



# **CODE MANUAL**

## for the

# **STATE BUILDING CONSTRUCTION CODE**

New York (State) State building code. "Commission.

STATE OF NEW YORK Thomas E. Dewey, Governor

## STATE BUILDING CODE COMMISSION

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**State Building Code Commission** 

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## FOREWORD

This Code Manual is a guide prepared for building officials, architects, engineers, builders, owners and others to assist them in the interpretation, application, and enforcement of the State Building Construction Code.

The Manual contains standards which, in the judgment of the Building Code Commission, are acceptable methods of compliance with the Code. The Code is the law, the Manual is not. The inclusion of standards in the Manual does not mean that they are the only acceptable methods of Code compliance. All construction methods and materials which meet the performance requirements of the Code are acceptable. Requirements set forth in any standard are to be interpreted as conditions of acceptance under that standard, and not as mandatory requirements excluding other methods of compliance.

This first issue of the Manual pertains to the construction of one- and two-family dwellings. For convenience of users, the text of the Code applicable to one- and two-family dwellings is included.

Correlation of the Code and Manual has been attained by related numbering. All sections of the one- and two-family dwellings code, for example, are designated by number with the prefix "A." Those standards in the Manual which apply to the requirements of that Code are designated with a corresponding number, preceded by the letters "AM." Thus section A 503-2 in the one- and two-family dwellings code setting forth mandatory *requirements* for heat producing equipment is correlated with section AM 503-2 in the Manual, which indicates acceptable *standards* of heat producing equipment.

The Manual is issued in loose-leaf form in order to permit insertion of future pages supplementing or superseding ones contained in the original issue. The Commission's technical staff will continue to study construction materials and methods, and will supervise procedures for the issuance of certificates of acceptance of building products, methods of assembly, and construction techniques. The product of these studies and of the processing of tests and acceptances will take the form of supplementary or superseding Manual pages. It is through this procedure that the Manual will remain a dynamic and up-to-date instrument for interpretation of Code provisions. The preparation of this Manual in conjunction with the performance code is a pioneering and logical step in the furtherance of modern building regulations.

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## **STATE BUILDING CONSTRUCTION CODE applicable to One- and Two-Family Dwellings**

## Part 1

## **General Provisions**

## A 101 TITLE

These regulations, promulgated pursuant to Article 18 of the Executive Law of the State of New York, shall be known as the State Building Construction Code applicable to one- and two-family dwellings. They are hereinafter referred to as **this Code**.

## A 102 PURPOSE

The purpose of this Code is to provide basic and uniform regulations in terms of performance objectives, establishing reasonable safeguards for the safety, health, and welfare of the occupants and users of buildings and structures, and making adequate performance the test of acceptability.

### A 103 EFFECTIVE DATE

This Code shall take effect on November 1, 1951.

## A 104 PARTIAL INVALIDITY

If any term, part, provision, section, subdivision or paragraph of this Code shall be held unconstitutional, invalid or ineffective in whole or in part, such determination shall not be deemed to invalidate the remaining terms, parts, provisions, sections, subdivisions and paragraphs thereof.

## A 105 SCOPE

## A 105-1 New Buildings

This Code shall apply to one- and two-family dwellings, including row houses, which do not exceed 3 stories and 35 feet in height, to their accessory structures, and to parts thereof, which are hereafter erected.

## A 105-2 Existing Buildings

#### A 105-2.1 General

This Code shall also apply to buildings described in paragraphs designated a, b, and c of this section A 105-2.1 as if they were hereafter erected.

a——An existing building to be occupied as a one- or two-family dwelling, which building was not previously so occupied.

b-----A dwelling which is moved into or moved within governmental limits subject to this Code.

c-----An existing dwelling which is altered or repaired, when the cost of such alterations or repairs within any twelve-month period exceeds

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**General Provisions** 

50 per cent of the cost of replacement of the dwelling at the beginning of that twelve-month period.

### A 105-2.2 Roof Covering

Whenever more than 25 per cent of the roof covering of a dwelling is replaced in any twelve-month period, all roof covering on such building shall be in conformity with applicable regulations of this Code.

#### A 105-2.3 Addition or Alteration

Any addition or alteration, regardless of cost, made to a dwelling, shall be made in conformity with applicable regulations of this Code.

#### A 105-2.4 Existing Uses Continued

Except as otherwise herein provided, nothing in this Code shall require removal, alteration, or abandonment of, nor prevent continued use or occupancy of, an existing building, unless such building constitutes a hazard to safety, health, or adjacent property.

#### A 105-3 Mixed Occupancy

A building which contains a use or occupancy other than residential as described in the definition of **dwelling** shall be deemed to be a building of mixed occupancy, not subject to regulations of this Code.

## A 105-4 Maintenance

All buildings or structures subject to this Code shall be maintained in a safe and sanitary condition in conformity with the provisions of this Code.

## A 105-5 Zoning

No provision of this Code shall be construed to repeal, modify, or constitute an alternative to any lawful zoning regulation.

## A 106 QUALITY OF MATERIALS

All materials, assemblies, construction, and equipment shall conform to the regulations of this Code, and shall conform to generally accepted standards with respect to strength, durability, fire resistance, and other qualities recognized under those standards. All test specimens and constructions shall be truly representative of the material, workmanship, and details to be used in actual practice.

#### A 107 ABBREVIATIONS AND DEFINITIONS

#### A 107-1 General

a——Abbreviations, terms, phrases, words, and their derivatives used in this Code shall have the meanings given in this section.

b-----Words used in the singular include the plural, and the plural the singular. Words used in the masculine gender include the feminine and neuter genders.

### A 107-2 Abbreviations

See section AM 107-2 General Standards — Abbreviations, part 1, page 5.

#### A 107-3 Definitions

See section AM 107-3 General Standards — Definitions, part 1, page 5.



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## AM 107-1 General

A generally accepted standard is usually designated by the abbreviation of the name of the issuing organization, year of issue, and title; in some instances, the designation of the standard is descriptive, as in the case of commercial standards of the National Bureau of Standards, United States Department of Commerce, which are designated CS, rather than by abbreviation of the issuing agency. AM appendix A lists organizations, their addresses, titles of their standards and designation numbers, and the dates of issue or revision. The following abbreviations are used in the text of the Manual to indicate standards and, or sources identified with standards.

- ACI American Concrete Institute
- AISC American Institute of Steel Construction, Inc.
- AISI American Iron and Steel Institute
- ASA American Standards Association, Inc.
- ASHVE American Society of Heating and Ventilating Engineers
- ASME American Society of Mechanical Engineers
- ASTM American Society of Testing Materials
- CS Commercial Standards, National Bureau of Standards, United States Department of Commerce
- FPL Forest Products Laboratory, Forest Service, United States Department of Agriculture
- NBFU National Board of Fire Underwriters
- NLMA National Lumber Manufacturers Association
- SPR Simplified Practice Recommendation, National Bureau of Standards, United States Department of Commerce
- ULI Underwriters' Laboratories, Inc.

## AM 107-2 Abbreviations

- **Btu.** British thermal unit
- C. Centigrade
- F. Fahrenheit
- gpm. Gallons per minute
- **psf.** Pounds per square foot
- **psi.** Pounds per square inch

## AM 107-3 Definitions

The definitions herein are a combination of those in the Code and those applicable to matter contained in the Manual. Definitions contained in the Code as applied to its provisions have the force and effect of law. Definitions applicable solely to Manual text and illustrations are meant to be explanatory only, and do not have the force and effect of law.

above-grade building volume. See building volume, above-grade.





1	AM 107-3	Code Manual——State Building Code Commission General Standards – Definitions
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accessory structure. A building, the use of which is incidental to that of the main building, and which is located on the same premises.

addition. Extension or increase in floor area or height of a building.

alley. Narrow supplementary thoroughfare for the public use of vehicles and pedestrians, affording access to abutting property.

alteration. Any change, rearrangement, or addition other than repairs; any modification in construction or equipment.

**approved.** Approved by the enforcement officer under the regulations of this Code, or approved by an authority designated by law or this Code.

attic. Space between top of uppermost floor construction and underside of roof construction. An attic accessible by fixed or movable stair shall be deemed to be a story, unless maintained unfinished and without human occupancy.

**backflow.** Flow of water or of other liquid from any source other than the intended source into pipes distributing a supply of potable water. Back-siphonage is one type of backflow.

**barometric damper.** Automatic, adjustable draft-actuated device, the purpose of which is to prevent excessive draft on a fuel-burning appliance and to make the appliance draft nearly independent of the chimney draft over the normal range of operation.

**basement.** The portion of the building that is partly underground which has more than one half its height measured from finished floor to finished ceiling above the average finished grade of the ground adjoining the building.

**bathroom.** Enclosed space containing one or more bathtubs or showers, or both, and which may also contain water closets, lavatories, or fixtures serving similar purposes.

**boiler.** Vessel in which steam, vapor, or heated water is generated for use external to itself by the direct application of heat resulting from the combustion of fuel.

breezeway. One-story covered passageway, open at the sides, connecting an accessory structure to a building, or connecting parts of a building.

**building.** A combination of any materials, whether portable or fixed, having a roof, to form a structure affording shelter for persons, animals, or property. The word *building* shall be construed, when used herein, as though followed by the words or part or parts thereof unless the context clearly requires a different meaning.

building line. Line established by law, ordinance, or regulation, beyond which no part of a building, other than parts expressly permitted, shall extend.

building volume, above-grade. Volume in cubic feet of a building, measured from the average adjoining grade level to the average roof level, and from outside to outside of exterior walls, but not including open porches, breezeways, or terraces.

cellar. Lowermost portion of the building partly or totally underground having half or more than half of its height, measured from finished floor to finished ceiling, below the average finished grade of the adjoining ground.

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_	AM 107-3

chimney. A shaft, primarily vertical, that is constructed of noncombustible materials, enclosing one or more flues.

column. Vertical supporting element whose height is more than three times its least side or diameter.

combustible material. Material which will ignite and support combustion when heated at any temperature up to 1382° F. (750° C.).

concrete. Mixture of natural, or Portland, or similar cement but excluding gypsum, with water and suitable fine and coarse aggregate.

—concrete, average. Concrete made without artificial aggregates or admixtures and the strength of which is not established by tests but is assumed according to water cement ratio.
—concrete, controlled. Concrete of a quality meeting the requirements in ACI, Building Code Requirements for Reinforced Concrete (see AM appendix A).

---concrete, plain. Concrete without reinforcement, or reinforced only for shrinkage, or for temperature change.

--concrete, reinforced. Concrete in which reinforcement other than that provided for shrinkage or temperature changes is embedded in such a manner that the two materials act together in resisting forces.

construction—classification. Construction of a building or structure in conformity with any one or any combination of the following five types:

-type 2, noncombustible construction. That type of construction in which the structural elements are of noncombustible materials which may or may not be fire protected, and in which all floor construction may have fire-resistance ratings of less than 2 hours.

-type 3, heavy timber construction. That type of construction in which the exterior walls are of masonry, the interior structural members of heavy timbers having flat surfaces with no sharp projections or concealed spaces, and floors and roofs of heavy plank, laminated, or equivalent noncombustible construction, with the further provision that noncombustible structural members having fire-resistance ratings of not less than  $\frac{3}{4}$  hour may be substituted for heavy timber members.

-type 5, wood frame construction. That type of construction in which the structural members, including the exterior walls, which may be faced with noncombustible materials, are wholly or partly of wood.

1	AM 107-3	Code Manual——State Building Code Commission General Standards – Definitions
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cross connection. Physical connection between 'wo otherwise separate piping systems through which a supply of potable water could be contaminated or polluted.

direct-fired heat producing equipment. Apparatus for the production of heat, having an integral combustion chamber in which solid, liquid, or gas fuel is burned.

**draft hood.** A device placed in, and made part of, the smoke pipe or the flue connected to heat producing equipment, or in the equipment itself, which is designed to insure ready escape of the products of combustion in the event of no draft, back draft, or stoppage beyond the draft hood; to prevent a back draft from entering the equipment; and to neutralize the effect of adverse stack action of the chimney flue upon operation of the equipment.

draft stop. Barrier to air movement.

dwelling. Building containing not more than two dwelling units occupied exclusively for residential uses. Residential uses shall include a private garage and customary home occupations conducted in the dwelling by the occupants, such as the practice of a profession.

---one-family dwelling. Building arranged for one dwelling unit.

-two-family dwelling. Building arranged for two dwelling units.

**dwelling unit.** One or more rooms with living, cooking, sanitary and sleeping facilities therein, arranged for one family with whom may reside not more than 5 lodgers or boarders.

elevator. Hoisting and lowering mechanism equipped with a car or platform which moves in guides for the transportation of persons in a primarily vertical direction.

enforcement officer. Officer or employee lawfully empowered to enforce the regulations of this Code.

fire limits. Boundary line establishing an area in which there exists, or is likely to exist, a fire hazard requiring special fire protection.

fire partition. Fire-resistive construction subdividing a building in order to restrict the spread of fire.

fire-resistance rating. Time in hours or parts thereof that a material or construction will withstand fire exposure, as determined in a fire test made in conformity with generally accepted standards, or as determined by extension or interpretation of information derived therefrom.

fire separation. A construction of specific fire resistance separating parts of a building. firestopping. Effective barriers against the spread of flames or hot gases within or between concealed spaces.

fire wall. Interior wall which completely subdivides a building into limited areas in all stories, or which separates two or more buildings to restrict the spread of fire; and, except in buildings of fire-resistive construction, is supported on a foundation and extends continuously through all stories to and above the roof.

fixture branch. Water supply pipe connecting one fixture, or two fixtures installed back to back, with water supply distributing pipe.



**floor area.** The horizontally projected floor area within surrounding walls of a building, or portion thereof.

flue. Enclosed passageway, primarily vertical, suitable for removal to outer air of gaseous products of combustion.

furnace, floor. A direct-fired self-contained appliance for heating air, designed to be inserted into and suspended from the floor of the space being heated.

furnace, warm air. Direct-fired heat producing equipment for use as the central primary means of supplying heated air.

-gravity furnace. Warm air furnace with circulation of air to be heated dependent primarily upon the difference in weight between the heated air and cold return air.

---forced-air furnace. Warm air furnace with circulation of heated air dependent primarily on a power-driven fan or blower.

garage, private. Storage space within a building for not more than 4 automobiles, including not more than 1 commercial vehicle, and without fixed facilities for repairing or refueling them.

gasvent. Conduit or pipe, primarily vertical, suitable for the removal to the outer air of the products of combustion from gas-fired appliances only.

-type B gasvent. Vent of noncombustible corrosion-resistive material of sufficient insulating value to permit its safe use near or within combustible construction, and only to be used with gas-burning equipment giving flue gas temperatures not in excess of 550° F. at the draft-hood outlet when burning gas at maximum rating.

-type C gasvent. Vent of noncombustible corrosion-resistive material which has insufficient insulating value, thereby limiting its use near or within combustible construction.

generally accepted standard. A specification, code, rule, guide or procedure in the field of construction widely recognized and accepted as authoritative, which is in harmony with this Code.

glass area. Gross area of glass within a sash, door, or opening; glass area may include small subdividing muntins and division bars.

grade, finished. Natural surface of the ground, or surface of ground after completion of any change in contour.

grade level. Mean elevation of the curb level when established and opposite the main walls of building located on or within 5 feet of the street line, or mean elevation of the finished grade abutting the building when curb level has not been established or when the main walls are more than 5 feet from the street line (see illustration in section AM 107-3 General Standards—Definitions, part 1, page 15, entitled, "Building Height").

habitable space. Space occupied by one or more persons for living, sleeping, eating, or

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cooking; excluding kitchenettes, bathrooms, toilet rooms, laundries, pantries, storage spaces, foyers, hallways, utility rooms, heater rooms, boiler rooms, and basement or cellar recreation rooms.

heartwood of a durable species. The inner core of the tree trunk comprising the annual rings containing nonliving elements, from species such as cedar, chestnut, southern cypress, locust, redwood, or other approved decay-resistant wood.

heater, recessed or wall. Self-contained, direct-fired, vented, heating appliance complete with grille permanently attached to a wall, floor or ceiling. Heated air is circulated by gravity or fan directly to space being heated by openings in casing, without connection to external ducts.

heater, space. Appliance for heating the space in which it is installed by radiation or convection or both; and without connection to external pipes or ducts to distribute the heated air to other spaces. Space heater is sometimes referred to as room heater.

—circulating space heater. Space heater having an outer jacket surrounding the casing enclosing the combustion chamber, and provided with openings at top and bottom so that room air can circulate between the casing and jacket.

--- radiating space heater. Space heater having an opening in the outer jacket to permit direct radiation from the inner casing.

-wall heater, unvented open-flame radiant type. Space heater of the open-front type, designed for surface mounting on wall or recessed, having exposed flames and a reflecting surface. The products of combustion are discharged through the front into the room.

heater, unit. Appliance having a fan and heat exchanger arranged to emit heated air.

heating appliances. Heat producing equipment other than boilers and warm air furnaces. This includes, among others, space heaters, unit heaters, wall heaters, water heaters and cooking appliances.

heat producing equipment. All apparatus used primarily for the generation of heat; includes boilers, warm air furnaces and all direct and indirect heating appliances.

height, building. Vertical distance measured from the grade level to the highest level of the roof surface of flat roofs, to the deck line of mansard roofs, or to the mean height between eaves and ridge for gable, gambrel, or hip roofs (see illustration in section AM 107-3 General Standards—Definitions, part 1, page 15, entitled, "Building Height").

interior finish. Finished surface of material directly applied on the interior side of walls or ceilings including that which is integral with or attached to the wall or ceiling, for acoustical correction, surface insulation, or decorative treatment and similar purposes, including but not limited to wainscoting and paneling, but not including surface finishes of paper or of materials having no greater fire hazard than paper, which are not more than 1/28th-inch thick. Interior finish does not include interior trim, finished flooring, doors and windows, or door and window frames.

interior trim. Material of narrow width, generally not exceeding 12 inches in width,

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around openings or on wall or ceiling; including casings, stools, aprons, baseboards, chair rails, picture molds, cornice moldings, and moldings applied for decoration.

kitchen. Space, 60 square feet or more in floor area, used for cooking or preparation of food, and deemed a habitable space.

kitchenette. Space, less than 60 square feet in floor area, used for cooking or preparation of food, and deemed not a habitable space.

**legal open spaces.** Open spaces on the same premises, such as yards or courts; streets, alleys or other open spaces permanently dedicated to public use; spaces acceptable under applicable ordinances or regulations as sources of natural light and natural ventilation. **load, dead.** Weight of all permanent construction, including walls, framing, floors, roofs, partitions, stairways, and fixed building-service equipment.

load, design. Total load which a structure is designed to sustain.

load, imposed. All loads, exclusive of dead load, that a structure is designed to sustain. load, live. Load imposed solely by the occupancy.

load, racking. Load, applied in the plane of an assembly in such manner as to lengthen one diagonal and shorten the other.

lot line. Line dividing one premises from another, or from a street or other public space. lumber, stress-grade. Lumber which has been graded for strength by a lumber grading or inspection bureau or other agency or individual recognized as being competent for the species, according to the principles outlined in ASTM, *Tentative Methods for Establishing Structural Grades of Lumber* (see AM appendix A).

lumber, yard. Lumber, exclusive of stress-grade lumber, for general construction purposes. masonry. Construction of units of such materials as clay, shale, concrete, glass, gypsum, or stone, set in mortar, or in mortar and grout; including plain concrete, but excluding reinforced concrete.

