be consistent with generally accepted good practice and in conformity with nationally recognized applicable standards acceptable to the State Building Code Commission.

2118.2 Location: Location of fuel supply tanks, meters, main shutoff valves, relief valves, and regulators other than integral appliance regulators shall be approved by the building official and shall conform to state and local regulations.

2118.3 Authority to disconnect: The building official is hereby authorized to order disconnected any fuel supply or appliance which does not conform to this code or which is found to be defective and may endanger life or property.

2118.3.1 Notice: A notice shall be attached to the piping or appliances stating the reasons for disconnection. Such notice shall not be removed nor shall the system or appliance be reconnected until authorized by the building official.

2118.4 Piping support: Gas piping shall be supported by metal straps or hooks at not more than six (6) feet on center for piping one (1) inch or less in size and not more than ten (10) feet on center for piping larger than one and one-quarter (1-1/4) inches. Piping shall be protected against physical damage. Buried piping shall be laid in a solid bed. Gas piping shall not be strained or bent and appliances shall not be supported by supply piping.

2118.5 Liquid fuel supply: Supply piping and all related equipment serving oilburning appliances shall be subject to the provisions of 527 CMR 4.00 (FPR-3).

SECTION 2119.0 ENERGY CONSERVATION BY COMPONENT DESIGN

2119.1 General: All buildings that are heated or mechanically cooled shall be constructed to provide the required thermal performance of the various components.

2119.2 Building enclosure elements

2119.2.1 Gross wall area: For the purposes of this article, the gross area of exterior walls consists of all opaque wall areas, including foundation walls, walls between floor spandrels, peripheral edges of floors, window areas including sash, and door areas, where such surfaces enclose a heated or mechanically cooled space including interstitial areas between two such spaces.

2119.2.2 Roof assembly: For the purposes of this article, a roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thereby creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses a heated or mechanically cooled space.

2119.2.3 Gross roof area: The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights exposed to the heated or mechanically cooled space.

2119.2.4 Ceiling plenums: Where air ceiling plenums are employed, the roof/ceiling assembly shall:

1. for thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and,

2. for gross area purposes, be based upon the interior face of the upper plenum surface.

SECTION 2120.0 BUILDING INSULATION

2120.1 Standards: Insulating materials must conform to the Federal Specifications (F.S.) and the American Society for Testing and Materials (ASTM) Test Standards as listed in Table 2120-1 for thermal resistance and fire safety.

2120.2 Installation

2120.2.1 Recessed light fixtures: Only IC labeled recessed lights allowing direct contact with insulating materials may be used in areas separating conditioned and unconditioned spaces.

2120.2.2 High heat sources: A clearance of three (3) inches from any high heat source is required for combustible insulating materials, including but not limited to, chimneys, flues and vents.

2120.2.3 Liquid foams: Liquid foams must meet minimum standards set forth in HUD "Use of Materials" Bulletin No. 74.

Table 2120-1
INSULATION MATERIAL STANDARDS

Material or product	Material specifications
Mineral fiber Blanket/Batt	F.S. HH-1-521E ASTM C665-70
Loose fill	F.S. HH-1-1030A ASTM C764-73
Mineral cellular Perlite	F.S. HH-1-574A ASTM C549-73
Vermiculite	F.S. HH-1-585B ASTM C516-67
Organic fiber Cellulose	F.S. HH-1-515C ASTM C739-77 E84-77
Reflective	F.S. HH-1-1252A
Organic Cellular Polystyrene Board	F.S. HH-1-524B ASTM C578-69
Urethane Board	F.S. HH-1-530A ASTM C591-69
Flexible Unicellular	F.S. HH-1-573B ASTM C534-70
Vapor Barriers	ASTM C755-73

2120.3 Foam plastics

2120.3.1 General: Except where specifically exempted by subsection 2 below, foam plastics 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 accordance with approved standards in the thickness intended for use.

2120.3.2 Specific requirements: The following requirements shall apply to all uses of foam plastics in or on the walls, ceilings, or in attics, roof or floors, crawl spaces or similar areas, and may be used in the following locations:

1. Within the cavity of a masonry or concrete wall.
2. On the room side surface of walls or ceilings or other surfaces provided the foam plastic is fully protected from the interior of the building by a thermal barrier of one-half (1/2) inch gypsum wallboard having a finish rating of not less than 15 minutes or other approved material having an equivalent finish rating. Thermal barriers shall be installed in a manner that they will remain in place for a minimum of 15 minutes under the same test conditions.
3. Foam plastic trim covering not more than ten (10) per cent of the wall or ceiling area may be used provided such trim: (1) has a density of not less than twenty (20) pounds per cubic foot; (2) has a maximum thickness of one-half (1/2) inch and a maximum width of four (4) inches; and (3) has a flame spread rating no greater than seventy-five (75).