---ashlar masonry. Masonry composed of rectangular units of natural or cast stone, or burned clay or shale, larger in size than brick and with sawed, dressed, or squared beds.

-hollow masonry. Masonry consisting in whole or in part of hollow masonry units.

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

—net cross-sectional area of masonry unit. The gross cross-sectional area of the masonry unit minus the area of the cores or cellular space. Gross cross-sectional area of scored units shall be determined to the outside of the scoring, but the cross-sectional area of the grooves shall not be deducted from the gross cross-sectional area to obtain the net cross-sectional area.

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

---solid masonry unit. A masonry unit whose net cross-sectional area in every plane

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parallel to the bearing surface is 75 per cent or more of its gross cross-sectional area measured in the same plane.

-rubble masonry. Masonry composed of roughly shaped stones.

-coursed rubble. Masonry composed of roughly shaped stones fitted approximately on level beds, and well bonded.

---random rubble. Masonry composed of roughly shaped stones laid without regularity of coursing, but well bonded and fitted together to form well defined joints.

mortar. A plastic mixture of cementitious material, fine aggregate, and water used to bond masonry or other structural units.

municipality. Any city, town, or village.

occupancy. Use of a building, structure, or premises.

**opening protective.** Assembly of materials and accessories with a specified fire-resistance rating, including any incidental frames, mullions, muntins, anchors, and hardware, which when installed in an opening in a wall, partition, floor, or roof prevents or retards passage of flame, heat, fumes, and smoke through that opening.

owner. Owner or owners of the freehold of the premises or lesser estate therein, a mortgagee or vendee in possession, assignee of rents, receiver, executor, trustee, lessee, or other person, firm, or corporation, in control of a building.

parapet. Portion of a wall entirely above the roof line.

partition, bearing. An interior bearing wall one story or less in height.

partition, nonbearing. An interior nonbearing wall one story or less in height.

party wall. See wall, party.

**plywood.** A cross-banded assembly made of layers of veneer, or veneer in combination with a lumber core or plies joined with an adhesive. Two types of plywood are recognized, namely, veneer plywood and lumber-core plywood. Generally, the grain of one or more plies is approximately at right angles to the other plies, and almost always an odd number of plies is used.

plumbing system. Pipes, fixtures, and other apparatus for supplying water for consumption, or for conveyance of wastes and drainage.

potable water. Water duly approved as satisfactory and safe for drinking.

premises. A lot, plot, or parcel of land including the buildings or structures thereon.

property line. Line constituting the boundaries of premises.

public sewer. Sewer operated by a public authority, or public utility, and available for public use.

public water supply. Water supply furnished by a public authority, or public utility, and available for public use.

repair. Replacement or renewal, excluding additions, of any part of a building, structure,

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device, or equipment, with like or similar materials or parts, for the purpose of maintenance of such building, structure, device, or equipment.

required. Required by this Code.

residual deflection. Deflection resulting from an imposed load, remaining after removal of the load.

residual deformation. Lengthening or shortening resulting from an imposed axial load, remaining after removal of the load.

residual pressure. Pressure of water within a water supply pipe when water is being supplied to fixtures connected thereto.

roof covering. Covering applied to roof surface to resist weather and fire.

row house. An attached one- or two-family dwelling in a row or group of such dwellings. self-closing. As applied to an opening protective means normally closed and equipped with an approved device to insure closing after having been opened.

sewage. Any liquid waste containing animal, vegetable, or mineral matter in suspension or solution.

shall. As used in this Code, is mandatory.

**smoke pipe.** A pipe or breeching connecting equipment for burning solid or liquid fuel to a flue or chimney.

smokestack. A vertical flue constructed of metal.

standard. See generally accepted standard.

story. Portion of a building which is between one floor level and the next higher floor level, or portion of a building which is between a floor level and the underside of the ceiling or roof surface directly above. If the ceiling over a basement or cellar is more than 4 feet above grade level, such basement or cellar shall be deemed a story (see illustration in section AM 107-3 General Standards—Definitions, part 1, page 15, entitled, "Building Height").

street. Thoroughfare dedicated and accepted by the municipality for public use.

street line. Line dividing a lot, plot, or parcel from a street.

stress-grade lumber. See lumber, stress-grade.

structural damage. Loosening, twisting, warping, cracking, or breaking of any piece, or of any fastening or joint, in a structural assembly, without loss of sustaining capacity of the assembly. Small cracks in reinforced concrete, perpendicular to the reinforcing bars, shall not be deemed to be structural damage. Deformation of sheet material when a structural assembly is under imposed load, which increases as the load increases but which disappears when the load is removed, shall not be deemed to be structural damage.

structural failure. Rupture; loss of sustaining capacity, marked increase in strain without increase in stress; deformation increasing more rapidly than the increase in imposed load. structure. Combination of any materials, whether fixed or portable, forming a construction,

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including buildings. The word structure shall be construed as though followed by the words or part or parts thereof.

toilet room. Enclosed space, containing one or more water closets, which may also contain one or more lavatories, urinals, and other plumbing fixtures.

trap seal. Depth of water in a trap measured upward vertically from the top of the dip of the trap to the mean water surface.

trap seal, residual static. Depth of trap seal remaining after a trap has been subjected to pressure disturbance.

ultimate strength. Greatest stress or load which can be imposed upon a material or structural member without causing structural failure.

unit masonry. See masonry units.

ventilation. Supply and removal of air to and from any space by natural or mechanical means.

ventilation, mechanical. Ventilation by power-driven devices.

ventilation, natural. Ventilation by opening to outer air through windows, skylights, doors, louvers, or stacks with or without wind-driven devices.

wall, bearing. Wall which supports any vertical load in addition to its own weight.

wall, cavity. 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.

wall, combustible exterior. Wall constructed wholly or in part of combustible materials. wall, faced. Wall in which the masonry facing and backing are so bonded as to exert common action under load.

wall, fire. See fire wall.

wall, foundation. Ground-supported bearing wall, partly or wholly below grade, which supports a wall, column, or other part of a building or structure.

wall, hollow. Wall built of masonry units so arranged as to provide an air space within the wall, and in which the facing and backing of the wall are bonded together with masonry units.

wall, nonbearing. Wall which supports no vertical load other than its own weight.

wall, noncombustible exterior. Exterior wall constructed of noncombustible materials. wall, party. Wall used or adapted for joint service between two buildings or structures.

wall, veneered. Wall having a facing of masonry or other approved weather-resistant noncombustible material securely attached to the backing but not so bonded as to exert common action under load.

yard lumber. See lumber, yard.

yield strength. Stress at which a material exhibits a specified limiting permanent set. Permanent set shall be deemed to mean residual deformation.



## Building Height



3-STORY BUILDINGS

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grade level. Mean elevation of the curb level when established and opposite the main walls of building located on or within 5 feet of the street line, or mean elevation of the finished grade abutting the building when curb level has not been established or when the main walls are more than 5 feet from the street line.

height, building. Vertical distance measured from the grade level to the highest level of the roof surface of flat roofs, to the deck line of mansard roofs, or to the mean height between eaves and ridge for gable, gambrel, or hip roofs.

story. Portion of a building which is between one floor level and the next higher floor level, or portion of a building which is between a floor level and the underside of the ceiling or roof surface directly above. If the ceiling over a basement or cellar is more than 4 feet above grade level, such basement or cellar shall be deemed a story.



## **STATE BUILDING CONSTRUCTION CODE applicable to One- and Two-Family Dwellings**

## Part 2

## **Space Requirements**

A 201 HABITABLE SPACE

### A 201-1 General Requirements

Each habitable space shall be so located in respect to grade level, and so lighted and ventilated as to provide healthful environment.

### A 201-2 Light

Habitable space shall be provided with natural light through one or more windows or skylights, or transparent or translucent panels, or any combination thereof, above the adjoining finished grade level. Windows or their equivalent shall face directly on legal open spaces or above a roof level. For each habitable space the total lighting area shall provide an amount of natural light equivalent to that transmitted through clear glass equal in area to 10 per cent of the floor area of the habitable space.

### A 201-3 Ventilation

Habitable space shall be provided with ventilation in accordance with either of the following:

a——Openable parts of windows or skylights, or louvers, transoms, or other openable exterior wall or roof surfaces above the adjoining finished grade level, facing legal open spaces and providing total clear ventilation area equal to not less than 5 per cent of the total floor area of each habitable space; or

b——Mechanical ventilation providing at least two air changes per hour either of outdoor air, or a mixture of outdoor and recirculated air, in such proportion that a minimum of one air change per hour shall be outdoor air.

### A 201-4 Location in Respect to Grade Level

Floor level of habitable space shall be not more than 4 feet below the average adjoining finished grade. No habitable space shall be located in cellars. Play or recreation rooms may be located below grade.

## A 202 KITCHENS AND KITCHENETTES

## A 202-1 General Requirements

Kitchens and kitchenettes shall have adequate light and ventilation for the maintenance of sanitary conditions, the safe and sanitary preparation and service of food, the safe use and proper operation of appliances and equipment therein, and for removal of accumulated heat, moisture, and odors.

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**Space Requirements** 

#### A 202-2 Light

a——Kitchens shall be provided with natural light as set forth in section A 201-2.

b——Kitchenettes shall be provided with natural or artificial light or both, of sufficient intensity and so distributed as to permit the safe use of the space, appliances, and equipment therein.

#### A 202-3 Ventilation

a-----Kitchens shall be ventilated as set forth in section A 201-3 or by other means which shall exhaust not less than 100 cubic feet of air per minute and replace such exhausted air by an equal amount of outdoor air or its equivalent. When performance of ventilating equipment is affected by atmospheric conditions and the room air temperature, the equipment shall deliver a minimum of 100 cubic feet of air per minute at least 90 per cent of the time.

b——Kitchenettes shall be ventilated by openable areas of not less than 3 square feet facing legal open spaces, or by other means as set forth in section A 202-3a.

#### A 203 BATHROOMS AND TOILET ROOMS

#### A 203-1 General Requirements

Bathrooms and toilet rooms shall have provisions for privacy. Lighting shall be adequate for maintenance of sanitary conditions, and ventilation sufficient to remove odors and excessive vapor.

#### A 203-2 Light

Light shall be either natural or artificial or both, so distributed and of sufficient intensity to permit the maintenance of sanitary conditions of the room and of the plumbing fixtures.

#### A 203-3 Ventilation

Ventilation shall be provided either by openable areas, the total of which shall be not less than 1½ square feet, facing legal open spaces, or by other means, such as mechanical ventilation or ducts with gravity circulation, exhausting at least 20 cubic feet of air per minute, and replacing the same by an equal amount of outdoor air or its equivalent.

## A 204 ATTICS, CRAWL SPACES, FLAT ROOFS

Ventilation shall be provided in unheated attics, spaces below flat roofs, and crawl spaces. Location and net areas of ventilation openings shall be such as to prevent deterioration of the structural members from condensation.

#### A 205 EXITS AND STAIRS

#### A 205-1 General Requirements

a——Exits and stairs shall not serve in common more than two dwelling units.

b——Stairs, both interior and exterior, shall be arranged and constructed to provide safe ascent and descent. A fixed stair shall be provided where travel is required between two floors, each of which contains a habitable space or a recreation room, and between the first floor and basement and cellar. Disappearing or folding stairs may Space Requirements

be used between two floors above grade where one of them only contains a habitable space or a recreation room.

## A 205-2 Treads

-----Minimum widths of treads shall be:

9 inches, plus nosing at least 1 inch wide; or

10 inches, where without nosing;

except that treads of folding or disappearing stairs intended for occasional use only shall have a minimum width of 6 inches.

b——Winder treads at converging ends of winders, exclusive of minimum 1-inch nosings, shall be not less than 4 inches wide unless the winders are guarded at the converging ends by continuous handrails which prevent walking where the tread widths are less than 6 inches. If the winder treads are without a minimum 1-inch nosing, the tread widths in these locations shall be not less than 5 inches and 7 inches, respectively.

c——Winder tread widths at distance of 18 inches from the converging ends shall be not less than the tread widths as set forth in section A 205-2a.

d——All treads shall be level and uniform in width, with no variation exceeding 1/8 inch in any one run of stairs.

## A 205-3 Risers

\_\_\_\_Maximum heights of risers shall be:

stairs having treads with nosing, 81/4 inches;

stairs having treads without nosing, 7<sup>3</sup>/<sub>4</sub> inches;

except that the maximum height of risers of folding or disappearing stairs, exterior stairs to basements or cellars, and of other stairs intended for occasional use only, shall be 9 inches.

b——There shall be no variation exceeding  $\frac{1}{4}$  inch in the height of risers in any one run of stairs.

## A 205-4 Width

Widths of stairs connecting habitable spaces shall be not less than 2 feet 8 inches clear between handrails or between handrails and opposite wall surface; except that stairs from a second story to a third story occupied by not more than 5 persons, and stairs to a basement and a cellar, shall not be less than 2 feet 4 inches clear between handrails or between handrail and opposite wall surface.

## A 205-5 Headroom

The minimum clear headroom over any portion of any fixed stair tread shall be not less than 6 feet 6 inches measured vertically from the surface of the tread.

## A 205-6 Handrails and Railings

a——Stairs or steps of more than 3 risers shall have a handrail or railing parallel to the stair slope on at least one side. Where one or both sides of such stairs or steps are open, railings shall be provided on the open sides.

b-----Window openings on stairs or landings, and well openings, shall be guarded by railings or other equivalent protection.

c----Handrails and railings shall be not less than 30 inches nor more than 36 inches in height above the floor or tread level. On stair runs, the height shall be measured directly above the riser face.

**Space Requirements** 

d——Clearance between handrail and supporting wall shall be not less than 1  $\gamma_2$  inches.

## A 205-7 Light

Treads of stairs shall be lighted by either natural or artificial light of sufficient intensity to allow safe ascent or descent.

#### A 206 EMERGENCY ESCAPE

## A 206-1 General Requirements

In addition to the primary exit from dwellings, there shall be provided a secondary exit or, in lieu thereof, one or more escape openings for emergency use.

#### A 206-2 Escape Openings

a----At least one escape opening or secondary exit shall be provided at each floor containing a habitable space or recreation room.

b-----Escape openings shall include doors, openable parts of windows, or openable panels, located so as to provide ready access to legal open spaces.

c——Escape openings shall have minimum dimensions of 24 by 30 inches, with bottom of openings no higher than 3 feet above finished floor in all above-grade stories, and no higher than 4 feet 6 inches where required in basement and cellar.

#### PRIVATE GARAGE

For regulations governing private garages see section A 407.

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## AM 201 Habitable Space

## AM 201-2 Light

Light-transmitting area for natural light is specified in terms of clear glass area. For each habitable space the clear glass area shall not be less than 10 per cent of the floor area of said habitable space.

## AM 201-3 Ventilation

Ventilation, if natural, shall be through openable areas specified as clear ventilating area. For each habitable space the clear ventilating area shall not be less than 5 per cent of the floor area of said habitable space.

Mechanical ventilating equipment for habitable spaces, kitchens and kitchenettes, and bathrooms and toilet rooms, if constructed and installed in conformity with ASHVE, *Heating Ventilating Air Conditioning Guide* (see AM appendix A), is acceptable as in conformity with generally accepted standards.

Kitchen exhaust systems in which ducts are employed should be made of noncombustible material, and installed to avoid temperature in excess of 175° F. on surface of adjacent combustible material.

Ventilating systems should not make return air connections from toilet room, bathroom, garage, nonhabitable basement spaces, storage spaces or confined spaces containing equipment provided with draft hood or draft regulator.



Location in Respect to Grade Level





Code Manual——State Building Code Commission

Space Standards – Kitchens and Kitchenettes, Bathrooms and Toilet Rooms – Ventilation



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## Ventilation of Kitchens, Kitchenettes, Bathrooms, and Toilet Rooms



## DUCT 10 FEET OR MORE IN HEIGHT



## DUCT LESS THAN 10 FEET IN HEIGHT



## MECHANICAL VENTILATION

Duct Sizes, Gravity Type Kitchens and kitchenettes— Ducts shall have a minimum crosssectional area of 144 square inches. Bathrooms and toilet rooms— Ducts shall have a minimum crosssectional area of 36 square inches. Minimum cross-sectional dimension, 3 inches.

## Duct Material

Ducts shall be of noncombustible material resistant to corrosion. Acceptable material shall include: 26 U. S. gage galvanized iron, noncorrodible metal of equivalent stiffness, asbestos, and noncombustible lath and plaster.

## **Ventilators**

Ducts less than 10 feet in height shall be equipped at the outlet with wind-driven or other draft-inducing ventilators or similar devices which will exhaust the required cubic feet of air per minute in such ducts whenever such ventilators or similar devices are subjected to a wind velocity in excess of 3 miles per hour.

## Replacement Air

Replacement air may be obtained from outdoors or from indoor spaces supplied directly with outdoor air. Air intake may be provided by permanent louvers or by allowing space between bottom of door and floor. Clear opening shall be equal to cross-sectional area of exhaust duct.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



Ventilation of Attics and Flat Roofs



## Gross Area of Openings

Unobstructed openings shall be 1/300th of attic or flat roof area. Screened or louvered openings shall be 1/150th of attic or flat roof area. Screened and louvered openings shall be 1/100th of attic or flat roof area.

Ventilation of unheated enclosed spaces, such as attics, below flat roofs, porches, etc., shall be provided with openings located in such manner that a free circulation of air is maintained in such spaces.

Net area of openings shall be sufficient to prevent deterioration of the structural members from condensation.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



## Ventilation of Crawl Spaces



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

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## AM 206 Emergency Escape

## AM 206-1 General Requirements

1—The Code requires as an emergency escape an additional means of egress to the outer air from habitable spaces and from recreation rooms located in basements or cellars, should the main means of egress be blocked by fire or smoke. It is not a requirement for a means of egress at grade level.

2—Emergency escape openings to the outer air should be on sides of buildings facing a street or alley, or facing yards or courts which are directly accessible from the street or legal open space. Emergency escape openings should be located as remote as practicable from primary exit.

## AM 206-2 Escape Openings

The following are acceptable emergency escapes:

**From first story**—Additional exterior door of adequate height and at least 24 inches wide to porch or grade, remote from main means of egress; or exterior window or panel with opening at least 24 inches by 30 inches, and with bottom of opening not more than 36 inches above floor; or interior door of adequate height and at least 24 inches wide through a fire partition or fire separation, affording access to a safe place of refuge from which there is ready egress to the street or legal open space.

From second story—Exterior door of adequate height and at least 24 inches wide to porch or balcony; or second stairway at least 24 inches wide to first floor; or exterior window or panel with opening at least 24 inches by 30 inches, and with bottom of opening not more than 36 inches above floor; or interior door of adequate height and at least 24 inches wide through a fire partition or fire separation, affording access to a safe place of refuge from which there is ready egress to the street or legal open space.

From third story or attic—Exterior door of adequate height and at least 24 inches wide to porch or balcony; or second stairway at least 24 inches wide to first floor; or exterior window or panel with opening at least 24 inches by 30 inches, and with bottom of opening not more than 36 inches above floor; or interior door of adequate height and at least 24 inches wide through a fire partition or fire separation, affording access to a safe place of refuge from which there is ready egress to the street or legal open space.