2120.3.3 Roof coverings: Foam plastics may be used as a roof covering if the foam plastic is a part of a Class A, B or C roofing assembly. That plastic foam which is nearest the interior of the building shall be protected by an approved barrier which need not have a fifteen (15) minute finish rating.

2120.3.4 Coverings over foam plastics: Ordinary roof coverings, other than Class A, B, or C, may be applied over foam plastic when the foam is separated from the interior of the building by plywood sheathing not less than one-half (1/2) inch in thickness with exterior glue, with edges supported by blocking, tongue and groove joints, or other approved type of edge support, or an equivalent material.

2120.3.5 Non-structural foam sheathing: Refer to Section 2104.3.10.

2120.4 Blanket/batt insulation

2120.4.1 Labeling: All insulation shall be labeled as required in Article 20.

2120.4.2 Cavities: Fill small cavities between rough framing and door and window heads, jambs, and sills with insulation.

2120.5 Perimeter insulation: Perimeter insulation for slab on grade construction shall be installed so that the concrete to concrete contact between the foundation wall and the floor slab is broken and the insulation extends downward the thickness of the slab and then extends four (4) feet vertically down from, or four (4) feet horizontally beneath, the floor slab.

SECTION 2121.0 VENTILATION

2121.1 Attic ventilation: Enclosed attics, and enclosed rafter spaces formed where ceilings are applied direct to the underside of roof rafters, shall have cross-ventilation for each separate space by ventilating openings protected against the entrance of rain and snow, sized by the criteria in Sections 2121.1.1 and 2121.1.2.

2121.1.1 With a ceiling vapor barrier installed: Attics with a ceiling vapor barrier must be ventilated with screened openings of at least one (1) square foot of free vent area for each three hundred (300) square feet of ceiling area.

2121.1.2 Without a ceiling vapor barrier installed: Attics without a ceiling vapor barrier installed shall be ventilated with screened openings of at least one (1) square foot of free vent area for each one hundred fifty (150) square feet of ceiling area.

2121.1.3 Eave vents: When eave vents are installed, adequate baffling shall be provided to deflect the incoming air above the surface of the insulation. Baffles shall be installed prior to insulation, and shall be installed over the exterior wall at an angle to provide a two (2) inch minimum clearance under the roof deck for upward flow of ventilation air to the fixed vents in the upper portion of the attic.

2121.1.4 Ridge or gable vent: When eave vents are installed, the ridge or gable vent must be at least three (3) feet above the level of the eave vents.

2121.2 Underfloor space ventilation

2121.2.1 With a ground vapor barrier: Underfloor spaces with an approved vapor barrier installed on the ground surface shall be ventilated with screened openings of one (1) square foot of vent area for each fifteen hundred (1,500) square feet of crawl space. Vents shall be positioned to provide cross ventilation. See Section 2102.9.

SECTION 2122.0 VAPOR BARRIERS

2122.1 Vapor barriers: A vapor barrier of 1.0 perm or less shall be installed on the winter warm side of walls, ceilings and floors enclosing a conditioned space.

2122.2 Seams: When using blanket insulation, all seams and joints shall be butted tight and tears taped or sealed.

Exception: Vapor barriers may be eliminated with adequate ventilation as defined in Section 2121.0.

SECTION 2123.0 U-VALUES OF BUILDING COMPONENTS

2123.1 General: All new construction and additions to existing buildings covered by this section shall conform to the maximum U and R values listed in Table 2123-1 and as specified in this section.

2123.2 Alternates: The stated U_o (or U) value of any one assembly, such as roof/ceiling, wall or floor, may be increased and the U_o (or U) value for other components decreased provided that the overall heat gain or loss for the entire building envelope does not exceed the total resulting from conformance to the stated U_o (or U) values.

TABLE 2123-1
MAXIMUM U VALUES AND MINIMUM R VALUES OF WALLS, ROOF/CEILING, AND FLOORS FOR ONE AND TWO-FAMILY DWELLINGS

ELEMENT	DESCRIPTION	U VALUE	TOTAL R VALUE	NOTES
Walls	All wall construction containing heated or mechanically cooled space	0.08	12.5	1
	Electric resistance heating	0.05	20.0	1
Foundation walls including band joist	Containing heated or mechanically cooled space	0.08	12.5	
	Containing unheated space	0.08	12.5	4
Roof/Ceiling Assembly	All roof construction containing heated or mechanically cooled space	0.033	30.0	
Windows	All construction enclosing heated or mechanically cooled space	0.65	1.54	2
	Electric resistance heating	0.40	2.50	6, 7
Doors	All construction enclosing heated or mechanically cooled space	0.40	2.50	
Floors	Floor sections over areas exposed to outside air or unheated space	0.05	20.0	3
	Slab on grade beneath conditioned space	--	10.0	5

NOTE 1: These values may be used when the doors and windows do not exceed fifteen (15) of the gross exterior wall area. When doors and windows exceed fifteen (15) percent of the gross wall area, see Section 2009.1, item 2.

NOTE 2: Double glazed primary windows or single glazed primary windows with storm windows will satisfy the required U value of zero point sixty-five (0.65).

Notes to Table 2123-1 (continued)

NOTE 3: Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of zero point zero eight (0.08).

NOTE 4: The U value requirement of zero point zero eight (0.08) for foundation walls may be omitted when floors over unheated spaces are provided with a U value of zero point zero five (0.05).

NOTE 5: R value for perimeter insulation (See Section 2120.5).

NOTE 6: When doors and windows do not exceed fifteen (15) percent of the gross exterior wall area, this value may be used. When doors and windows do not exceed ten (10) percent of the gross exterior wall area, windows having a U value of 0.65 (R value of 1.54) may be used. When windows and doors exceed fifteen (15) percent of the gross exterior wall, see Section 2009.1, item 2.

NOTE 7: Double glazed primary windows with storm windows or most triple glazed primary windows or double glazed low emissivity primary windows will satisfy the required U value of zero point forty (0.40).

SECTION 2124.0 AIR LEAKAGE FOR ALL BUILDINGS

2124.1 General: The requirements of this section shall apply to all buildings and structures and apply to those locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cooled and are not applicable to the separation of interior conditioned spaces from each other.

2124.2 Exterior envelope sealing: Exterior joints around windows and door frames; openings between walls and foundations, between walls and roof and between wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other such openings in the building envelope shall be caulked, gasketed, weatherstripped, or otherwise sealed.

2124.3 Infiltration: All exterior doors and windows shall be designed to limit air leakage into or from the building envelope, and shall have air infiltration rates no greater than 0.5 cfm per linear foot of operable sash crack for windows, 0.5 cfm per square foot of door area for sliding glass doors and 1.25 for entrance doors, according to the testing procedure of ASTM E283.

Exceptions:
1. Permanently installed storm windows and doors installed over exterior windows and doors shall be accepted when windows and doors have not been tested for infiltration according to Section 2124.3.
2. Fixed glazing is exempt from infiltration testing requirements.
3. Fire doors with a fireresistive rating over one (1) hour, and fire windows are exempt from this section.

SECTION 2125.0 SYSTEM DESIGN HEATING/COOLING CAPACITY

2125.1 General: The rated capacity of the heating/cooling system at design conditions shall not be greater than one hundred twenty-five (125) per cent of the design output load calculated in accordance with this Article. Equipment designed for standby purposes is not included in the capacity limitation requirement. The cooling cycles of heat pumps are exempt from this requirement.

2125.2 HVAC equipment performance requirements: HVAC equipment shall meet the requirements stated here and in Article 20.

2125.2.1 Data: The requirements for energy conservation apply to equipment and component performance for heating, ventilating, and air conditioning systems. Where equipment efficiency levels are specified, data furnished by the equipment supplier, or certified under a nationally-recognized certification program or rating procedure, shall be used to satisfy these requirements.

2125.2.2 HVAC-system heating equipment, heat pumps-heating mode: Heat pumps whose energy input is entirely electric shall show a coefficient of performance (COP heating, as defined herein) not less than 2.2 for air source of 47 dB/43WB, 1.2 (17 dB/15WB and 2.2 water source (60 entering)).

2125.2.3 Mechanical ventilation: Each mechanical ventilation system (supply and/or exhaust) shall be equipped with a readily accessible means for either shut-off or volume reduction, and shut-off when ventilation is not required.