From recreation rooms in basements or cellars—Interior or exterior second stairway at least 24 inches wide with access to grade; or exterior window or panel with opening at least 24 inches by 30 inches with sill not more than 4 feet 6 inches above floor, affording access

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

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to grade or to open areaway with access to grade; or interior door of adequate height and at least 24 inches wide through a fire partition or fire separation, affording access to a safe place of refuge from which there is ready egress to the street or legal open space.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.
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## **STATE BUILDING CONSTRUCTION CODE applicable to One- and Two-Family Dwellings**

#### Part 3

#### **Structural Requirements**

#### **A 301** GENERAL REQUIREMENTS

a-Buildings and parts thereof shall be capable of sustaining safely their own weight and the loads to which they are subject.

b----Buildings shall be constructed and integrated so that loads are transmitted to the soil without unsafe deformation or movement of the building or of any structural part.

c——Wherever structural material or assemblies may, if unprotected, deteriorate and become structurally unsound under the proposed condition of use, approved protection shall be provided. Causes of such deterioration shall include, among others, action of freezing and thawing, dampness, wetting and drying, termites and rodents.

d——Parts of buildings built in soil which is water bearing at any season of the year shall be constructed so that ground water will not flow into habitable spaces, basements, and cellars.

#### A 302 SOIL BEARING VALUE

#### A 302-1 Determination

The allowable bearing value of the soil upon which a building rests shall be the presumptive bearing value in accordance with generally accepted standards, or shall be the value determined by either:

a----Field loading tests made in accordance with generally accepted standards, or

b-----Laboratory determination made by a person skilled and competent to make such determination and based on subsurface explorations, such as borings or test pits.

#### A 302-2 Performance Criteria

a----Under field loading test, the total settlement caused by the proposed load on the soil, measured after a period during which no settlement has occurred for 24 hours, shall not exceed <sup>3</sup>/<sub>4</sub> inch; nor shall a 50 per cent increase in the proposed load cause an additional settlement, measured after a period during which no settlement has occurred for 24 hours, exceeding 60 per cent of the total settlement under the proposed load.

b——The loads imposed on the soil by separate parts of a foundation shall not cause unsafe movement or deformation through differential settlement.

#### A 303 ANALYSIS AND TEST PROCEDURES

#### A 303-1 General

The capacity of an assembly to sustain dead and imposed loads with-

out exceeding the allowable stresses shall be determined by any one of the procedures herein described under paragraphs designated a, b, and c, of this section A 303-1, or by an approved combination of them.

-Design analysis according to generally accepted engineering practice to establish that stresses in component structural material will not exceed safe working stresses defined in generally accepted standards, or in the absence of such standards, exceed safe working stresses interpreted and established from test results with due consideration given to the reliability, durability, and uniformity of the material and its behavior under stress. In no case shall the safe working stress exceed two thirds of the yield strength nor one half of the ultimate strenath of the material. When safe working stresses are assigned to a material, the structural characteristics and reasonable uniformity of the material, as utilized, shall be assured by conformity to generally accepted standards.

-Tests made in accordance with generally accepted standards of h assemblies truly representative of the construction to be used in order to establish that such assemblies conform to the performance criteria set forth in section A 305.

-Comparison with an approved assembly of known characteristics and behavior under load, which assembly is directly comparable, in all essential characteristics, to the assembly under consideration.

#### A 303-2 Load Test

Load tests or other suitable tests, if required by the enforcement officer and if made in conformity with generally accepted standards, shall be evidence of the acceptability of the construction.

#### A 304 **DESIGN LOADS**

A building and all parts thereof shall be of sufficient strength to support the loads and the movements caused by such loads to which they may be subjected, without exceeding the safe working stresses prescribed by this Code or in generally accepted standards. Such loads shall include the dead load and the following imposed loads where applicable: live, snow, wind, soil pressure, hydrostatic-head, and impact loads.

#### Live Loads A 304-1

#### A 304-1.1 General

-Loads set forth in section A 304-1.2 do not include unusual conαcentrations, such as storage units, floor-to-ceiling bookshelves, and commercial vehicle wheel loads in garages. Where such loads occur, suitable approved provisions shall be made for their support.

-Structural members and flooring, if any, spanning the floor structural members shall be designed to support the uniformly distributed live loads or the concentrated loads, whichever produce the greater stress.

-Uniformly distributed loads may be reduced 20 per cent when structural members support 150 square feet or more of floor or roof area.

#### Uniformly Distributed and Concentrated Live Loads A 304-1.2

Uniformly distributed and concentrated live loads shall be the greatest load produced by the intended use and occupancy, but in no case less than the minimum live load in accordance with the following table.

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Location	Uniformly distributed loads in pounds per square foot	Concentrated live loads <sup>1</sup> in pounds
First floor <sup>2</sup> Other floors	40 30	250 250
Accessible by fixed, folding or disappearing stair, in areas where the ceiling height is 3 feet or more	30	250
Accessible by fixed, folding or disappearing stair, in areas where the ceiling height is less than 3 feet	20	150
Accessible by scuttle or other means, other than a stair, and of such height that household goods may be stored therein	20	150
Roofs and eaves used as promenades Other roofs and eaves Stair treads Garages for passenger cars	30 3 75 75	250 200 250 2000
		i

# TABLE A 304-1.2.—UNIFORMLY DISTRIBUTED AND CONCENTRATED LIVE LOADS

<sup>1</sup> Applied on area I inch in diameter at point of maximum deflection in all locations except garages where load is applied on area 9 inches in diameter. <sup>2</sup> First floor of a one-family dwelling, and first and second floors of a two-family dwelling. <sup>3</sup> For minimum imposed load see section A 304-9c.

#### A 304-2

#### Snow Loads

The snow load shall be in accordance with the following table and the snow map on page 6, part 3.

Zone numbers		Roc	of slope fro	om horizont	al¹							
on snow map	0°	20°	30°	40°	50°	60° or more						
20	20	18	11	6	2	0						
25	25	22	14	7	3	0						
30	30	27	17	9	3	0						
35	35	31	20	10	4	0						
40	40	35	23	12	4	0						
45	45	40	25	13	5	0						
50	50	44	28	15	5	0						
60	60	53	34	18	6	0						
70	70	62	39	21	7	0						
80	80	71	45	24	8	0						
90	90	80	51	26	9	0						

TABLE A 304.2——SNOW LOADS In pounds per square foot normal to roof surface

<sup>1</sup> For slopes between those tabulated, compute loads by straight-line interpolation.

SNOW MAP OF NEW YORK STATE



Numbers Indicate Zones Within Lines

#### A 304-3 Wind Loads

Minimum wind loads shall be in accordance with the following tables, designated A 304-3a and A 304-3b, applied normal to the surface, and based on an average 5-minute gust velocity of 77.8 miles per hour at a height of 30 feet above grade level.

TABLE A	304-3a.——WIND	LOADS:	WALLS,	EAVES	AND	CORNICES
	in po	unds per	square fo	oot		

Height of interval above grade level in feet	Walls and chimneys <sup>1</sup>	Eaves and cornices (Load acting upward)
25 or over	18	36
15 to 25	15	30
0 to 15	12	24

<sup>1</sup> Exterior walls shall be capable of withstanding wind load acting on both the interior and exterior surfaces.

TABLE A	30	4-3Ь.—	W	IND	LC	ADS:	ROOFS
	In	pounds	per	squ	are	foot	

Mean elevation of roof above grade	Direction	Slope from horizontal <sup>2</sup>							
level in feet	of load <sup>1</sup>	0° to 20°	20° to 30°	30° to 60°	Over 60°				
20 and over	Inward	5	5	5 to 14	14				
	Outward	17	17 to 14	14	14				
Up to 20	Inward	5	5	5 to 11	11				
	Outward	14	14 to 11	11	11				

<sup>1</sup> Inward and outward loads are to be considered as acting non-simultaneously. <sup>2</sup> Loads on intermediate slopes between 20° and 30° acting outward and between 30° and 60° acting inward, shall be computed by straight-line interpolation. Structural Requirements | State Building Construction Code applicable to One- and Two-Family Dwellings

#### A 304-4 Soil Pressure and Hydrostatic-Head Loads

Parts of structures below ground shall be designed to withstand the following loads, if applicable, and such loads shall be in addition to other imposed loads:

a——Lateral load, from adjacent soil.

b——Lateral load, from hydrostatic head.

c——Lateral load, from surcharge of fixed or moving heads.

d-----Uplift from hydrostatic head.

#### A 304-5 Horizontal Impact Loads

a----All railings including handrails, both exterior and interior, shall be capable of sustaining safely a horizontal lateral impact at the top of the railing equivalent to a uniformly distributed horizontal load of 50 pounds per linear foot.

b----Nonbearing partitions shall be capable of sustaining without structural damage or displacement at top and bottom, their own weight and an impact load applied as directed in section A 305-4.

#### A 304-6 Overturning Force and Moment

a——The overturning force shall be the wind load. The wind load shall be the load set forth in table designated A 304-3a, and shall be applied only to the windward vertical surface above the horizontal plane under consideration, and to the rise of roof. The resisting force shall be the dead load of the structure above the horizontal plane under consideration.

b——The moments of stability and overturning shall be computed about the leeward edge of the horizontal plane under consideration. c——The moment of stability of the structure above the horizontal plane under consideration shall be not less than 1½ times the overturning moment due to wind.

#### A 304-7 Sliding Force

The sliding force due to wind load, equal to the overturning force as determined by section A 304-6a, shall be resisted by the dead load of the structure above the horizontal plane under consideration, anchors, and where applicable, soil friction, providing a total resisting force equal to not less than  $1\frac{1}{2}$  times the sliding force. Anchors used to resist overturning may also provide resistance to sliding.

#### A 304-8 Uplift Force

Uplift force due to wind or hydrostatic head shall be resisted by dead load, acting directly or through anchors or fastenings, equal to not less than 1¼ times the uplift force.

#### A 304-9 Combined Loads

a——The stress due to wind may be ignored if it is less than one third of the stress due to dead load plus imposed load excluding wind load. b——If the stress due to wind exceeds one third of the stress due to dead load plus imposed load excluding wind load, the safe working stress may be increased by one third.

c——On roofs and eaves, the minimum imposed load shall be 20 psf perpendicular to the roof surface, where snow plus wind loads total less than 20 psf.

d----On roofs and eaves subject to live load, live load and snow load shall be considered as acting non-simultaneously.

e——On surfaces that are not vertical, snow or live load, and the inward wind load, shall be considered as acting simultaneously in such combination as imposes the greater load.

#### A 304-10 Loads Imposed During Construction

All flooring, structural members, walls, bracing, scaffolding, sidewalk bridges, hoists and temporary support of any kind incidental to the erection, alteration, or repair of any building shall be of such strength as to suffer no structural damage when subject to the temporary loads imposed during construction.

#### A 305 PERFORMANCE CRITERIA UNDER TEST

Buildings subject to this Code shall, when submitted to the tests set forth in this section, meet the performance criteria prescribed for each test. Failure to meet the test criteria shall be evidence of noncompliance with this Code.

#### A 305-1 Under Imposed Load

When the assembly reacts by bending under the imposed load, exclusive of impact load, the deflection shall not exceed 1'/360th of the span when the underside is to be plastered, and 1/240th of the span in other cases.

#### A 305-2 Under 1 ½ Times Imposed Load

a----Under  $1\frac{1}{2}$  times the imposed load, exclusive of impact load, the assembly shall sustain the load without structural damage. In testing floor assemblies and assemblies in compression, the  $1\frac{1}{2}$ -times load shall be applied twice.

b----For floor assemblies, the residual deflection from first application of the load shall not exceed 25 per cent of the maximum deflection under load. After the second application of the  $1\frac{1}{2}$ -times load, the total residual deflection shall be not more than 1.1 times the residual deflection resulting from the first application of the load.

c——For assemblies in compression, the residual deformation after the second application of the  $1\frac{1}{2}$ -times load shall not be more than 1.001 times the residual deformation resulting from the first application of the load.

#### A 305-3 Under 2 Times Imposed Load

Under 2 times the imposed load, exclusive of impact load, the assembly shall sustain load without structural failure.

#### A 305-4 Impact Loads

Under an impact load of 60 pounds falling 4 feet on an area 10 inches in diameter applied to the center of the assembly, the assembly shall sustain no structural damage.

#### A 305-5 Racking Loads

Where exterior walls and other partitions react by racking, the racking deformation under and while sustaining the imposed load shall not exceed 1/400th of the height of the wall. Under  $1\frac{1}{2}$  times the load inducing racking there shall be no structural damage, and under 2 times the load inducing racking the assembly shall sustain the load without structural failure.

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#### A 305-6 Transmitted Loads

Fastenings and connections shall be capable of transmitting, without failure, twice the loads borne by them.

#### A 306 SAFETY DURING CONSTRUCTION

During construction reasonable provisions shall be made to protect persons from injury and to permit access to, and use of, utilities including, among others, fire hydrants, fire-alarm boxes, police call boxes, street lights, and manholes. Code Manual——State Building Code Commission Structural Standards – General Requirements – Foundations



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#### AM 301b Foundations

#### 1-General

**Depth**—In all cases, foundations are required to extend to levels of suitable bearing material. Soil bearing values are required to be in accordance with section AM 302-1 *Structural Standards*—Soil Bearing Value, Determination, part 3, page 99. On sloping ground, foundations are required to be of sufficient depth so that erosion of the surrounding ground surface will not permit sliding, slippage, or rotation of foundations, and must conform to the requirements illustrated in section AM 301b Structural Standards—General Requirements—Foundations, part 3, page 15, entitled, "Foundations Adjacent to Sloping Ground: Stepped Footings."

Where subject to frost action, the bottoms of foundations are required to be not less than 3 feet below the adjoining ground surface, except that the enforcement officer may approve lesser foundation depths for one-story accessory frame structures, such as garages and porches, which in his opinion would not be adversely affected by frost action. In localities where frost penetrates more than 3 feet below the ground surface, the enforcement officer may require that foundations subject to frost action be placed at such greater depth as he establishes from frost penetration records as the safe minimum depth therefor.

Foundation Beds—All beds of foundations are required to be level. Where foundations are supported at different levels or at different levels from foundations of adjacent structures, the effect of such differences in levels must be considered in the design. Foundations may not be placed on frozen bearing material.

### 2—Footings

Where Required—Footings are required to be provided under all hollow masonry piers and foundation walls, under columns where column loads are transmitted directly to bearing soil, and wherever elsewhere required to distribute loads to bearing soil.

Footings are not required under concrete or solid masonry piers and foundation walls where the area of the bottom of the wall is sufficient to transmit safely the load to rock or bearing soil, provided a suitable mortar bed is placed under the lowest course of masonry units and any cored holes in the lower three courses of masonry units are filled with mortar. **Design**—Footings are required to be proportioned and designed so as to distribute imposed loads without material differential settlement and in accordance with the allowable unit bearing values of the supporting soils, and without exceeding allowable stresses in the materials of the footings. The full dead load, including the weight of the footings, foundations, and overlying fill, and the design live loads reduced as permitted by the Code, are required to be considered in proportioning and designing footings. Where footings cross pipe trenches or conduits or otherwise lack stable support, they must be reinforced,

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supported and, or proportioned so as to comply with the design criteria of this section. Materials—Footings are required to be of concrete having a minimum compressive strength at 28 days of 2000 psi; or of solid masonry units laid in type A-1, A-2, or B mortar or grout and with any cored holes filled with mortar or grout. Concrete, mortar and other materials are to conform to the requirements therefor in section AM 301b Structural Standards—General Requirements, part 3, beginning on page 17, entitled, "Materials— General" and part 3, page 39, entitled, "Reinforced Concrete."

#### **Concrete Footings**

(a)—Plain Concrete Footings: Depth of plain concrete footings bearing on soil may be not less than 6 inches. The projection of plain concrete footings beyond the line of a foundation wall, pier, chimney, or similar structural element may not exceed one half the footing depth unless reinforcement, to resist bending and shear, is provided.

(b)—Reinforced Concrete Footings: In reinforced concrete footings, a minimum of 6 inches of concrete is required above the reinforcement, and the reinforcement is to be located not less than 3 inches from soil abutting the footing; except that lesser distance above reinforcement may be provided where reinforced sections of footings span over pipes or conduits.

(c)—Pouring: Unless otherwise approved by the enforcement officer, under specified conditions of approval, concrete footings may not be placed in or under water. In no case may water flow through newly placed concrete.

#### Unit Masonry Footings

(a)—Unit masonry footings are required to have a depth at least twice their projection beyond foundation walls, piers, chimneys, or similar structural elements. Maximum offset for such footings, when of brickwork, are required to be  $1\frac{1}{2}$  inches for one course of brickwork and 3 inches for two courses of brickwork; for other unit masonry the offset is required to be 7 inches or less horizontal to 12 inches vertical.

(b)—All unit masonry footings are required to be securely bonded together by alternate stretcher and header courses and are to rest upon full beds of mortar.

### **Protection Against Freezing**

Footings are required to be protected from freezing until the concrete or mortar of the footings has thoroughly set. When normal Portland cement is used, such protection is to be maintained for at least two days after placing. When approved high early strength Portland cement is used, such protection is to be maintained for at least one day after placing.

### 3—Foundation Piers, Piles, and Posts

Buildings may be supported on piers, piles, or posts, provided that:

(a)-When extending above grade line, piers, piles and posts are anchored and braced



at the top by suitable beams, which may also support the superstructure. When supporting masonry, such beams shall be of reinforced concrete or structural steel.

(b)—Hollow masonry piers are suitably capped with not less than 6 inches of solid masonry.

(c)—The above-ground height of piers does not exceed the limits specified in AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 28, paragraph entitled, "Piers," and mortar is of type A-1, A-2, or B, as described in AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 19, paragraph entitled, "Mortar Proportions by Volume." Any portion of such pier which is not laterally supported by soil is to be included in the above-ground height of the pier. (d)—The anchorage of superstructure to foundation piers, piles, or posts is sufficient to safely resist uplift, and the piers, piles, or posts have sufficient cross-sectional area, or are reinforced, to resist tension and bending due to wind loads.

(e)—Wood piles used to support permanent structures are cut off and capped below the mean low water level or lowest ground water level, or are pressure-treated with an approved preservative.

(f)—Wood posts conform to the requirements in section AM 301c Structural Standards— General Requirements—Protection Against Detrimental Conditions, Frost, and Termites, part 3, page 91.

(g)—Structural steel piles have either a protective covering or have additional thickness to combat the effects of corrosion.

For pier-supported buildings without basement or cellar, masonry curtain walls may be used to close the space between the piers, up to the first floor level, provided the provisions of AM 301d Structural Standards—General Requirements—Protection Against Ground Water, part 3, page 97, entitled, "Crawl Spaces," are complied with. Such curtain walls may not be less than  $3\frac{1}{2}$  inches actual thickness and must be ground supported on suitable footings at the level of the bottoms of the foundation piers, or must be supported on suitable corrosion-resistive noncombustible construction located below the level of frost penetration.

## 4—Foundation Walls

### General

Foundation walls are required to conform to applicable provisions included in AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, beginning on page 16. Where single forms are used, concrete may not be poured against frozen ground.

### **Pilasters**

(a)-In 6-Inch Concrete Foundation Walls: Pilasters, cast integrally with the walls and

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not less than 12 inches wide and 2 inches thick, are required to be provided where girders frame into 6-inch concrete walls.

(b)—In 8-Inch Masonry Foundation Walls: Pilasters of solid masonry, or of hollow masonry filled with mortar or concrete, well bonded into the wall and not less than 12 inches wide and 4 inches thick, are required to be provided where girders, whose clear span exceeds 12 feet, frame into 8-inch masonry walls of dwellings two or more stories in height.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

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#### AM 301b Masonry Construction

#### Materials—General

Unless otherwise indicated in this Manual, masonry materials are required to conform to standards and requirements as herein set forth. For complete title and date of issue of standards, see AM appendix A.

#### Brick

Brick and other solid clay or shale masonry units—ASTM, Standard Specifications for Building Brick (Solid Masonry Units Made From Clay or Shale).

Sand-lime brick—ASTM, Standard Specifications for Sand-Lime Building Brick.

Concrete brick—ASTM, Standard Specifications for Concrete Building Brick.

Clay, shale, or sand-lime brick in contact with soil where subject to frost action must conform to the requirements of grade SW brick as referred to in the ASTM standards above; where subject to action of weather, or in contact with soil where not subject to frost action, must conform to the requirements of grade MW brick in the ASTM standards above; where not subject to action of weather, or frost action, and not in contact with soil, must conform to the requirements of grade NW brick in the ASTM standards above; except that grade MW brick having a satisfactory local record of resistance to frost action when in contact with soil may be used where grade SW brick is required above.

## Structural Clay Tile: and Hollow Clay or Shale Masonry Units

Where subject to action of weather or soil—ASTM, Standard Specifications for Structural Clay Load-Bearing Wall Tile, grade LBX.

Load-bearing, where not subject to action of weather or soil—ASTM, Standard Specifications for Structural Clay Load-Bearing Wall Tile, grade LB or grade LBX.

Non-load-bearing, where not subject to action of weather or soil—ASTM, Standard Specifications for Structural Clay Non-Load-Bearing Tile.

### **Concrete Masonry Units**

Hollow units in load-bearing masonry subject to action of weather or soil—ASTM, Standard Specifications for Hollow Load-Bearing Concrete Masonry Units, grade A.

Hollow units in non-load-bearing masonry not subject to action of weather or soil—ASTM, Standard Specifications for Hollow Non-Load-Bearing Concrete Masonry Units.

Solid load-bearing units—ASTM, Standard Specifications for Solid Load-Bearing Concrete Masonry Units.

### **Cast Stone**

ACI, Specification for Cast Stone.



#### **Natural Stone**

Stone is required to be sound and free from loose or friable inclusions, and must have sufficient strength, durability, and resistance to impact for the intended use.

#### **Gypsum Partition Tile or Block**

ASTM, Standard Specifications for Gypsum Partition Tile or Block. Gypsum partition tile or block may not be used for bearing walls, nor where exposed to continuous dampness.

#### **Cementitious Materials**

Gypsum—ASTM, Standard Specifications for Gypsum.

Hydrated lime—ASTM, Standard Specifications for Hydrated Lime for Masonry Purposes. Hydraulic hydrated lime—ASTM, Standard Specifications for Hydraulic Hydrated Lime for Structural Purposes.

Quicklime—ASTM, Standard Specifications for Quicklime for Structural Purposes.

Masonry cement-ASTM, Standard Specifications for Masonry Cement.

Natural cement—ASTM, Tentative Specifications for Natural Cement.

Portland cement-ASTM, Standard Specifications for Portland Cement.

Air-entraining Portland cement—ASTM, Tentative Specifications for Air-Entraining Portland Cement.

Portland blast furnace slag cement—ASTM, Tentative Specifications for Portland Blast Furnace Slag Cement.

### Aggregates

Aggregate for mortar—ASTM, Standard Specifications for Aggregate for Masonry Mortar. Aggregate for concrete—ASTM, Standard Specifications for Concrete Aggregates; or ASTM, Standard Specifications for Lightweight Aggregates for Concrete. For concrete not exposed to the weather, the enforcement officer may approve other aggregates shown to be satisfactory for the intended purpose by test or experience.

#### Concrete

Maximum size of aggregate and ratio of aggregate to cement are required to be such as to produce a mixture which will work readily into the corners and angles of the forms without segregation of materials and without flow of excess free water to the surface.

### Materials in Combination

#### 1---General

(a)—Materials used in masonry are required to be of good quality conforming to generally accepted practice, and must be durable under the conditions of use. Materials exposed to the weather or to the action of soil are required to be resistant thereto.



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(b)—Materials which meet the applicable requirements of the standards specified in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, beginning on page 17, entitled, "Materials—General," are acceptable.

(c)—Secondhand materials may be used only when they conform to the requirements of those standards and have been thoroughly cleaned.

#### 2—Nominal Dimensions

Except as otherwise indicated, dimensions of masonry and masonry units given in this standard are nominal dimensions which may vary from actual dimensions up to  $\frac{1}{2}$  inch.

### 3—Cement

Cement used in concrete is required to be Portland cement. Cement used in mortar is required to be Portland cement or masonry cement.

### 4—Water

Water is required to be clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances.

#### 5----Concrete

(a)—Concrete is required to have a minimum compressive strength at 28 days of 2000 psi and shall be either "controlled concrete" or "average concrete."

(b)—"Average concrete" is required to be in the proportions of 1 part Portland cement to not more than 6 parts of combined separate volumes of fine and coarse aggregate, and not more than  $7\frac{1}{2}$  gallons of water per bag of 94 pounds of cement. Surface water carried by the aggregate must be subtracted from the quantity of water specified.

(c)—Where mixes other than that specified in the preceding paragraph are used, the enforcement officer is to require acceptable proof that concrete having a minimum compressive strength at 28 days of 2000 psi is being used.

### 6—Mortar

(a)—For the purpose of this standard, mortar may be classified in accordance with either ASA, Building Code Requirements for Masonry, listed in AM appendix A, or with the following, based on information contained in ASTM, Tentative Specifications for Mortar for Unit Masonry, listed in AM appendix A:

Mortar Proportions by Volume—Aggregate measured in a damp and loose condition is required to be at least  $2\frac{1}{4}$  times but not more than 3 times the sum of the volume of the cementitious materials, including lime, for the following types of mortar:

Type A-1: 1 part Portland cement to  $\frac{1}{4}$  part (minimum and maximum) hydrated lime or lime putty.

Type A-2: 1 part Portland cement to more than  $\frac{1}{4}$  and less than  $\frac{1}{2}$  part hydrated lime or lime putty.



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Type B: 1 part Portland cement to more than  $\frac{1}{2}$  and less than  $\frac{11}{4}$  parts hydrated lime or lime putty; or 1 part cement meeting specifications for type II ASTM, Standard Specifications for Masonry Cement (see AM appendix A).

Type C: 1 part Portland cement to more than  $1\frac{1}{4}$  and less than  $2\frac{1}{2}$  parts hydrated lime or lime putty; or 1 part cement meeting specifications for type I ASTM, Standard Specifications for Masonry Cement (see AM appendix A).

Type D: 1 part Portland cement to more than  $2\frac{1}{4}$  and less than 4 parts hydrated lime or lime putty.

The commonly used 1:3 cement mortar, with admixture of only sufficient lime or other plasticizing agent approved by the enforcement officer for workability, would be a type A-1, or a type A-2 mortar, depending upon the quantity of added lime. A  $1:\frac{1}{4}:3$  mix would be a type A-1 mortar, and a  $1:\frac{1}{2}:4$  mix a type A-2 mortar. The frequently used 1:1:6 mix is a type B mortar.

(b)—Mortar of other ingredients or proportions proposed for use under this standard is required to be classified according to strength and is to have a flow after suction for 1 minute of not less than 70 per cent of that immediately before suction. Laboratory tests for flow after suction are required to be made with cementitious materials and aggregates (and admixture, if any) representative of the materials to be used in the construction, and samples are to be made, stored and tested in accordance with the water retention test described in ASTM, Standard Specifications for Masonry Cement, listed in AM appendix A.

(c)—When classified by test, mortar types are required to show the following minimum strengths:

Mortar type	Minimum compressive strength of 2-inch cubes at 28 days (in psi)
Ā-1	2500
A-2	1800
B	750
<b>C</b>	350
D	150

(d)—In making tests, the weight per cubic foot of the materials in the mortar should be assumed to be:

Material	Weight per cubic foot
Portland cement	94 lb
Masonry cement	Weight printed on bag
Hydrated lime	40 lb
Sand, damp and loose	1 cu ft contains 80 lb of dry sand

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

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#### 7—Grout

(a)—Grout may be substituted for mortar in the inner tiers of solid masonry walls. When such substitution is made, the grout is to correspond in type to the mortar for which substitution is made by the addition of water to produce consistency for pouring without segregating the constituents of the mortar.

(b)—Grout is required to be of type A-1, type A-2, or type B mortar, and shall be known respectively as type A-1, type A-2, and type B grout.

### 8—Grouted Masonry

(a)—The materials used in grouted masonry are required to conform to those required for masonry laid in mortar, except that the masonry units in either the facing or backing, but not necessarily in both, at the time of laying are required to absorb in 24-hour cold immersion an amount of water weighing at least 5 per cent of the dry weight of the unit. (b)—In grouted masonry, the two outer tiers are required to be laid with full bed joints of type A-1, A-2, or B mortar, and with the bed joints filled with sufficient mortar to form dams to retain the grout. All interior joints are to be filled with grout.

(c)—One exterior tier may be built up three courses before grouting, but the other exterior tier may not be built up more than one course above the grouting.

(d)—Grouted vertical joints parallel to the wall faces may not be less than  $\frac{3}{4}$  inch in thickness.

(e)—If work is stopped for one hour or longer, horizontal construction joints are to be formed by stopping the grout  $1\frac{1}{2}$  inches below the top of the exterior tiers.

### Allowable Unit Stresses

### 1—General

When constructed in conformity with applicable requirements of this standard, the allowable unit stresses in masonry are required to be those given in the table of AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 22, entitled, "Allowable Stresses for Masonry Bearing Walls."

### 2-Composite Walls

In composite walls or other structural members composed of different kinds or grades of units or mortar, the allowable unit stress in the masonry may not exceed the allowable stress for the weakest of the combinations of units and mortars of which the member is composed.

#### 3—Grouted Brick Masonry

For grouted brick masonry, the allowable unit stresses may not be more than  $1\frac{1}{2}$  times that allowed for corresponding masonry laid in mortar.



#### 4-Plain Concrete

For plain concrete, the allowable unit stresses may not exceed 25 per cent in compression, nor 3 per cent for tension in extreme fiber in bending, of the compressive strength of the concrete; except that when the ratio of height to thickness of structural members of plain concrete exceeds 10, the percentage for compression is to be reduced proportionately to 19 per cent for a ratio of height to thickness of 22; and except that for cavity walls and hollow walls the allowable unit stresses shall not exceed those contained in the table below.

		e A-1 ortar	Type mo	e A-2 rtar	Type B mortar		Type C mortar		Type D mortar
Type of masonry	Com- pression	Tension or shear	Com- pression	Tension or shear	Com- pression	Tension or shear	Com- pression	Tenslon or shear	Com- pression only
BRICK MASONRY <sup>1</sup> Comp. strength of brick: 8000 psi plus	400 250 175 125	20 20 20 20 20	350 225 160 115	15 15 15 15	300 200 140 100	15 15 15 15	200 150 110 75	10 10 10 10	100 100 75 50
SOLID CONCRETE MASONRY UNITS ASTM Grade A ASTM Grade B	175 125	12 12	150 115	12 12	125 100	12 12	<b>80</b> 60	10 10	•••
HOLLOW MASONRY UNITS	85	122	75	102	70	102	••		
STONE MASONRY         Granite, ashlar.         Limestone, ashlar.         Marble, ashlar.         Sandstone, ashlar.         Cast stone, ashlar.         Rubble stone, coursed bonded.         Rubble stone, random.	800 500 500 400 400 140 100	12 12 12 12 12 12 	700 450 450 350 350 125 85	12 12 12 12 12 12 	640 400 320 320 100 70	12 12 12 12 12 12 12 	500 325 325 250 250 80 50	10 10 10 10 10 10 	400 250 250 160 160 
HOLLOW WALL OR CAVITY WALL <sup>3</sup> Solid masonry units Hollow masonry units Plain concrete: compression, 300 psi; tension or shear, 30 psi	125 60	12 <sup>2</sup> 12 <sup>2</sup>	115 55	10 <sup>2</sup> 10 <sup>2</sup>	100 50	10 <sup>2</sup> 8 <sup>2</sup>	•••		

ALLOWABLE STRESSES FOR MASONRY BEARING WALLS [On Gross Cross-Sectional Area, Except Where Noted] in pounds per square inch

<sup>1</sup> The allowable stresses for brick masonry shall apply to all solid masonry of solid masonry units of clay or shale, or of sand-lime brick or concrete brick, having corresponding strengths when tested in the position taken in the masonry. For increased allowable stress values for grouted brick masonry see AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 21, paragraph entitled, "3—Grouted Brick Masonry."

<sup>a</sup>On net area.

• The inner and outer parts of cavity walls shall be considered as acting independently.



#### **Foundation Walls**

#### 1—Mortar

Mortar used in masonry foundation walls is required to be as follows:

Type of masonry	Mortar type
Solid masonry	A-1, A-2, or B
Hollow masonry 8 inches thick	A-1, or A-2
Hollow masonry 10 inches or more in thickness	A-1, A-2, or B
For masonry other than above	A-1, or A-2

#### 2—Thickness

Masonry foundation walls are required to be of the minimum thicknesses illustrated in section AM 301b Structural Standards-General Requirements-Masonry Construction, part 3, page 29, entitled, "6-Inch and 8-Inch Foundation Walls," part 3, page 30, entitled, "6-Inch Unit Masonry Foundation Walls for Houses Without Basements or Cellars," and part 3, page 31, entitled, "8-Inch and 10-Inch Foundation Walls."

#### Walls Above Grade

#### 1—Mortar

Mortar used in walls above grade is required to be of the types specified in the table in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 24, entitled, "Mortar—Walls Above Grade."

#### 2—Thickness

(a)—Walls above grade are required to be of the minimum thicknesses illustrated in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 32, entitled, "Maximum Height of Above-Grade Walls."

(b)—Except for window-panel backs and permitted chases and recesses, walls may not vary in thickness between their lateral supports. When a change in thickness, due to minimum thickness requirements, occurs between floor levels, the greater thickness is required to be carried up to the higher floor level. 

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 MORTAR – WALLS ABOVE GRADE1

Type of masonry	Mortar type
Solid masonry not less than 12 inches thick and laterally supported at intervals not exceeding 12 times the wall thickness, but not including parapet walls or rubble stone walls	A–1, A-2, B, C, or D
Solid masonry same as above, except either less than 12 inches in thickness or not laterally sup- ported at intervals not exceeding 12 times the wall thickness	A-1, A-2, B, or C
Hollow masonry, load-bearing or exterior	A–1, A–2, or B
Hollow walls or cavity walls	A–1, A–2, or B
Parapet walls; rubble stone walls; isolated piers	A–1, A–2, or B
Structural glass block	A–1, A–2, or B
Masonry other than above	A–1, A–2, or B

<sup>1</sup>Exceptions: Gypsum mortar is required to be used in laying gypsum partition tile and block; and may also be used in laying nonbearing partitions of hollow masonry units. Gypsum mortar must be composed of 1 part gypsum and not more than 3 parts mortar aggregate, by weight. Fire brick is required to be laid in fire clay or other suitable refractory mortar.

### 3—Parapet Walls

Parapet walls may not be higher than 4 times their thickness unless reinforced or laterally supported. Whenever the wall is built of unit masonry, it is to be capped with an approved coping.

#### Bracing

1—Thicknesses of walls in relation to distances between bracing for such walls are to be in the ratios illustrated in section AM 301b Structural Standards—General Requirements— Masonry Construction, part 3, page 33, entitled, "Bracing of Interior and Exterior Masonry Walls."

2—During erection, walls are required to be adequately braced to resist wind and other imposed loads.

#### Bond

#### **1—Solid Brick Bearing Walls**

(a)—Masonry-bonded solid brick bearing walls are required to be bonded so that not less than 16 per cent of the wall surface of each face is composed of full length headers. The distance between adjacent full length headers may not exceed 24 inches either vertically or horizontally.



(b)—Where solid brick walls are constructed to conform in all respects (except for inner space) to the requirements specified for cavity walls, the inner and outer parts of the walls must be bonded together, and metal ties of size, type, and spacing specified for cavity walls may be used.

### 2—Solid Brick Nonbearing Walls

Solid brick nonbearing walls must be bonded as required for bearing walls, or are to be bonded with corrosion-resistant metal ties spaced not farther apart than 24 inches vertically and horizontally.

### 3—Walls of Hollow Masonry Units or Large Solid Masonry Units

These walls are required to be bonded as illustrated in section AM 301b Structural Standards-General Requirements-Masonry Construction, part 3, page 34, entitled, "Bonding Walls of Hollow Masonry Units or Large Solid Masonry Units."

### 4—Stone Walls

(a)—In ashlar masonry, through bond stones uniformly distributed are required to the extent of not less than 10 per cent of the face area.

(b)—Rubble stone masonry 24 inches or less in thickness is required to have bond stones with a maximum spacing of 3 feet vertically and horizontally.

### 5—Faced Walls

(a)—Material used for facing may not be less than 2 inches actual thickness, and in no case less in thickness than 1/12th the height of the unit. Brick facing is required to be bonded to the backing as prescribed for masonry bonded solid brick walls.

(b)—Ashlar facing of either natural or cast stone is required to have at least 20 per cent of the superficial area extending not less than 4 inches into the backing to form bond stones, which are to be uniformly distributed throughout the wall. Every projecting stone, and, except when alternate courses are full bond courses, every stone not a bond stone is required to be anchored securely to the backing with substantial corrosion-resistant metal anchors with a cross-section of not less than 3/16 inch by 1 inch, or its equivalent in crosssectional area. There is to be at least 1 anchor to each stone and not less than 2 anchors for each stone more than 2 feet in length and 3 square feet in superficial area. Facing stones of greater size are to have at least 1 anchor to each 4 square feet of superficial face area.

### 6—Plain Concrete Walls

At openings in concrete walls, reinforcement symmetrically disposed in the thickness of the wall is required to be placed not less than 2 inches and not more than 3 inches above,



and not less than 3 inches nor more than 4 inches below openings, and is to extend not less than 24 inches beyond sides of such openings or be of equivalent developed length with hooks. Such reinforcement is required to consist of one  $\frac{5}{8}$ -inch round bar for each 6 inches or fraction thereof of wall thickness.

### 7-Cavity Walls

Cavity walls are required to be constructed as illustrated in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 35, entitled, "Cavity Wall Construction."

### 8--Hollow Walls

Bonding units in hollow walls are required to be spaced generally as required for masonry bonded solid brick walls, and so as to provide equivalent bond.

### **Masonry Veneers**

### 1—Scope

The provisions of this section apply to masonry veneers on masonry walls and on frame structures.

#### 2—Veneers Not to be Load Bearing

Veneers may not be considered a part of the wall in computing the strength of bearing walls, nor a part of the required thickness of bearing walls. Veneers may not support any vertical load other than the dead load of the veneer above.