2125.2.4 HVAC-system equipment, electrically operated cooling mode: HVAC-system equipment as listed below whose energy input in the cooling mode is entirely electric, shall show a Coefficient of Performance (COP) cooling as defined herein not less than 1.8 for under 65,000 Btu/hr., 2.0 for over 65,000 Btu/hr.

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SECTION 2126.0 CONTROLS

2126.1 Temperature control: Each HVAC system shall be provided with at least one (1) thermostat for the regulation of temperature. Each thermostat shall be capable of being set as follows:

1. Where used to control heating only, 55-75° F.
2. Where used to control cooling only, 70-85° F.
3. Where used to control both heating and cooling it shall be capable of being set from 55-85° F. and shall be capable of operating the system heating and cooling in sequence. It shall be adjustable to provide a temperature range of up to 10° F. between full heating and full cooling.

2126.2 Humidity control: If an HVAC system is equipped with a means for adding moisture to maintain specific selected relative humidities in spaces or zones, a humidistat shall be provided. This device shall be capable of being set to prevent new energy from being used to produce space relative humidity above thirty (30) per cent relative humidity when moisture is added, or below sixty (60) per cent relative humidity when moisture is removed.

2126.3 Zoning for temperature control: At least one (1) thermostat for regulation of space temperature shall be provided for each separate HVAC system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating and/or cooling input to each zone or floor. Register dampers and hot water radiator hand dampers will suffice.

2126.4 Control setback and shut-off

2126.4.1 General: The thermostat required in Section 2126.3 or an alternate means such as a switch or clock, shall provide a readily accessible, manual or automatic means for reducing the energy required for heating and cooling during periods of nonuse or reduced need, such as, but not limited to, unoccupied periods and sleeping hours.

2126.4.2 Energy expended: Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

SECTION 2127.0 BALANCING

2127.1 General: The HVAC system design shall provide means for balancing the air and water systems such as but not limited to dampers, temperature and pressure test connections,

flow measuring stations or meters, and balancing valves. The HVAC systems shall be field balanced to achieve conditions stated in the plans and specifications.

SECTION 2128.0 DUCT INSULATION

2128.1 General: When low pressure supply air ducts are located outside of the conditioned space (except return air plenums), all transverse joints shall be sealed using mastic or mastic plus tape. For fibrous glass duct work, pressure sensitive tape may be used. For duct construction refer to Section 2115.0, Ducts.

2128.2 Insulation: All duct systems, or portions thereof, exposed to nonconditioned spaces shall be insulated to provide a thermal resistance, excluding film resistances, of $R = \frac{t_i - t_o}{15}$ (hr) (sq. ft.) (F)/Btu, where $t_i - t_o$ is the temperature differential (absolute value) between the air in the duct and the surrounding air.

Exceptions: Duct insulation, except when needed to prevent condensation, is not required in any of the following cases:
1. In basements and cellars with insulated walls.
2. When the heat gain or loss of the ducts, without insulation, will not increase the energy requirements of the building.
3. Exhaust air ducts.

Where required to prevent condensation, insulation with vapor barriers shall be installed in addition to insulation required above.

SECTION 2129.0 PIPE INSULATION

2129.1 General: All hot water piping, or portions thereof, exposed to nonconditioned space shall be insulated to provide a thermal resistance in the range of R equals 4.0 to 4.6. This is typically one (1) inch of pipe insulation.

Reference Standards - Article 21

RS-21-1 Shower Compartment Finish

Glazed Ceramic Wall Tile Installed with Portland Cement Mortar ANSI A108.1,1967 - American National Standards Institute (ANSI) A108.1 - 1967

Ceramic Tile Installed with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy-ANSI A108.6, 1969

Dry-Set Portland Cement Mortar (for installation of ceramic tile) - ANSI A118.1,1967

Organic Adhesives for Installation of Ceramic Tile-ANSI A136.1,1967 (Type I only in Shower Compartments) Standard Specification for Ceramic Tile-ANSI A137.1,1967

Ceramic Tile Installed with Dry-Set Portland Cement Mortar - ANSI A108.5,1967

Ceramic Mosaic Tile Installed with Portland Cement Mortar - ANSI A108.2,1967

Ceramic Tile Installed with Water-Resistant Organic Adhesives - ANSI A108.4,1968

RS-21-2 Glazing Materials

Glass. Federal Specification DD-G 451c

Safety Glazing Materials - ANSI Z97.1,1972

RS-21-3 Foundations

Building Brick and Facing Brick. (Made from Clay or Shale). Standard Specifications C62-58 and C216 of the American Society for Testing and Materials (ASTM).