### 3—Attachment

(a)—Veneer is required to be attached to backing by masonry or metal ties as illustrated in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 36, entitled, "Exterior Masonry Veneers," and is to be supported in all cases on masonry foundations. In addition, masonry veneer 11/2 inch and thinner, of the nonadhesion type, is required to be supported every 12 feet vertically on noncombustible supports, and when attached to frame construction may not extend more than 20 feet above the finished grade.

(b)—Units of adhesion-type scored-back flat tile or terra cotta, may be cemented to masonry when mortar types A-1, A-2, or B are used.

### 4—Drainage

Weep holes are required to be provided at a maximum spacing of 2 feet 8 inches in the vertical joints at the base of the bottom course and at the base of the course supported on intermediate supports, if any, and flashing or wash similar to the detail for cavity walls is to be installed as illustrated in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 35, entitled, "Cavity Wall Construction."

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#### Miscellaneous Construction Requirements

#### 1-Bonding of Intersecting Walls

Masonry walls are required to be securely anchored or bonded at points where they intersect. Where two bearing walls meet or intersect and the courses are built up together, the intersections are to be bonded by laying at least 50 per cent of the units at the intersection in a true bond.

### 2-Anchoring of Walls to Wood-Framed Floor Construction

Masonry walls are required to be securely anchored to each tier of wood joists or wood beams as illustrated in section AM 301b Structural Standards—General Requirements— Masonry Construction, part 3, page 37, entitled, "Anchoring of Masonry Walls to Wood Floor Construction," and in section AM 301b Structural Standards—General Requirements —Wood Construction, part 3, page 85, entitled, "Roof Framing"; except that anchor may be omitted for first floor joists where the construction is neither hollow wall nor cavity wall. Ends of anchors are to be embedded in solid masonry.

### 3—Chases and Recesses

In 8-Inch Walls: Chases and recesses in walls from 8 inches to 12 inches in thickness may be constructed as illustrated in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 38, entitled, "Chases and Recesses in 8-Inch Masonry Walls."

In 12-Inch Walls: Chases and recesses in walls 12 inches or more in thickness may not be deeper than one third of the wall thickness, and are required to conform to the following limitations: The aggregate area of recesses and chases in any wall may not exceed one fourth of the net area of the face of the wall in any story; chases and recesses may not be cut in hollow walls, cavity walls, or walls of hollow masonry, but where permitted, may be built in; there is required to be at least  $7\frac{3}{4}$  inches of masonry between chases or recesses and the jambs of openings; no horizontal chase may exceed 4 feet in length nor may the horizontal projection of any diagonal chase exceed 4 feet in length; masonry directly over chases or recesses more than 12 inches in width is required to be supported on approved lintels; there may be no chase or recess within the required area of any pier.

### 4—Lintels and Arches

(a)—The masonry above openings is required to be supported by arches or lintels of metal or masonry, plain or reinforced, which are to bear on the wall at each end for not less than 4 inches. Arches and lintels are to be designed to carry the superimposed load without overstress. In arches, provision is to be made to resist lateral thrust.

(b)—All lintels are required to be of sufficient strength to carry the superimposed load without deflection of more than 1/360th of the clear span.



(c)—Segmental masonry arches are to have at least 1-inch rise for each foot of span. (d)—Jack or flat masonry arches 8 inches in depth are to have a minimum horizontal skewback distance of 1 inch for every foot of span, at each end; when 12 inches in depth the minimum horizontal skewback at each end is to be  $1\frac{1}{2}$  inches per foot of span.

### 5—Protection Against Freezing

Masonry is required to be protected against freezing for at least 48 hours after being laid. Unless adequate precautions against freezing are taken, no masonry may be built when the temperature is below  $32^{\circ}$  F. on a rising temperature, or below  $40^{\circ}$  F. on a falling temperature, at the point where the work is in progress. No frozen material may be built upon.

#### 6-Piers

The unsupported height of above-ground piers may not exceed 10 times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers supporting beams or girders, the cellular spaces are required to be filled solidly with concrete or type A-1 or A-2 mortar whenever the unsupported height of the pier exceeds 6 times its least dimension.

### 7—Wetting of Masonry Units

Except when added moisture may freeze, bricks (clay or shale), laid in other than type D mortar, are to be wetted when laid unless their gain in weight resulting from partial immersion flatwise in  $\frac{1}{8}$  inch of water for 1 minute is less than  $\frac{3}{4}$  ounce per 30 square inches of net area.

### 8-Wood Supports Prohibited

Masonry, with the exception of fireplace hearths and bathroom concrete floors, may not be supported on wood girders or other wood construction.

### 9—Existing Walls

(a)—An existing masonry wall may be used in the renewal or extension of a building provided that under the new conditions of use it meets the requirements of this standard. (b)—Structurally sound existing masonry walls, which are of insufficient thickness when increased in height, are required to be strengthened by an addition of the same material not less than 8 inches in thickness laid in type A-1 or A-2 mortar. All linings are to be thoroughly bonded into existing masonry by toothings to assure combined action of wall and lining. Such toothings are to be distributed uniformly throughout the wall and are to aggregate in vertical cross-sectional area not less than 15 per cent of the total vertical area of the lining. Stresses in the masonry under the new conditions may not exceed the allowable stresses prescribed for composite walls in this standard. The foundations and lateral support are to be equivalent to those required for new walls under similar conditions.





Corbeling shall be done with solid units resting on solid units. Top corbel courses shall be header courses of headers not less than 6 inches long. Individual corbels shall project not more than one third the height of the corbel unit.

### FOUNDATION WALLS LESS IN THICKNESS THAN WALLS SUPPORTED

(For supported walls not exceeding in height 9 feet to eave line and 15 feet to gable peak).

**General**—Foundation walls are to be of sufficient strength to resist safely lateral pressures from adjacent earth and to support their vertical loads.

6-inch concrete foundation walls may be used to support 6-inch exterior masonry walls where total height of foundation wall and wall supported does not exceed 17 feet to the eave line and 23 feet to the gable peak; also may be used to support wood framed or light metal framed exterior walls not exceeding in height 12 feet to the eave line and 20 feet to the gable peak. At basements or cellars, the maximum depth below the adjacent grade level of 6-inch concrete foundation walls is to be 4 feet. The concrete is to be vibrated or rodded immediately after placing, to eliminate air pockets and honeycombing.

8-inch foundation walls may be used to a depth not more than 5 feet below adjacent grade level when of solid masonry other than plain concrete; and to a depth not more than 4 feet below adjacent grade level when of hollow masonry: provided that the total height of the foundation wall and the wall supported does not exceed 35 feet. The depths of 4 feet and 5 feet may be increased to 6 feet with the approval of the enforcement officer when he is satisfied that soil conditions warrant such increase.

Rubble stone should not be used for foundation walls.

Thickness in relation to wall supported—Foundation walls may be not less in thickness than walls supported, except that 10-inch, nominal, cavity walls and masonry veneered frame walls, not exceeding in height 9 feet to the eave line and 15 feet to the gable peak, may be supported on 8-inch foundation walls when acceptable provisions are made by corbeling or otherwise to support parts projecting beyond foundation walls.

**Mortar**—The permitted heights, and the depths below adjacent grade level, illustrated on this page, apply to masonry laid in mortars prescribed in this standard.



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# 6-Inch Unit Masonry Foundation Walls for Houses Without Basements or Cellars



6-inch unit masonry foundation walls may be used under the conditions illustrated, provided that the spans of joists are such that the allowable masonry stresses indicated in the table in section AM 301b General Requirements—Masonry Construction, part 3, page 22, entitled, "Allowable Stresses for Masonry Bearing Walls," are not exceeded. For protection of crawl spaces against ground water see section AM 301d General Requirements -Protection Against Ground Water, part 3, beginning on page 95. For ventilation of crawl spaces see illustration in section AM 204 Space Standards—Attics, Crawl Spaces, Flat Roofs, part 2, page 11, entitled, "Ventilation of Crawl Spaces."

Footings need not be required where the area of the bottom of wall is sufficient to transmit safely the load to rock or bearing soil, provided a suitable mortar bed is placed under the lowest course of masonry units and all cored holes in the lower three courses of masonry units are filled with mortar.

Sill is to bear on a minimum 4-inch top course of solid masonry units whose core holes are completely filled with mortar. Finished grade may be not more than 1 foot above or below the level of the ground in the crawl space.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



## 8-Inch and 10-Inch Foundation Walls







IO-IN. SOLID MASONRY FOUNDATION WALLS

IO-IN. HOLLOW MASONRY FOUNDATION WALLS General—Foundation walls are to be of sufficient strength to resist safely lateral pressures from adjacent earth, and to support their vertical loads.

**Mortar**—The permitted heights, and the depths below adjacent grade level, illustrated on this page, apply to masonry laid in mortars prescribed in this standard.

Thickness in relation to wall supported—Foundation walls may be not less in thickness than walls supported, except that 10-inch nominal cavity walls and masonry-veneered frame walls, not exceeding in height 9 feet to the eave line and 15 feet to the gable peak, may be supported on 8-inch foundation walls when acceptable provisions are made by corbeling or otherwise to support parts projecting beyond foundation walls, as illustrated in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 29, entitled, "6-Inch and 8-Inch Foundation Walls."

8-inch foundation walls may be used to a depth not more than 7 feet below adjacent grade level when of solid brick masonry reinforced with at least one  $\frac{3}{6}$ -inch round deformed bar, continuous from footing to top of foundation wall, for each 2 feet of length of the wall, or when of plain concrete; provided that the total height of the foundation wall and the wall supported does not exceed 35 feet.

10-inch foundation walls may be used to a depth not more than 7 feet below adjacent grade level when of solid masonry; and to a depth of not more than 6 feet below adjacent grade level when of hollow masonry.

Rubble stone should not be used for foundation walls.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



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# Maximum Height of Above-Grade Walls



6-INCH WALLS OF SOLID OR HOLLOW MASONRY OR PLAIN CONCRETE



8-INCH WALLS OF SOLID OR HOLLOW MASONRY OR PLAIN CONCRETE



#### Rubble Stone Walls

The permitted heights illustrated on this page do not apply to rubble stone walls. Rubble stone walls may be not less than 16 inches thick.

#### Mortar and Bracing

The permitted heights as determined by considerations of strength, illustrated on this page, apply to masonry laid in mortars and braced at the intervals prescribed in this standard.

#### Cavity Walls and Hollow Walls of Hollow Masonry Units

The maximum height of such walls, braced at intervals prescribed in this standard, is to be determined by considerations of strength, but in no case are the maximum heights prescribed for cavity walls, and hollow walls, of solid masonry units to be exceeded.

### Reinforced Concrete Walls

The maximum height of such walls is to be determined by considerations of strength, designed in conformity with ACI, Building Code Requirements for Reinforced Concrete, listed in appendix A.

CAVITY WALLS AND HOLLOW WALLS OF SOLID MASONRY UNITS



## Bracing of Interior and Exterior Masonry Walls



#### MAXIMUM RATIO OF UNBRACED HEIGHT OR LENGTH (L) TO THICKNESS (T)

Type of masonry	Ratio
Solid masonry (except rubble stone) type A-1, A-2, B, or C mortar. Solid masonry (except rubble stone) type D mortar. Grouted solid masonry (except rubble stone) type A-1, A-2, or B mortar and grout	20 12 22
Hollow walls, type A-1, A-2, or B mortar Cavity walls, type A-1, A-2, or B mortar Plain concrete 2000 psi Rubble stone: coursed and bonded Rubble stone: random	18 141 22 18 14

<sup>1</sup> Based on nominal thickness.

#### Bracing

Except where reinforced brick masonry is used, masonry walls are to be braced, either horizontally or vertically, at such distances that the ratios of distance to wall thickness do not exceed those given in the table.

Bracing may be obtained by cross walls, piers, or buttresses, when the limiting distance is measured horizontally, or by floors or roofs, where the limiting distance is measured vertically.

Sufficient bonding or anchorage is to be provided between the walls and the bracing to resist the design wind load, acting either inwardly or outwardly. Piers, columns, or buttresses relied upon for bracing are to have sufficient strength and stability to transfer the wind force, acting in either direction, to the ground.

When walls are dependent upon floors or roofs for their bracing, provision is to be made in the building to transfer the lateral forces to the ground.



# Bonding Walls of Hollow Masonry Units or Large Solid Masonry Units



Bonding courses at least 50 per cent greater in thickness than units below but lapping less than  $3\frac{1}{2}$  inches



#### Spacing of Bond Units

Where two or more hollow units, or solid units exceeding brick size, are used to make up the thickness of a wall, and the stretcher courses are bonded by bonding courses lapping at least  $3\frac{1}{2}$  inches over the unit below, such bond courses may be spaced up to but not exceeding 34 inches apart. Where the bond courses lap less than  $3\frac{1}{2}$  inches over the unit below, the bond units are to be at least 50 per cent greater in thickness than the units below and are to be spaced at vertical intervals not exceeding 17 inches.

#### Mortar Coverage

Hollow masonry units are to have full mortar coverage of face shells in both the horizontal and vertical joints.

Bonding courses lapping at least 31/2 inches over units below



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



# **Exterior Masonry Veneers**





### Location of Ties

Veneer thicker than 1½ inches-A tie is to be provided for each 300 square inches of wall surface, and ties may not be farther apart than 25 inches horizontally or vertically.

Veneer 1½ inches and thinner-Ties are to be spaced not farther apart than 16 inches horizontally and vertically.

Metal ties are to be of corrosionresistant metal or of metal coated with a noncorroding metal or other approved protective coating.

(W & M gage [Washburn and Moen] is the same gage as United States Steel wire gage.)



#### ANCHOR LOCATIONS



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.
Code Manual—State Building Code Commission Structural Standards – General Requirements – Reinforced Concrete – Stucco – Reinforced Gypsum Concrete



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#### AM 301b Reinforced Concrete

Reinforced concrete construction in conformity with ACI, Building Code Requirements for Reinforced Concrete, listed in AM appendix A, is acceptable under the State Building Construction Code applicable to one- and two-family dwellings as in conformity with generally accepted standards.

#### AM 301b Stucco

Stucco is required to be installed in conformity with ASA, Standard Specifications for Portland Cement Stucco, listed in AM appendix A.

#### AM 301b Reinforced Gypsum Concrete

Gypsum concrete construction in conformity with ASA, Building Code Requirements for Reinforced Gypsum Concrete, listed in AM appendix A as modified herein, is acceptable under the State Building Construction Code applicable to one- and two-family dwellings as in conformity with generally accepted standards.

#### 1—Allowable Stresses

The allowable stresses given in ASA, Building Code Requirements for Reinforced Gypsum Concrete, listed in AM appendix A, are to apply only to the use of gypsum concrete in locations where it will be maintained in a dry state and effectively protected against moisture, including moisture which may accumulate within the gypsum concrete because of differential vapor pressure.

#### 2—Exposure

Gypsum concrete may not be used where exposed directly to the weather or where subject to frequent or continuous wetting, or where exposed to detrimental moisture accumulation within the gypsum concrete, or where exposed so that, for prolonged periods, the temperature on the surface of the gypsum concrete is 250° F. or more. Precautions are required to be taken against saturation and freezing during construction.

3	AM 301b	Code Manual——State Building Code Commission Structural Standards – General Requirements – Steel Joists – Structural Steel
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#### AM 301b Steel Joists

Steel joist construction in conformity with ASA, Building Code Requirements for Steel Joist Construction, listed in AM appendix A, and protected as herein specified, is acceptable under the State Building Construction Code applicable to one- and two-family dwellings as in conformity with generally accepted standards.

#### Protection

Joists exposed to the weather or to unusual or specially corrosive conditions, including installation in crawl spaces, are to be kept protected by painting or the equivalent, so that detrimental corrosion will not occur; when subjected to such exposure or conditions, steel joists of material lighter than 15 U. S. gage may be used only with the approval of the enforcement officer under acceptable assurance of maintenance protection.

#### AM 301b Structural Steel

Structural steel construction in conformity with AISC, Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, listed in AM appendix A, and protected as herein specified, is acceptable under the State Building Construction Code applicable to one- and two-family dwellings as in conformity with generally accepted standards.

#### General

All structural steel is required to be given a shop coat of rust-inhibitive paint and a field coat of protective paint, or equivalent, except that paint or other protection may be omitted from steel inherently rust resistive, and from steel encased in concrete made with noncorrosive aggregates.

#### Members Encased in Exterior Walls

Structural steel encased in exterior walls, with less than 8 inches of solid masonry between the steel and the exterior face of the wall, or encased in walls of hollow masonry units, is to be protected by mortar parging of the steel, or waterproof coating of the steel, or of the exterior of the masonry, or equivalent.



### AM 301b Formed Steel Construction

Formed steel construction designed in conformity with AISI, Light Gage Steel Design Manual, and AISI, Steel Regulations (Bulletin V), insofar as applicable to formed steel construction, listed in AM appendix A, and protected as herein specified, is acceptable under the State Building Construction Code applicable to one- and two-family dwellings as in conformity with generally accepted standards.

#### Protection

1-All light-gage formed steel is required to be protected with an unbroken film of rustinhibitive coating.

2—Load-bearing light-gage formed steel construction is to be protected and maintained against detrimental corrosion which might cause failure of structural elements or assemblies. 3—Whenever load-bearing light-gage formed steel construction is assembled or located so that moisture due to condensation or from other sources may accumulate on or within the assembly in concealed or not easily accessible locations and cause detrimental corrosion, the surface on which moisture may accumulate is to be thoroughly protected against corrosion by a coating of durable paint or noncorrodible metal, or other protective material approved by the enforcement officer.



#### Wood Construction

#### Sizes

1-All wood structural members are required to be of sufficient size and strength and are to be conditioned and used so as to carry their imposed loads safely.

2—Unless otherwise specifically noted, sizes given in this standard are nominal sizes. The actual dimension in inches of dressed lumber may not be less than that given in the following table:



3-Nominal sizes may be shown on drawings.

#### **Grade and Quality**

1—Lumber when graded is required to be graded under rules applicable thereto in NLMA, National Design Specification for Stress-Grade Lumber and Its Fastenings, and ASTM, Tentative Methods for Establishing Structural Grades of Lumber, listed in AM appendix A. Wherever the ability of lumber to resist stresses or sustain loads depends upon its being of a specific grade, acceptable assurance thereof is to be provided, such as grade marking by an agency or person recognized as being competent. Lumber is to be either stress-grade lumber with the allowable stresses set forth in the table in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, pages 46, 47, 48 and 49, entitled, "Working Stresses for Stress-Grade Lumber," or yard lumber. When yard lumber has been graded, it is to be allotted the allowable stresses set forth in the table in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 45, entitled, "Yard Lumber, Allowable Unit Stresses." Where the grade of yard lumber has not been established, such lumber is to be assumed to have the lowest allowable stress accorded to the species, for yard lumber.

2-No lumber of lower grade than that listed in the table in section AM 301b Structural Standards-General Requirements-Wood Construction, part 3, page 45, entitled, "Yard Lumber, Allowable Unit Stresses," and none with a slope of grain in the center half of the length exceeding 1 in 8 may be used for members in bending, such as floor or ceiling joists, roof joists, rafters, beams, or girders.

3-No lumber of obviously unsuitable quality may be used in any construction. All lumber is to be sound and free from rot, decay, and shakes, and other defects which would affect its durability or render it unsafe for the purpose for which it is intended.



4-Framing lumber 2 inches or less in nominal thickness should not have a moisture content of more than 19 per cent.

## Allowable Unit Stresses

#### 1—Normal Loading

For conditions of normal loading, generally applicable to the construction of one- and two-family dwellings, allowable unit stresses are required to be those given in the tables in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, pages 45, 46, 47, 48, and 49, entitled, "Yard Lumber, Allowable Unit Stresses," and "Working Stresses for Stress-Grade Lumber."

#### 2—Short-Time Loading

For short-time loading, including snow, wind, and impact, allowable unit stresses for normal loading, other than the modulus of elasticity, may be increased as follows:

15 per cent for 2 months' duration, as for snow.

25 per cent for 7 days' duration.

33-1/3 per cent for wind.

100 per cent for impact.

Such increases are not cumulative.

#### 3—Long-Time Loading

For members designed to be fully stressed by unusual fixed concentrated loads as described in A 304-1.1a of the Code to the safe maximum for more than 3 years, either continuously or cumulatively, allowable unit stresses for normal loading are required to be reduced 10 per cent.

#### 4—Lumber Alternately Wet and Dry: Lumber Pressure Impregnated

Allowable unit stresses specified in the tables in section AM 301b Structural Standards— General Requirements—Wood Construction, part 3, pages 45, 46, 47, 48, and 49, entitled, "Yard Lumber, Allowable Unit Stresses," and "Working Stresses for Stress-Grade Lumber," apply to lumber used under conditions where it is continuously dry or continuously wet, and to the heartwood of a durable species under varying conditions of use. Where these conditions are not met and other approved protective measures are not taken, and for lumber preservative impregnated under pressure and high temperature, the allowable unit stresses for normal loading are required to be multiplied by the following reduction factors expressed in percentages:



#### Maximum Spans of Joists

The tables in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, pages 50 to 58, entitled, "Maximum Allowable Spans of Joists," give the maximum allowable spans for the species of wood, allowable stress, size of joist surfaced on four sides, spacing of joist, live load, and permissible deflection indicated thereon. The weight of joist has been based on an assumed density of wood of 40 pounds per cubic foot. The spans have been determined for both bending and deflection and the lesser tabulated. Values to the left of the broken line have been determined by deflection considerations.

#### Design and Assembly

In the design, preparation, fabrication, and installation of stress-grade lumber, and of yard lumber as applicable thereto, including the use of connectors and other mechanical devices for fastening, the applicable requirements of the Code will be met by conformity with NLMA, *National Design Specification for Stress-Grade Lumber and Its Fastenings*, listed in AM appendix A.

Code Manual——State Building Code Commission

#### Structural Standards – General Requirements – Wood Construction



3

NOVEMBER 1951

#### YARD LUMBER, ALLOWABLE UNIT STRESSES (In pounds per square inch)

			5	Stress	(psi be	ending	)	Modulus
Species	Rules under which graded	Commercial grade name			Depth			of elasticity
			4″	6″	8″	10″	12″	(in thousands)
Douglas fir, coast region	WCLA	No. 3 framing, joists, plank No. 1 studding, blocking No. 2 studding, blocking	210 850 500	450 850 500	600 850 500	700 850 500	650 850 500	1600 1600 1600
Douglas fir, Rock y Mountain re- gion	WPA	No. 1 dimension (or timbers) No. 2 dimension (or timbers)	650 180	800 400	850 500	950 600	1050 650	1200 1200
Fir, balsam	NELMA	Selected merchantable	1100 550	1000 750	1100 850	1050 850	1150 1000	1000 1000
Fir, white	WPA	No. 1 dimension (or timbers) No. 2 dimension (or timbers)	650 180	800 400	850 500	950 600	1050 650	1100 1100
Hemlock, eastern	NH and HMA	No. 1 common dimension No. 2 common dimension	650 650	800 750	850 750	1050 750	1050 750	1100 1100
Hemlock, western (west coast hemlock)	WCLA	No. 3 framing, joists, plank No. 1 studding, blocking No. 2 studding, blocking	<b>210</b> 750 <b>4</b> 50	450 750 450	600 750 450	700 750 450	650 750 450	1400 1400 1400
Larch, western	WPA	No. 1 dimension (or timbers) No. 2 dimension (or timbers)	<b>850</b> 240	1100 550	1150 700	1300 850	1450 900	1500 1500
Pine, eastern white (northern white pine)	NPMA	No. 1 dimension and timbers	500	650	700	800	850	1000
Pine, western white (Idaho white pine) ponderosa and sugar	WPA	No. 1 dimension (or timbers) No. 2 dimension (or timbers)	500 140	650 300	700 400	800 500	850 550	1000 1000
Pine, red (Nor- way pine)	NH and HMA Also NPMA	No. 1 dimension and timbers	650	800	350	950	1050	1200
Red cedar, west- ern (western red cedar)	WCLA	Select merchantable dimension         No. 1 dimension, plank         No. 2 dimension, plank         No. 3 dimension, plank	900 500 300 140	1000 850 450 300	1100 850 550 400	1100 850 550 500	1150 850 650 450	1000 1000 1000 1000
Spruce, red and white (castern spruce)	NELMA	Selected merchantable	1350 650	1250 900	1350 1050	1300 1050	1400 1200	1200 1200
Spruce, red and white (eastern spruce)	NH and HMA	No. 1 dimension and timbers	650	800	850	950	1050	1200
Spruce, Engel- mann	WPA	No. 1 dimension (or timbers) No. 2 dimension (or timbers)	$\begin{array}{c} 450 \\ 120 \end{array}$	550 250	600 350	650 400	750 450	800 800
Spruce, Sitka	WCLA	Select merchantable dimensionNo. 1 dimension, framingNo. 2 dimension, framingNo. 3 dimension, framing	1100 650 400 180	1250 900 550 400	1350 1050 650 500	1400 1050 700 600	1400 1050 800 550	1200 1209 1200 1200
Tamarack	NH and HMA	No. 1 common dimension	700	850	950	1150	1150	1300

Abbreviations—CRA, California Redwood Association; NELMA, Northeastern Lumber Manufacturers Association; NH and HMA, Northern Hendock and Hardwood Manufacturers Association; NPMA, Northern Pine Manufacturers' Association; WCLA, West Coast Lumbermen's Association; WPA, Western Pine Association.

WORKING STRESSES FOR STRESS-GRADE LUMBER

			Stresses for Joists an [The working st	nd Planks resses be	s FOI s, Bear low are	ns and St e for norr	S-GRADE tringers, Po nal loading	LUM osts ar ; cond	BER Id Tin itions]	nbers			_						دى
						I	Allowable u	nit str	esses i	n <b>pour</b>	nds per	squar	e inch					z	.
	1		2 Rules under which graded	3 Extreme fiber in	4	5(i) Compres- sion per-	6	7 Co sti	mpress ruts) fo	sion pa or ratio	arallel t os of le	to grai ngth-t	n (for o-leas	solid ( t-dime	colum nsion (	ns and (l/d)	solid	OVEMB	AM 30
	Species and comme	ercial grade <sup>1</sup>		bending "f" and tension paralleltc grain <sup>2</sup> "t'	Hori- zontal shear ''H''	pendicu- lar to grain "c⊥"	Modulus of elasticity "E"	l/d 11 or less "c"3	<i>l/</i> d 14	<i>l/</i> d 17	l∕d 20	l/d 23	l/d 26	l∕d 30	<i>l/</i> d 35	l/d 40	<i>l/</i> d50	1951	Ъ
	ASH, WHITE: 2150 f Grade 1900 f Grade 1700 f Grade 1450 f Grade 1300 f Grade 1450 c Grade 1200 c Grade 1075 c Grade	J.&P. J.&P.—B.&S. J.&P.—B.&S. J.&P.—B.&S. B.&S. P.&T. P.&T. P.&T. P.&T.	National Hardwood Lumber Association	2150 1900 1700 1450 1300	145 145 145 120 120	600	1,500,000	1700 1500 1325 1150 1050 1450 1200 1075	1586 1421 1271 1114 1023 1379 1159 1046	1452 1328 1206 1073 991 1295 1111 1012	1224 1170 1097 1003 939 1154 1031 954	932 932 926 892 855 932 904 862	730 730 730 730 731 730 730 730 728	548	403	308	197		
part	BEECH: 2150 f Grade 1900 f Grade 1700 f Grade 1450 f Grade 1550 c Grade 1450 c Grade 1200 c Grade	J.&P J.&PB.&S. J.&PB.&S. J.&PB.&S. P.&T P.&T P.&T	National Hardwood Lumber Association	2150 1900 1700 1450	145 145 145 120	600	1,600,000	1750 1525 1350 1150 1550 1450 1200	1640 1453 1300 1119 1474 1388 1165	1509 1368 1241 1082 1384 1314 1123	1288 1225 1139 1020 1234 1188 1054	995 995 983 922 995 992 943	<b>779</b>	584	430	329	210		Coc
3 page 46	BIRCH: 2150 f Grade 1900 f Grade 1700 f Grade 1450 f Grade 1550 c Grade 1450 c Grade	J.&P. J.&P.—B.&S. J.&P.—B.&S. J.&P.—B.&S. P.&T. P.&T. P.&T. P.&T.	National Hardwood Lumber Association	2150 1900 1700 1450	145 145 145 120	600	1,600,000	1750 1525 1350 1150 1550 1450 1200	1640 1453 1300 1119 1474 1388 1165	1509 1368 1241 1082 1384 1314 1123	1288 1225 1139 1020 1234 1188 1054	995 995 983 922 995 992 943	<b>779</b>	584	430	329	210		le Manual——S Structural : Requireme
	CHESTNUT: 1450 f Grade 1200 f Grade 1075 c Grade	J.&P. J.&P.—B.&S P.&T	National Hardwood Lumber Association	1450 1200	120 120	360	1,000,000	1200 950 1075	1110 905 1009	1003 852 932	823 763 802	<b>}622</b>	486	365	269	205	132		itate Buil Standa nts – V
	CYPRESS, SOUTHERN: 1700 f Grade 1300 f Grade 1450 c Grade 1200 c Grade	J.&P.—B.&S J.&P.—B.&S P.&T P.&T	National Hardwood Lumber Association	1700 1300	145 120 	360	1,200,000	1425 1125 1450 1200	1320 1072 1338 1136	1196 1011 1208 1062	986 907 968 936	<b>}746</b>	583	438	322	247	158		iding Code C rds – Gen Vood Cons
	CYPRESS, TIDE- WATER RED: 1700 f Grade 1300 f Grade 1450 c Grade 1200 c Grade	J.&P.—B.&S J.&P.—B.&S P.&T P.&T	Southern Cypress Manufacturers Association	1700 1300	145 120	360	1,200,000	1425 1125 1450 1200	1320 1072 1338 1136	1196 1011 1208 1062	986 907 986 936	746	583	438	322	247	158		ommission eral truction

	DOUGLAS FIR,																		
	Dense Select Struc-	J.& PB.&S		2150	145	455		1550	1474	1384	1234	995	779						lode
•	tural. <sup>5</sup> Select Structural 1700 f.—Dense No. 1 <sup>5</sup> 1450 f.—No. 1 1100 f.—No. 2 Dense Select Struc- tural. <sup>5</sup>	J.&P.—B.&S J.&P.—B.&S J.&P.—B.&S J.&P. P.&T	West Coast Bureau of Lumber Grades and Inspection	1900 1700 1450 1100	120 145 120 110	415 455 390 390 455	1,600,000	1450 1325 1200 1075 1550	1388 1277 1165 1049 1474	1314 1222 1123 1019 1384	1188 1126 1054 969 1234	992 977 943 889 995	779 779 779 772 772 779	<b>584</b>	430	329	210		Manual Ictural Si Ilirement
	Select Structural Dense No. 1 <sup>5</sup> No. 1.	P.&T P.&T P.&T			  	415 455 390		1450 1400 1200	1388 1344 1165	1314 1278 1123	1188 1165 1054	992 990 943	779 779 779	]					State
	DOUGLAS FIR, INLAND RE- GION:		· ·	9150	145	455	1 600 000	1750	1640	1500	1999	005	770	594	430	320	210		rds - Vood
	Select Structural Common Structural . Select Structural 5 Structural Common Structural .	J.&PB.&S J.&PB.&S J.&P	Western Pine Asso- ciation	1900 1450	145 100 95	400 380 455 400 380	1,500,000 1,500,000 1,600,000 1,500,000 1,500,000	1400 1250 1750 1400 1250	1336 1204 1640 1336 1204	1260 1150 1509 1260 1150	1133 1059 1288 1133 1059	934 915 995 934 915	730 779 730	548 584 548	403 430 403	308 329 308	210 197 210 197		ing Code ( General Construe
Po.	ELM, ROCK :           2150 f Grade           1900 f Grade           1700 f Grade           1450 f Grade           1450 c Grade           1450 c Grade           1200 c Grade	J.&P. J.&P.—B.&S. J.&P.—B.&S. J.&P.—B.&S. P.&T. P.&T. P.&T. P.&T.	National Hardwood Lumber Association	2150 1900 1700 1450	145 145 145 120	600	1,300,000	1750 1525 1350 1150 1550 1450 1200	1582 1415 1273 1103 1434 1354 1146	1384 1284 1184 1047 1296 1243 1082	1069 1064 1031 952 1063 1053 976	808 808 808 804 308 808 808 806	632	475	349	268	170		iommission [ c <b>tion</b>
irt 3 page 4	ELM, SOFT: 1700 f Grade 1450 f Grade 1200 f Grade 1075 c Grade	J.& P. J.& P.—B.& S J.& P.—B.& S P.& T	National Hardwood Lumber Association	1700 1450 1200	120 120 120	300	1,200,000	1225 1050 875 1075	1158 1007 851 1030	1079 958 822 977	946 873 773 887	746 739 697 746	583 583 584 583	<b>438</b>	322	247	158		
7	GUM, BLACK AND RED: 1700 f Grade 1450 f Grade 1200 f Grade 1075 c Grade	J.& P J.& PB.& S J.& PB.& S P.& T	National Hardwood Lumber Association	1700 1450 1200	120 120 120	360	1,200,000	1225 1060 875 1075	1158 1007 851 1030	1079 958 822 977	946 873 773 887	746 739 697 746	583 583 584 583	<b>}</b> 438	322	247	158		
	HEMLOCK, EASTERN: Select Structural Prime Structural Common Structural Utility Structural Select Structural	J.&P.—B.&S J.&P. <sup>s</sup> J.&P. <sup>s</sup> J.&P. <sup>s</sup> P.&T	Northern Hemlock and Hardwood Manufac- turers Association	1300 1200 1100 950	85 60 60 	360	1,100,000	850 775 650 600 850	824 755 638 590 824	792 732 624 580 792	740 691 601 561 740	656 629 563 532 656	535 536 508 488 535	402 402 402 403 402	) 295 ]	226	145	NOVEMBER	AM 30
	HEMLOCK, WEST COAST: 1600 f.—Select Struc- tural	J.&P		1600	100	920	1 400 000	1100	1064	1022	951 027	840	681	)	976	900	104	1951	lb
	1450 f.—No. 1 1100 f.—No. 2 No. 1 Hemlock Tim- bers.	J.&PB.&S J.&P P.&T	West Coast Bureau of Lumber Grades and Inspection	1450 1100	90 	300	1,400,000	850 1075	834 1042	814 1003	937 781 937	634 730 834	654 680	1911	310	288	104		ယ

(See footnotes at end of table).

# WORKING STRESSES FOR STRESS-GRADE LUMBER Stresses for Joists and Planks, Beams and Stringers, Posts and Timbers [The working stresses below are for normal loading conditions]

WORKING STRESSES FOR STRESS-GRADE LUMBER Stresses for Joists and Planks, Beams and Stringers, Posts and Timbers [The working stresses below are for normal loading conditions]														ſ	تى	>			
				<b>-</b>		Allowable u	nit st	resses i	n pou	nds pe	r squai	e inch		<u> </u>			F		
1 Species and comme	rcial grade <sup>1</sup>	2 Rules under which graded	3 Extreme fiber in	4	5(i) Compres- sion per-	6	7 Co str	mpress ruts) fo	sion pa or ratio	arallel os of le	to grai	n (for o-least	solid o dime	column nsion (	ns and (l/d)	solid	NOV	A	
			bending "f" and tension parallelto grain <sup>2</sup> "t"	Hori- zontal shear "H"	pendicu- lar to grain "c⊥"	Modulus of elasticity "E"	l/d 11 or less "c"3	l∕d 14	<i>l/</i> d 17	l∕d 20	l∕d 23	l∕d 26	l∕d 30	l∕d 35	l/d 40	l/d 50	EMBER 195	3016	
LARCH: Select Structural <sup>5</sup> Structural Common Structural Select Structural <sup>5</sup> Structural Common Structural.	J.&P.—B.&S. J.&P.—B.&S. J.&P.—B.&S. P.&T. P.&T. P.&T. P.&T.	Western Pine Associa- tion	2150 1900 1450	145 120 120	455 415 390 455 415 390	1,300,000	1750 1450 1325 1750 1450 1325	1582 1354 1252 1582 1354 1252	1384 1243 1167 1384 1243 1167	1069 1053 1023 1069 1053 1023	808	632	475	349	268	170			
MAPLE, IIARD:           2150 f Grade           1900 f Grade           1700 f Grade           1450 f Grade           1450 c Grade           1450 c Grade           1200 c Grade	J.&P. J.&P.—B.&S. J.&P.—B.&S. J.&P.—B.&S. P.&T. P.&T. P.&T. P.&T.	National Hardwood Lumber Association	2150 1900 1700 1450	145 145 145 120	600	1,600,000	1750 1525 1350 1150 1550 1450 1200	1640 1453 1300 1119 1474 1388 1165	1509 1368 1241 1082 1384 1314 1123	1288 1225 1139 1020 1234 1188 1054	995 995 983 922 995 992 943	779	584	430	329	210			
OAK, RED AND WHITE: 2150 f Grade 1900 f Grade 1700 f Grade 1450 f Grade 1300 f Grade 1325 c Grade 1200 c Grade 1075 c Grade	J.&P. J.&P.—B.&S. J.&P.—B.&S. J.&P.—B.&S. B.&S. P.&T. P.&T. P.&T. P.&T.	National Hardwood Lumber Association	2150 1900 1700 1450 1300	145 145 145 120 120	600	1,500,000	1550 1375 1200 1050 950 1325 1200 1075	1463 1315 1159 1023 930 1271 1159 1046	1362 1243 1111 991 906 1206 1111 1012	1190 1122 1031 939 866 1097 1031 954	932 932 904 855 804 926 904 862	730 730 731 712 730 730 730 728	548	403	308	197		Structu Require	Code Manual–
PINE, NORWAY: Prime Structural Common Structural Utility Structural	J.&P. <sup>8</sup> J.&P. <sup>8</sup> J.&P. <sup>8</sup>	Northern Hemlock and Hardwood Manufac- turers Association	1200 1100 950	75 75 75	360	1,200,000	900 775 650	874 758 640	842 738 628	790 704 608	707 650 577	583 572 531	438 438 439	322	247	158		ral Star ments	State
PINE, SOUTHERN: Dense Select Struc- tural. <sup>5</sup> Dense Structural <sup>5</sup> Dense Structural S.E.&S. <sup>5</sup> Dense No. 1 Struc- tural. <sup>5</sup> No. 1 Dense 1400F <sup>9-5</sup> No. 1 Dense <sup>5</sup> No. 1 Dense <sup>5</sup> No. 2 Dense <sup>5</sup> Dense Select Struc-	J.&P.—B.&S J.&P.—B.&S J.&P.—B.&S J.&P.—B.&S J.&P.—B.&S J.&P.B.&S J.&P. <sup>8</sup> J.&P. <sup>8</sup> J.&P. <sup>9</sup> J.&P. <sup>9</sup> J.&P. <sup>9</sup> J.&P. <sup>9</sup>	Southern Pine Inspec- tion Bureau	2400 2000 1800 1600 1400 1200 1700 1450 1250 1100	120 <sup>7</sup> 120 <sup>7</sup> 120 <sup>7</sup> 120 <sup>7</sup> 120 120 150 125 100 85	455 455 455 455 390 455 390 455 390 455 390	1,600,000	1750 1400 1300 1150 1400 1200 1400 1200 1025 875 1750	1640 1344 1255 1119 1344 1165 1344 1165 1003 861 1640	1509 1278 1202 1082 1278 1123 1278 1123 977 845 1509	1288 1165 1112 1020 1165 1054 1165 1054 934 817 1288	995 990 971 922 990 943 990 943 865 774 995	779 779 779 779 779 779 779 779 779 764 711 779	584	430	329	210		ıdards – General – Wood Construction	Building Code Commission