Sand-Lime Building Brick. Standard Specification C73-51 of ASTM.

Concrete Building Brick. Standard Specification C55-55 of ASTM.

Hollow Load-Bearing Concrete Masonry Units. Standard Specification C90-59 of ASTM.

Solid Load-Bearing Concrete Masonry Units. Standard Specification C145-59 of ASTM.

Method of Test for Concrete Masonry Units. Standard Specification C140-63T of ASTM.

Structural Clay Load-Bearing Wall Tile. Standard Specifications C34-62 and C112-60 of ASTM.

Cast Stone. Specification ACI 704-44 of the American Concrete Institute.

Cold-Drawn Steel Wire for Concrete Reinforcement. Standard Specification A82 of ASTM.

Cement, Masonry. Standard Specification C91-67 of ASTM.

Quicklime for Structural Purposes. Standard Specification C5-59 of ASTM.

Hydrated Lime for Masonry Purposes. Standard Specification C207-49 of ASTM.

Processed Pulverized Quicklime. Standard Specification C51-47 of ASTM.

Mortar for Masonry Other than Gypsum. Specifications C161-44T and C270-59T of ASTM.

Aggregate for Masonry Mortar. Specification C144-52T of ASTM.

Aggregates for Grout. Standard Specification C404 of ASTM.

Sampling and Testing Brick. Standard Specification C67-60 of ASTM.

Portland Cement. Standard Specifications C150-62 and C175-66 of ASTM.

Portland Blast Furnace Slag Cement. Specification C205-62T of ASTM.

Portland Pozzolan Cement. Specification C340-62T of ASTM.

Concrete Aggregates. Specification C33-61T of ASTM.

Concrete Proportions. ACI 613-54 and 613-59 of the American Concrete Institute.

Concrete Reinforcement. Specifications A615-68, A616-68, A617-68 and A82-66 of ASTM.

Steel Bar Mats. Standard Specifications A184-65, A615-68, A616-68 and A617-68 of ASTM.

Welded Steel Wire Fabric. Specification A185-61T of ASTM.

Admixtures for Concrete. Standard Specification C494-62T of ASTM.

Concrete Tests. Standard Specifications C31-62, C39-61, C42-61 and C192-62 of ASTM.

Splitting Tensile Strength. Specification C496-62T of ASTM.

Ready-Mixed Concrete. Standard Specification C94-62 of ASTM.

Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction. AWS D12. 1-61 of the American Welding Society.

Hollow Brick. (Hollow Masonry Units Made from Clay or Shale) Standard Specification C652-70 of ASTM.

Building Brick and Facing Brick. (made from Clay or Shale) Standard Specifications C62-69 and C216 of ASTM.

Mortar for Masonry Other than Gypsum. Standard Specification C270-68 of ASTM.

Aggregate for Masonry Mortar. Standard Specification C144-70 of ASTM.

Aggregate for Masonry Grout. Standard Specification C404-70 of ASTM.

Methods of Sampling and Testing Brick. Standard Specification C67-66 of ASTM.

Applicable Standards or Publications in Referenced Standard RS-21-5.

RS-21-4 Preservatives

American Wood Preserves Bureau (AWPB) Standards CP-22, CP-33, CP-44, CP-55, and CP-77 for pressure treated poles.

AWPB Standards LP-2, LP-3, LP-4, LP-5 and LP-7 for pressure treated softwood lumber used above ground.

AWPB Standards LP-22, LP-33, LP-44, LP-55 and LP-77 for pressure treated softwood lumber used in contact with the ground.

RS-21-5 Wall Construction

Applicable Standards or Publications in Reference Standard RS-21-3.

Classification, Definition and Methods of Grading for all Species of Lumber. Standard D245-70 of ASTM; American Softwood Lumber Standards PS 20-70 of the U. S. Department of Commerce.

Design for Permanence, Wood Construction DATA #6 National Forest Products Association (NF.PA).

Eastern Pine, Jack Pine, Eastern Spruce, Balsam Fire, Eastern Hemlock and Tamarack. Grading Rules, Northern Hardwood and Pine Manufacturers Association (September 1, 1970).