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Dense Structural <sup>5</sup>	$[P.\&T.\dots]$				455		1400	1344	1278	1165	990	779	1	ł	1			[	
S.E.&S.5	Ρ.αΙ		•••••	••••	455		1300	1255	1202	1112	971	779						<b>A</b>	St Co
Dense No. 1 Struc- tural. <sup>5</sup>	Р.&Т		•••••	• • • • • •	455		1150	1119	1082	1020	922	779						q	de
No. 1 Dense 1400F <sup>9-5</sup> No. 1 1200F <sup>9</sup>	P.&T P.&T		1400 1200	140 120	455 390		1400 1200	1344 <sup>•</sup> ) 1165	1278 1123	1165 105 <b>4</b>	990 943	779 779						lire	Man; ctur
PINE, SOUTHERN LONGLEAF:																		mei	al
Select Structural	J.&PB.&S		2400	120 7			1750	1640	1509	1288	995	779	)					Its	Sta
Prime Structural Longleaf. <sup>5-6</sup>	J.&P.—B.&S		2000	1207			1400	1344	1278	1165	990	779						I	Stat
Merchantable Struc- tural Longleaf <sup>5-6</sup>	J.&P.—B.&S		1800	120 7			1300	1255	1202	1112	971	779						W	e E
Structural S.E.&S. Longleaf. <sup>5</sup>	J.&P.—B.&S		1800	120 7			1300	1255	1202	1112	971	779						bod	Build Is -
No. 1 Structural	J.&P.—B.&S		1600	120 7	455	1,600,000	1150	1119	1082	1020	922	779						<b>O</b>	
No. J Longleaf 1400F. <sup>9-5</sup>	J.&P.—B.&S		1400	140	455		1400	1344	1278	1165	990	779						DINS	g Co
No. 1 Longleaf <sup>5</sup> No. 2 Longleaf <sup>5</sup>	J.&P. <sup>8</sup>	Southern Pine Inspec-	1700	150			1400	1344	1278	1165	990	779	584	430	329	210			de
Select Structural	P.&T	tion Dureau					1025 1750	$\frac{1003}{1640}$	977 1509	934 1288	865 995	764 779						ieti	
Prime Structural	Р.&Т						1400	1344	1278	1165	990	779						ion	mmi
Merchantable Struc-	Р.&Т						1300	1255	1202	1112	971	779							ssio
Structural S.E.&S.	Р.&Т			:			1300	1255	1202	1112	971	779							ä
No. 1 Structural	Р.&Т						1150	1119	1082	1020	922	779	J						
No. 1 Longleaf	Р.&Т		1400	140	455		1400	1344	1278	1165	990	779							
POPLAR, YELLOW: 1500 f Grade	J.&P.		1500	110			1200	1126	1038	880	684	,							
1250 f Grade 1075 c Grade	J.&PB.&S. P.&T.	National Hardwood	1250	iiŏ	300	1,100,000	950	913	869	794	678	535	402	295	226	145			
					<b></b>		1075		950	051	004	) 							
Dense Structural <sup>5</sup>	J.&PB.&S		1700	110			1450	1338	1208	986	)								
Dense Structural	J.&PB.&S   P.&T	Association	1300	95 	320	1,200,000	1100 1450	1051 1338	994 1208	897 986	746	583	438	322	247	158			
Heart Structural	P.&T		· · · · · · · · ·				1100	1051	994	897	j						z	1	
SPRUCE, EASTERN: 1450 f Structural	JSP	Northeastern Lumber	1450	110			1050	1007	05.0	070	720						DVE		2
Grade.	L&D	Manufacturers Asso-	1400	110	000	1 000 000	1030	1007	958	013	(39						M		3
Grade.		ciation, inc.	1300	95	300	1,200,000	975	941	901	833	726	583	438	322	247	158	2		301
<b>J200</b> f Structu <b>ral</b> Grade.	J.&P		1200	95			900	874	842	790	707						136		5
												, <u> </u>	•				- 1		1

<sup>4</sup> Abbreviations: J.&P., joists and planks; B.&S., beams and stringers; P.&T., posts and timbers; S.E.&S., square edge and sound. <sup>5</sup> When graded in accordance with par, 310 of Mise, Pub. 185, U. S. Dept. of Agr. <sup>3</sup> When graded according to par. 310 of Mise, Pub. 185, U. S. Dept. of Agr. and when the l/d ratio is 11 or less. <sup>4</sup> According to 1948 Standard Grading Rules, including Supplement No. 1. <sup>5</sup> These grades meet the require-

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ments for density. <sup>6</sup> These grades are based on requirements for heartwood. <sup>7</sup> The grading rules provide a basis for obtaining higher shearing stresses of 140, 160 and 180 pounds per square inch when specified. <sup>8</sup> These grades are applicable to 2-inch thickness only. <sup>9</sup> These grades are applicable only in sizes 3 inches and thicker.

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(From supplement No. 1, 1950, NLMA, Wood Structural Design Data, volume 1, 1948, as listed in AM appendix A).

Т	ABLE 1.— Maximum	MAXIMUM / DOUGLAS I Dressed lu Supp deflection =	ALLOWABL FIR, COAST Imber surface porting ceilir = $\frac{1}{360}$ x span	E SPANS O REGION ed 4 sides <sup>1g</sup> , by live loa	F JOISTS: nd 40 psf		ABLE 2.— Maximum	MAXIMUM A DOUGLAS I Dressed In Not su deflection =	ALLOWABLI FIR, COAST imber surface inporting ceil $\frac{1}{240}$ x span,	E SPANS O REGION ed 4 sides ling , by live loa	F JOISTS: nd 40 psf	-	دىت
		Stre	ess-grade lum	ıber	Yard lumber			Stre	ess-grade lum	be <b>r</b>	Yard lumber	NOVE	AM
Nominal size in inches	Spacing in inches c. to c.	Select structural 1900 f.	No. 1 1450 f.	No. 2 1100 f.	WCLA graded No. 3 6" 450 psi 8" 600 psi 10" 700 psi 12" 650 psi	Nominal size in inches	Spacing in inches c. to c.	Select structural 1900 f.	No. 1 1450 f.	No. 2 1100 f.	WCLA graded No. 3 6" 450 psi 8" 600 psi 10" 700 psi 12" 650 psi	MBER 1951	301b
2x6	12 16 20 24	11'-3" 10 -2 9 -6 8 -11	11'-3" 10 -2 9 -4 8 -7	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6'-8" 5 -9 5 -3 4 -9	2x6	12 16 20 24	12'-11" 11 -8 10 -10 10 -3	12'-11" 11 -5 10 -4 9 -6	11'-5" 10 -0 9 -0 8 -3	7'-4" 6 -4 5 -9 5- 3	-	
2x8	12 16 20 24	15 -0 13 -8 12 -8 11 -11	15 -0 13 -8 12 -4 11 -5	13 -10 12 -0 10 -9 10 -0	10 -1 8 -10 7 -11 7 -3	2x8	12 16 20 24	$     \begin{array}{r}       17 - 1 \\       15 - 7 \\       14 - 6 \\       13 - 7     \end{array} $	17 -1 15 -2 13 -7 12 -7	15 -2 13 -4 11 -10 10 -10	11 -2 9 -10 8 -9 8 -1	_	Code Ma Stri Rec
3x8	12 16 20 24	$     \begin{array}{r}       17 - 8 \\       16 - 0 \\       14 - 11 \\       14 - 0     \end{array} $	17 -8 16 -0 14 -11 14 -0	17 -3 15 -1 13 -7 12 -7	12 -9 11 -2 10 -1 9 -2	3x8	12 16 20 24	20 -2 18 -4 17 -1 16 -0	20 -2 18 -4 17 -1 15 -9	19 -0 16 -8 14 -11 13 -9	14 -0 12 -3 11 -1 10 -2	_	<sup>nual</sup> ——St uctural S <b>Juiremen</b>
2x10	12 16 20 24	19 -0 17 -3 16 -1 15 -1	19 -0 17 -3 15 -7 14 -1	17 - 4 15 - 1 13 - 7 12 - 6	13 -10 12 -1 10 -10 10 -0	2x10	12 16 20 24	21 -8 19 -9 18 -5 17 -3	21 -8 19 -2 17 - 4 15 -10	<b>19 -0</b> <b>16 -8</b> <b>15 -0</b> <b>13 -9</b>	15 -1 13 -3 12 -0 11 -0	_	ate Buildin t <b>andards</b> ts – Woo
3x10	12 16 20 24	22 -4 20 -3 18 -10 17 -9	22 -4 20 -3 18 -10 17 -9	21 -7 18 -11 17 -1 15 -9	17 -2 15 -1 13 -7 12 -6	3x10	12 16 20 24	25 -6 23 -2 21 -6 20 -3	256 23 -2 21 -6 19 -10	23 -7 20 -9 18 -9 17 -3	18 -9 16 -6 15 -0 13 -9	_	g Code Cor - Gener d Constr
2x12	12 16 20 24	23 -0 20 -10 19 -5 18 -3	23 -0 20 -10 18 -11 17 -4	20 -10 18 -3 16 -4 15 -1	16 -0 140 12 -7 11 -7	2x12	12 16 20 24	26 -3 23 -11 22 -2 21 -0	26 -3 23 -1 20 -10 19 -0	22 -11 20 -1 18 -0 16 -6	17 -6 15 -4 13 -11 12 -8		nmission 'al 'uction

TABLE Maxin	3.—MAXI DOU Dru mum defle	$\begin{array}{r} \text{MUM AL}\\ \text{JGLAS FIF}\\ \text{essed lumbor}\\ \text{Suppor}\\ \text{ection } = \frac{1}{36} \end{array}$	LOWABLE R, COAST er surfaced tting ceilin 	E SPANS REGION 4 sides g by live l	OF JOISTS: oad 30 psf	TABLE 4.	.—MAXIN Maxir	IUM ALLO Dres	WABLE SP ssed lumber Supportin tion $= \frac{1}{360}$	ANS OF JC surfaced 4 s ng ceiling - x span, by	DISTS: HEM ides y live load	40 psf		Code M Struct Requi
		Stres	s-grade lur	nber	Yard lumber				Stress-gra	de lumber		Yard lumber		anual ural reme
Nominal size in inches	Spacing in inches c. to c.	Select structural 1900 f.	No. 1 1450 f.	No. 2 1100 f.	WCLA graded No. 3 6" 450 psi 8" 600 psi 10" 700 psi 12" 650 psi	Nominal size in inches	in inches c. to c.	Select structural 1300 psi	Prime structural 1200 psi	Common structural 1100 psi	Utility structural 950 psi	NH&HMA graded No. 2 common dimension 750 psi		Standards Standards ents – Woo
2x6	12 16 20 24	12'-5" 11 -2 10 -5 9 -10	12'-5" 11 -2 10 -4 9 -6	11'-5" 10 -0 9 -0 8 -3	7'-4" 6-4 5-9 5-3	2x6	12 16 20 24	9'-11" 9 -0 8 -5 7 -11	9'-11" 9 -0 8 -5 7 -10	9'-11" 9 -0 8 -2 7 -5	9'-8" 8 -5 7 -7 6 -11	8'-7" 7 -6 6 -9 6 -2		lding Code – Gener d Constr
2x8	12 16 20 24	16 -5 15 -0 13 -11 13 -1	$   \begin{array}{r}     16 -5 \\     15 -0 \\     13 -7 \\     12 -7   \end{array} $	15 -2 13 -4 11 -10 10 -10	11 -2 9 -10 8 -9 8 -1	2x8	12 16 20 24	13 -3 12 -1 11 -2 10 -6	13 -3 12 -1 11 -2 10 -4	13 -3 12 -0 10 -9 10 -0	12 -10 11 -2 10 -1 9 -2	11 -5 9 -11 8 -11 8 -2		Commissic al uction
3x8	12 16 20 24	<b>19 -4</b> 17 -7 16 -5 15 -4	19 -4 17 -7 16 -5 15 -4	19 -0 16 -8 14 -11 13 -9	14 -0 12 -3 11 -1 10 -2	3x8	12 16 20 24	15 -6 14 -2 13 -1 12 -4	15 -6 14 -2 13 -1 12 -4	15 -6 14 -2 13 -1 12 -4	15 -6 14 -1 12 -7 11 -8	14 -3 12 -6 11 -3 10 -4		ă
2x10	12 16 20 24	20 -10 19 -0 17 -8 16 -7	20 -10 19 -0 17 -4 15 -10	19 -0 16 -8 15 -0 13 -9	15 -1 13 -3 12 -0 11 -0	2x10	12 16 20 24	16 -10 15 -3 14 -2 13 -4	16 -10 15 -3 14 -2 13 -1	16 -10 15 -1 13 -7 12 -6	16 -1 14 -2 12 -8 11 -8	14 -4 12 -6 11 -3 10 -4	 z	
3x10	12 16 20 24	24 -6 22 -3 20 -8 19 -5	246 223 208 195	23 -7 20 -9 18 -9 17 -3	18 -9 16 -6 15 -0 13 -9	3x10	12 16 20 24	19 -8 17 -10 16 -7 15 -7	19 -8 17 -10 16 -7 15 -7	19 -8 17 -10 16 -7 15 -7	19 -8 17 -8 15 -10 14 -5	17 -10 15 -7 14 -2 13 -0	OVEMBER 195	AM 3011
2x12	12 16 20 24	25 -3 23 -0 21 -4 20 -1	25 -3 23 -0 20 -10 19 -0	22 -11 20 -1 18 -0 16 -6	17 -6 15 -4 13 -11 12 -8	2x12	12 16 20 24	20 -4 18 -6 17 -2 16 -1	20 -4 18 -6 17 -1 15 -9	20 -4 18 -3 16 -4 15 -1	19 -5 17 -0 15 -4 14 -0	17 -3 15 -1 13 -7 12 -5	1	
						-		 	<u> </u>	<u> </u>	<u> </u>			l



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## TABLE 5.—MAXIMUM ALLOWABLE SPANS OF JOISTS: HEMLOCK, EASTERN Dressed lumber surfaced 4 sides Not supporting ceiling

Maximum deflection  $=\frac{1}{240}$  x span, by live load 40 psf

Nominal	Spacing		Stress-grad	de lumber		Yard lumber
size in inches	in inches c. to c.	Select structural 1300 psi	Prime structural 1200 psi	Common structural 1100 psi	Utility structural 950 psi	NH&HMA graded No. 2 common dimension 750 psi
2x6	12 16 20 24	11'-4" 10 -4 9 -8 9 -0	11'-4" 10 -4 9 -5 8 -7	11'-4" 10 -0 9 -0 8 -3	10'-8" 9 -4 8 -4 7 -8	9'-6" 8 -3 7 -5 6 - 10
2x8	12 16 20 24	$15 -2 \\ 13 -10 \\ 12 -9 \\ 12 -0$	15 -2 13 -10 12 -5 11 -6	15 -2 13 -4 11 -10 10 -10	14 -1 12 -5 11 -0 10 -1	12 -6 11 -0 9 -9 8 -11
3x8	12 16 20 24	$     \begin{array}{r}       17 -9 \\       16 -3 \\       15 -0 \\       14 -2     \end{array} $	17 -9 16 -3 15 -0 14 -2	17 -9 16 -3 14 -11 13 -9	17 -7 15 -5 13 -10 12 -9	15 -8 13 -9 12 -4 11 -4
2x10	12 16 20 24	19 -1 17 -6 16 -3 14 -11	19 -1 17 -5 15 -8 14 -5	19 -0 16 -8 15 -0 13 -9	$17 -9 \\ 15 -6 \\ 14 -0 \\ 12 -9$	15 -8 13 -9 12 -4 11 -4
3x10	12 16 20 24	22 -6 20 -5 19 -0 17 -10	22 -6 20 -5 19 -0 17 -10	$ \begin{array}{r} 22 - 6 \\ 20 - 5 \\ \hline 18 - 9 \\ 17 - 3 \end{array} $	$22 - 0 \\ 19 - 4 \\ 17 - 6 \\ 16 - 0$	19 -6 17 -1 15 -6 14 -3
2x12	12 16 20 24	$ \begin{array}{r}     23 -4 \\     21 -2 \\     19 -8 \\     \overline{18 - 0} \end{array} $	23 -4 21 -0 18 -11 17 -3	22 -11 20 -1 18 -0 16 -6	21 -4 18 -8 16 -9 15 -4	18 -11 16 -7 14 -10 13 -7



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#### TABLE 6.—MAXIMUM ALLOWABLE SPANS OF JOISTS: HEMLOCK, EASTERN Dressed lumber surfaced 4 sides Supporting ceiling

Maximum deflection  $=\frac{1}{360}$  x span, by live load 30 psf

Nominal	Specing		Stress-grad	le lumber		Yard lumber
in inches	in inches c. to c.	Select structural 1300 psi	Prime structural 1200 psi	Common structural 1100 psi	Utility structural 950 psi	NH&HMA graded No. 2 common dimension 750 psi
2x6	12	10'-11"	10'-11"	10'-11"	10'-8"	9'-6"
	16	9 -11	9 -11	9 -11	9 -4	8 -3
	20	9 -3	9 -3	9 -0	8 -4	7 -5
	24	8 -8	8 -7	8 -3	7 -8	6 -10
2x8	12	14 -6	14 -6	14 -6	14 -1	12 -6
	16	13 -3	13 -3	13 -3	12 -5	11 -0
	20	12 -3	12 -3	11 -10	11 -0	9 -9
	24	11 -6	11 -6	10 -10	10 -1	8 -11
3x8	12	17 -0	17 -0	17 -0	17 -0	15 -8
	16	15 -7	15 -7	15 -7	15 -5	13 -9
	20	14 -6	14 -6	14 -6	13 -10	12 - 4
	24	13 -7	13 -7	13 -7	12 -9	11 - 4
2x10	12	18 -6	18 -6	18 - 6	17 -9	15 -8
	16	16 -9	16 -9	16 - 8	15 -6	13 -9
	20	15 -7	15 -7	15 - 0	14 -0	12 - 4
	24	14 -7	14 -5	13 - 9	12 -9	11 -4
3x10	12	21 -7	21 -7	21 -7	21 -7	19 -6
	16	19 -7	19 -7	19 -7	19 -4	17 -1
	20	18 -2	18 -2	18 -2	17 -6	15 -6
	24	17 -1	17 -1	17 -1	16 -0	14 -3
2x12	12 16 20 24	22 -4 20 -1 18 -10 17 -8	22 -4 20 -4 18 -10 17 -3	22 -4 20 -1 18 -0 16 -6	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	18 -11 16 7 14 -10 13 -7