House Framing. Manual for National Forest Products Association Wood Construction DATA #1.

National Design Specification for Stress-Grade Lumber and Its Fastenings. National Forest Products Association 1977 with Supplement.

Northeastern Lumber. Standard Grading Rules, Northeastern Lumber Manufacturers Association (April, 1977).

Pine, Southern. Grading Rules, Southern Pine Inspection Bureau (1977).

Redwood. Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service (December, 1976).

Softwood Plywood. Construction and Industrial Product Standard PS 1-74 (August, 1974) of the U. S. Department of Commerce, Bureau of Standards.

Design Specifications for Light Metal Plate Connected Wood Trusses. Truss Plate Institute (TPI) 197.

West Coast Lumber. Standard Grading Rules, West Coast Lumber Inspection Bureau.

Western Lumber. Standard Grading Rules, Western Wood Products Association (1977).

Poles Building Design. American Wood Preservers Institute (November, 1972).

Plank-and-Beam Framing. Wood Construction Data No. 4, National Forest Products Association.

Fiberboard Nail-Base Sheathing and Structural Insulating Board. Standard Specifications D2277-66 and C208-66 of ASTM.

Particleboard. U. S. Department of Commerce-Commercial Standard CS 236-66.

Material Specifications for Structural Steel. Standard Specifications A27, A36, A53, A148, A167, A235, A237, A242, A245, A252, A303, A307, A325, A354, A374, A375, A412, A440, A441, A446, A449, A490, A500, A501, A502, A514, A529, A570, A572 and A588 of ASTM.

Standard Specification for Structural Glued Laminated Timer Using "E" Rated and Visually Graded Lumber of Douglas Fir, Southern Pine, Hem-Fir and Lodepole Pine, American Institute of Timber Construction.

Canadian Lumber. Standard Grading Rules for Canadian Lumber, U. S. Edition (July 1, 1973). Approved by the American Lumber Standards Board of Review.

Specifications for Aluminum Structures of the Aluminum Association.

Connectors other than those specified in Section 2102.0 of this Code may be used in accordance with Table RS-21-6.

Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, American Institute of Steel Construction, 1969 Edition and Supplements Nos. 1 and 2.

RS-21-6 Wall Covering

Applicable Standards and Publications in Reference Standards RS-21-2 and RS-21-5.

Aluminum Structures. Specifications for, by the Aluminum Association (November, 1967).

Plaster Liquid Bonding Agents. U. S. Government Military Specification MIL-B-19235 (Docks) (1965), and Standards Specifications of the California Lathing and Plastering Contractors Association (1965), and Recommendations of the Gypsum Association.

Adhesives for Fastening Gypsum Wallboard to Wood Framing. Specification C557-67 of ASTM.

Perlite, Vermiculite and Sand Aggregates for Gypsum and Portland Cement Plaster. Standards Specification C35-70 of ASTM.

Metal Lath, Wire Lath, Wire Fabric Lath and Metal Accessories. Approval Standard A42.4-1967 of ANSI.

Gypsum Wallboard Tape and Joint Compound. Standard Specifications C475-70 and C474-67 of ASTM.

Gypsum Backing Board. Standard Specification C442-67 of ASTM.

Gypsum Lath. Standard Specification C37-69 of ASTM.

Lime. Standard Specifications C206-68 and C6-49 of ASTM.

Gypsum Plasters. Standard Specification C28-68 of ASTM.

Gypsum Sheathing Board. Standards Specification C79-67 of ASTM.

Gypsum Veneer Plaster. Standards Specification C587-68 of ASTM.

Gypsum Veneer Base. Standard Specification C588-68 of ASTM.

Gypsum Wallboard. Standard Specification C36-70 of ASTM.

Keene's Cement. Standard Specification C61-64 of ASTM.

Gypsum Molding Plaster. Standard Specification C59-50 of ASTM.

Gypsum Plastering. Standard Specification A42.1-1964 of ANSI.

Interior Lathing and Furring. Standard Specifications 2.4-1967 of ASTM.

Application and Finishing of Gypsum Wallboard.
Standard Specifications A97.1-65 of ANSI.

Surface Burning Characteristics of Building Materials.
Standard Method of Test E-84-70 of ASTM.

Design and Application Manual for Exterior and Interior Walls.
Cedar Shake and Shingle Bureau.

RS-21-7 Floors

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-5.

Maximum Spans for Joists and Rafters. Technical Bulletin 2, of NFoPA.

Canadian Dimension Lumber, Revised edition 1972, Canadian Wood Council.

RS-21-8 Roof-Ceiling

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-6.

Maximum Spans for Joists and Rafters. Technical Bulletin 2, of NFoPA.

Canadian Dimension Lumber. 1971, Canadian Wood Council.

RS-21-9 Roof Coverings

Aluminum Sheet Metal Work in Building Construction by the Aluminum Association (October, 1967).

Composition Roofing. Standard Specification 55-A (May, 1967) Underwriters' Laboratories, Inc.

Roofing Asphalt. Standard Specification D312-44 of ASTM.

Composition Roofing. Standard Specification 55-B. (April, 1962), Underwriters' Laboratories, Inc.

Sheet Metals. Standard Specifications A245-62aT, A361-63T and B209-70 of ASTM.

Corrosion-Resistant Metals. Standard Specifications A219-58, A239-41 and B209-70 of ASTM.

Composition Roofing Testing. Standard Specification 790 (September, 1958), Underwriters' Laboratories, Inc.

Wood Shakes. Grading Rules for Certi-Sawn Taper Sawn Red Cedar Shakes - 1981, and Grading Rules for Certi-Split Red Cedar Shakes - 1985. Cedar Shake and Shingle Bureau.

Asbestos-Cement Shingles. Standard Specification C222-60 of ASTM.

Slate Shingles. Standard Specification C406-57T of ASTM.

Wood Shingles. Grading Rules for Certi-Grade Shingles - 1984. Cedar Shake and Shingle Bureau.

Wire. Standard Specifications B134-62, B211-63, and B250-62 of ASTM.

Design and Application Manual for New Roof Construction. Cedar Shake and Shingle Bureau.

RS-21-10 Chimney and Fireplace

Applicable Standards or Publications in Reference Standards RS-21-3 and RS-21-5.

RS-21-11 Mechanical Materials

Galvanized Sheet Metals. Standard Specification A525-64T of ASTM.

Tank Piping and Valves for Oil Burning Appliances. Pamphlet No. 31, June, 1965, of the NFiPA.

Nonmetallic Ducts. Standard No. 181 of the UL.

Refrigeration. Standard No. B9.1-1964 of the ANSI.

Wrought Steel and Wrought Iron Pipe. Standard B36.10-1959 of the ANSI.

Seamless Cooper Tube, Copper Pipe and Red Brass Pipe. Standard Specifications B42-62, B43-62, B68-60, B88-66, B251-66, and B280-66 of ASTM.

Compression (neoprene) Gaskets (including hubless piping system) for Cast Iron Piping and Fittings in Condensate Drain Lines. Standard Specification C564-70 of ASTM, or CISPI Standards HSN-72 and 301-72.

Stainless Steel Coupling (hubless piping system) for Cast Iron Piping and Fittings in Condensation Drain Lines. CISPI Standard 301-72.

Load Calculation for Residential Winter and Summer Air-Conditioning. Manual J., Third Edition, of NISC.

Installation of Gas Appliances and Gas Piping. Standard No. 54, 1969 of the NFiPA.

Installation of Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises. Standard No. 54-A, 1969 of the NFiPA.

Chimneys, Fireplaces and Venting Systems. Standard No. 211, 1970 of the NFiPA.

Installation of Residence-Type Warm Air Heating and Air Conditioning Systems. Standard No. 90-B, 1971 of the NFiPA.

RS-21-12 Mechanical Equipment

Applicable Standards or Publications in Reference Standard RS-21-11.

Mechanical Ventilation. Testing and Rating Procedures of Home Ventilating Institute.

RS-21-13 Smoke/Heat Detectors

NFiPA Standard No. 101 of 1971-1972

NFiPA Standards No. 74 of 1971-1972

RS-21-14 Solid-Fuel Appliances

Factory-Built Chimneys. Standard No. 103, 1978 of the UL.

Factory-Built Fireplaces. Standard No. 127, 1972 of the UL.

Free-Standing Fireplaces. Standard No. 737, 1978 of the ANSI/UL.

Free-Standing Room Heaters. Standard No. 1482, 1979 of the UL.

Solid and Solid/Liquid Fuel Burning Central Heating Boilers and Warm Air Furnaces. Standard No. B366-M, 1979 of the Canadian Standards Association (CSA).

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