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## TABLE 7.—MAXIMUM ALLOWABLE SPANS OF JOISTS: PINE, SOUTHERN (S); PINE, SOUTHERN LONGLEAF (LL) Dressed lumber surfaced 4 sides Supporting ceiling

Maximum deflection  $=\frac{1}{360}$  x span, by live load 40 psf

				Str	ess-grade lum	ber		
Nominal size in inches	in inches c. to c.	Dense structural (S) and merchantable structural (LL)	No. 1 dense (S) and No. 1 (LL)	No. 1 dense structural (S) and No. 1 structural (LL)	No. 1 dense 1400 F (S) and No. 1 1400 F (LL)	No. 2 dense (S) and No. 2 (LL)	No. 1 1200 F (S)	No. 2 (S)
		1800 psi	1700 psi	1600 psi	. <u> </u>	1250 psi		1100 psi
2x6	12 16 20 24	11'-3" 10 -2 9 -6 8 -11	11'-3" 10 -2 9 -6 8 -11	11'-3" 10 -2 9 -6 8 -11	11'-3" 10 -2 9 -2 8 -5	11'-2" 9 -8 8 -8 7 -11	10'-11" 9 -5 8 -6 7 -10	10'-5" 9 -2 8 -2 7 -5
2x8	12 16 20 24	15 -0 13 -8 12 -8 11 -11	15 -0 13 -8 12 -8 11 -11	15 -0 13 -8 12 -8 11 -11	- 15 -0 13 -8 12 -2 11 -2	149 129 115 106	14 -5 12 -6 11 -3 10 -4	13 -10 12 -0 10 -9 10 -0
3x8	12 16 20 24	17 -8 16 -0 14 -11 14 -0	17 -8 16 -0 14 -11 14 -0	17 -8     16 -0     14 -11     14 -0	17 -8 16 -0 14 -11 14 -0	$     \begin{array}{r}       17 -8 \\       16 -0 \\       14 -6 \\       13 -4     \end{array} $	17 -8 15 -9 14 -4 13 -1	17 -3 15 -1 13 -7 12 -7
2×10	12 16 20 24	19 -0 17 -3 16 -1 15 -1	19 -0 17 -3 16 -1 15 -1	19 -0 17 -3 16 -1 15 -1	19 -0 17 -3 15 -4 14 -1	18 -6     16 -2     14 -7     13 -4	18 -1 15 -10 14 -3 13 -1	17 -4 15 -1 13 -7 12 -6
3x10	12 16 20 24	22 -4 20 · 3 18 -10 17 -9	22 -4 20 -3 18 -10 17 -9	22 -4 20 -3 18 -10 17 -9	22 -4 20 -3 18 -10 17 -9	22 -4 20 -3 18 -3 16 -9	22 -4 19 -10 17 -10 16 -5	21 -7 18 -11 17 -1 15 -9
2x12	12 16 20 24	23 -0 20 -10 19 -5 18 -3	23 -0 20 -10 19 -5 18 -3	23 -0 20 -10 19 -5 18 -3	23 -0 20 -8 18 -7 17 -0	22 -2 19 -6 17 -6 16 -1	21 -10 19 -1 17 -1 15 -9	20 -10 18 -3 16 -4 15 -1



# TABLE 8.—MAXIMUM ALLOWABLE SPANS OF JOISTS: PINE, SOUTHERN (S); PINE, SOUTHERN LONGLEAF (LL) Dressed lumber surfaced 4 sides Not supporting ceiling

Maximum deflection  $=\frac{1}{240}$  x span, by live load 40 psf

				Sti	ess-grade lum	ber		
Nominal size in inches	Spacing in inches c. to c.	Dense structural (S) and merchantable structural (LL) 1800 psi	No. 1 dense (S) and No. 1 (LL) 1700 psi	No. 1 dense structural (S) and No. 1 structural (LL) 1600 psi	No. 1 dense 1400 F (S) and No. 1 1400 F (LL)	No. 2 dense (S) and No. 2 (LL) 1250 psi	No. 1 1200 F (S)	No. 2 (S) 1100 psi
2x6	12 16 20 24	12'-11" 11 -8 10 -10 10 -3	12'-11" 11 -8 10 -10 10 -2	12'-11" 11 -8 10 -10 9 -11	12 -11 11 -2 10 -1 9 -3	12'-3" 10 -7 9 -6 8 -9	12'-0" 10 -5 9 -5 8 -7	11'-5" 10 -0 9 -0 8 -3
2x8	12 16 20 24	$     \begin{array}{r}       17 - 1 \\       15 - 7 \\       14 - 6 \\       13 - 7     \end{array} $	17 -1 15 -7 14 -6 13 -7	$     \begin{array}{r}       17 - 1 \\       15 - 7 \\       14 - 4 \\       13 - 2     \end{array} $	17 -1 14 -11 13 -5 12 -4	16 -2 14 -0 12 -7 11 -7	15 -10 13 -10 12 -5 11 -6	15 -2 13 -4 11 -10 10 -10
3x8	12 16 20 24	20 -2 18 -4 17 -1 16 -0	20 -2 18 -4 17 -1 16 -0	20 -2 18 -4 17 -1 16 -0	20 -2 18 -4 16 -10 15 -6	20 -2 17 -7 15 -11 14 -8	19 -9 17 -3 15 -7 14 - 4	19 -0 16 -8 14 -11 13 -9
2x10	12 16 20 24	21 -8 19 -9 18 -5 17 -3	21 -8 19 -9 18 -5 17 -1	21 -8 19 -9 18 -1 16 -7	21 - 518 - 1016 - 1015 - 6	20 -4 17 -9 16 -0 14 -8	19 -11 17 -5 15 -8 14 -5	19 -0 16 -8 15 -0 13 -9
3x10	12 16 20 24	$ \begin{array}{r} 25 -6 \\ 23 -2 \\ 21 -6 \\ 20 -3 \end{array} $	256 23 -2 216 20 -3	25 -6 23 -2 21 -6 20 -3	25 -6 23 -2 21 -2 19 -6	25 -3 22 -2 20 -1 18 -5	24 -921 -919 -818 -0	23 -7 20 -9 18 -9 17 -3
2x12	12 16 20 24	26 -3 23 -11 22 -2 21 -0	26 -3 23 -11 22 -2 20 -7	26 -3 23 -11 21 -10 20 -0	25 -9 22 -7 20 -5 18 -8	24 -5 21 -5 19 -3 17 -8	23 -11 21 -0 18 -11 17 -3	22 -11 20 -1 18 -0 16 -6



# TABLE 9.-MAXIMUM ALLOWABLE SPANS OF JOISTS: PINE, SOUTHERN (S); PINE, SOUTHERN LONGLEAF (LL) Dressed lumber surfaced 4 sides Supporting ceiling

Maximum deflection  $=\frac{1}{360}x$  span, by live load 30 psf

		Stress-grade lumber						
Nominal sizeSpacingin inchesin inches c. to c.	Dense structural (S) and merchantable structural (LL) 1800 psi	No. 1 dense (S) and No. 1 (LL) 1700 psi	No. 1 dense structural (S) and No. 1 structural (LL) 1600 psi	No. 1 dense 1400 F (S) and No. 1 1400 F (LL)	No. 2 dense (S) and No. 2 (LL) 1250 psi	No. 1 1200 F (S)	No. 2 (S) 1100 psi	
2x6	12	12'-5"	12'-5"	12 -5"	12'-5"	12'-3"	12'-0"	11'-5"
	16	11 -2	11 -2	11 -2	11 -2	10 -7	10 -5	10 -0
	20	10 -5	10 -5	10 -5	10 -1	9 -6	9 -5	9 -0
	24	9 -10	9 -10	9 -9	9 -3	8 -9	8 -7	8 -3
2x8	12	16 -5	16 -5	16 -5	16 -5	16 -2	15 –10	15 -2
	16	15 -0	15 -0	15 -0	14 -11	14 -0	13 –10	13 -4
	20	13 -11	13 -11	13 -11	13 -5	12 -7	12 –5	11 -10
	24	13 -1	13 -1	13 -1	12 -4	11 -7	11 –6	10 -10
3x8	12	19 -4	19 -4	19 -4	19 -4	19 -4	19 -4	19 -0
	16	17 -7	17 -7	17 -7	17 -7	17 -7	17 -3	16 -8
	20	16 -5	16 -5	16 -5	16 -5	15 -11	15 -7	14 -11
	24	15 -4	15 -4	15 -4	15 -4	14 -8	14 -4	13 -9
2x10	12	20 -10	20 -10	20 -10	20 -10	20 -4	19 -11	19 -0
	16	19 -0	19 -0	19 -0	18 -10	17 -9	17 -5	16 -8
	20	17 -8	17 -8	17 -8	16 -10	16 -0	15 -8	15 -0
	24	16 -7	16 -7	16 -7	15 -6	14 -8	14 -5	13 -9
3x10	12	24 -6	24 -6	246	24 -6	24 -6	24 -6	23 -7
	16	22 -3	22 -3	223	22 -3	22 -2	21 -9	20 -9
	20	20 -8	20 -8	208	20 -8	20 -1	19 -8	18 -9
	24	19 -5	19 -5	195	19 -5	18 -5	18 -0	17 -3
2x12	12	25 -3	25 -3	25 -3	25 -3	24 -5	23 -11	22 -11
	16	23 -0	23 -0	23 -0	22 -7	21 -5	21 -0	20 -1
	20	21 -4	21 -4	21 -4	20 -5	19 -3	18 -11	18 -0
	24	20 -1	20 -1	20 -1	18 -8	17 -8	17 - <b>3</b>	16 -6

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]	FABLE 10.—M	AXIMUM ALLOW Dressed S	ABLE SPANS OF J lumber surfaced 4 s upporting ceiling	OISTS: SPRUCE,	EMBER 1951 EASTERN
	Ν	laximum deflection	$=\frac{1}{360}$ x span, by	live load 40 psf	
		·	Stress-grade lumber		Yard lumber
Nominal size in inches	Spacing in inches	Structural 1450 f.	Structural 1300 f.	Structural 1200 f.	NH&HMA graded No. 1 dimension 6" 800 psi 8" 850 psi
	c. to c.				10" 950 psi 12" 1050 psi
2x6	12 16 20	10'-3" 9-3 8-8	10'-3" 9 -3 8 -8	10'-3" 9 -3 8 -6	8'-10" 7 -9 7 -0
	20	8 -2	8-2	7 –10	6 -4
2x8	12 16 20 24	13 -8 12 -6 11 -6 10 -10	13 -8 12 -6 11 -6 10 -8	13 -8 12 -6 11 -3 10 -4	12 -1 10 -6 9 -5 8 -7
3x8	12 16 20 24	16 -0 14 -6 13 -8 12 -9	16-0 14-6 13-8 12-9	16 -0 14 -6 13 -8 12 -9	15 -3 13 -4 12 -0 11 -0
2x10	12 16 20 24	17 -3 15 -8 14 -8 13 -9	$     \begin{array}{r}       17 - 3 \\       15 - 8 \\       14 - 8 \\       13 - 7     \end{array} $	17 -3 15 -8 14 -3 13 -1	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

20 -3

18 –5

17 –1

16 -1

20 - 10

18 - 11

17 –9

16 -8

12

16

20

24

12

16

20

24

3x10

2x12

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

20 – 3

18 –5

17 **–**1

16 -1

20-10

18 – 11

17 –9

16 -4

20 -1

17 -8

15 -10

14 –5

20 –4

17 - 11

16 -1

14 -10

20 –3

18 –5

17 –1

16 -1

20 - 10

18 – 11

17 -1

15 –9

 

 TABLE 11.—MAXIMUM ALLOWABLE SPANS OF JOISTS:

 SPRUCE, EASTERN

 TABLE 12.—MAXIMUM ALLOWABLE SPANS OF JOISTS: SPRUCE, EASTERN د Dressed lumber surfaced 4 sides Dressed lumber surfaced 4 sides Not supporting ceiling Supporting ceiling Maximum deflection  $=\frac{1}{240}x$  span, by live load 40 psf Maximum deflection  $=\frac{1}{360}$  x span, by live load 30 psf AM 3016 IOVEM Stress-grade lumber Stress-grade lumber Yard lumber Yard lumber Nominal Spacing Spacing Nominal Ä NH&HMA graded size NH&HMA graded size No. 1 dimension No. 1 dimension 1951 6" 800 psi 8" 850 psi 10" 950 psi 12" 1050 psi 6" 800 psi 8" 850 psi 10" 950 psi Structural Structural Structural Structural Structural Structural 1450 f. 1300 f. 1200 f. 1450 f. 1300 f. 1200 f. in in in in inches inches inches inches 12" 1050 psi c. to c. c. to c. 11'-9" 11'-3" 9'-10" 11'-9" 11'-9" 9'-10" 12 11'-3" 11'-3" 1210 -3 8 - 7 10 - 5 10-3 10 -3 216 16 10 - 710 -7 8-7 2x6 16 9 – 5 7 -8 9-11 9 - 5 20 9-6 9 - 6 20 9-11 7 - 87 –1 9 -0 8-7 24 8 - 118-11 8 - 7 24 9-4 7 – 1 15 -7 13 -3 15 -7 13 -3 12 15-0 15 -0 15 -0 Code Manual-12 15-7 13 -8 11 -7 14 -2 13 -10 11 -7 16 13 - 813 -8 14 - 22x8 2x8 16 13 -0 12 -5 10-6 20 12 -7 12 -7 12 - 510-6 20 13 - 2**Structural Standards** Requirements 9 - 7 12 -0 11 -6 9 - 7 24 11-11 11 - 11 11 -6 24 12 - 416 -7 18-4 16 -7 12 17 - 717 -7 17 -7 12 18-4 18-4 16 -0 14 -7 16 -8 16 -8 14 -7 3x8 16 16-0 16 -0 16 -8 3x8 16 13 - 215 -7 13 -2 20 15 -- 0 15 -0 15 -- 0 15 -7 15 -7 20 14 -0 14 -0 12-1 -State 14 -4 12 -1 24 14 - 024 14 -7 14 -7 19 -8 18-10 18 - 10 17 -9 19 -8 19 -8 17 - 9 12 18-10 12 **Building Code Commission** I 17 –3 17 - 315 -6 17 –11 17 -5 15 -- 6 2x10 16 17 - 317-11 2x10 16 16 **-1** 16 -1 15 -- 8 14 -0 16 -8 16 -5 15 -8 14 -0 20 **Wood Construction** 20 12 -9 14 -11 14 -5 14 - 5 12 -9 24 15 -1 24 15 -8 14 -11 22 -4 22 -4 22 -0 23 - 223 - 2 23 - 222 -0 12 22 - 412 20 – 3 19 -4 20 - 320 - 3General 21 -1 21 - 1 19-4 3x10 16 21 - 13x10 16 19-6 18 - 9 18-9 18-9 17 - 6 19-6 17 - 6 20 20 19-6 17 -- 8 16 -0 24 17 -8 18-5 18-0 16-0 17 -8 18 - 5 24 22 -11 23 - 10 12 22 -11 22 -11 22 - 523 -10 22 -5 23 - 1012 20-10 19 -8 20 - 1021-8 21 -0 19-8 2x12 16 20 - 1021 - 82x12 16 19 -5 18-11 17 -8 20 -2 19-8 17 - 8 20 19-5 20 18-11 16 -2 24 18 --0 17 - 3 18-0 17 -3 16 - 2 18-4 19 -0 24

part

w

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#### **Protection Against Detrimental Conditions**

#### 1—General

Wood used structurally under conditions which might result in decay or destruction is required to be selected or protected to prevent eventual failure. Acceptable conditions of installation are described in this section. For protection against termites see section AM 301c Structural Standards—General Requirements—Protection Against Termites, part 3, pages 91 to 94. For protection against ground water, see section AM 301d Structural Standards —General Requirements—Protection Against Ground Water, part 3, pages 95 to 98. For condensation control of crawl spaces, see illustration in section AM 204 Space Standards— Attics, Crawl Spaces, Flat Roofs, part 2, page 11, entitled, "Ventilation of Crawl Spaces." For condensation control of attic spaces and flat roofs, see illustration in section AM 204 Space Standards—Attics, Crawl Spaces, Flat Roofs, part 2, page 10, entitled, "Ventilation of Attics and Flat Roofs."

#### 2—Below-Grade Wood Posts

Wood posts used as columns in basements or cellars, and in below-grade crawl spaces or air spaces are permitted when they bear on concrete, masonry, or other approved impermeable bases extending not less than 3 inches above the floor or paving level.

#### 3—Members Embedded in Below-Grade Exterior Masonry

The embedment or resting of wood members within below-grade exterior masonry is permitted when the wood members are the heartwood of a durable species; or the wood members are pressure impregnated in an approved manner with an approved preservative; or the parts within the masonry are given a minimum of two brush coats of an approved preservative.

#### 4-Floor Sleepers Exposed to Moisture

The installation of wood sleepers or other wood members embedded in or laid on masonry or concrete that is in direct contact with earth is permitted when the wood members are the heartwood of a durable species; or the wood members are pressure impregnated in an approved manner with an approved preservative, and any unavoidable cut surfaces are given a minimum of two brush coats of an approved preservative.

#### 5—Detrimental Vapor Condensation

The installation of thermal insulating materials between wood structural members under conditions where differential vapor pressure may cause detrimental condensation to occur within the thermal insulation, is permitted when vapor migration into the thermal insulation is prevented by a vapor-resistant barrier, and vapor movement outward from the thermal insulation under vapor pressure of 1 inch of mercury is possible at a rate of 5 grains of



moisture or more per square foot per hour. Under the same vapor pressure, the vaporresistant barrier may not pass more than 1 grain of moisture per square foot per hour.

## Splicing

Structural framing members may not be spliced between bearing points unless approved provisions are made for transferring stress at the splice.

#### Exterior Stud Walls, and Bearing Partitions

1-Exterior stud walls and stud bearing partitions are required to be designed to carry safely all loads, including loads due to wind or other lateral forces.

2—Stud framing is to be of studs not less than 2 by 4 inches, spaced not more than 16 inches on centers for two- and three-story construction. For construction less than two stories in height, properly braced and assembled so that the assembly provides adequate rigidity, spacing may be increased up to 24 inches on centers. Studs are to be set with the larger cross-sectional dimension at right angles to the wall or bearing partition unless designed as individual columns.

3—Stud framing having an unsupported height of more than 10 feet is to have studs bridged or otherwise braced in an approved manner at intervals not exceeding 8 feet.

4—Sills are to be anchored to foundations as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 67, entitled, "Anchors and Nailing for Exterior Stud Walls."

5—Diagonal or corner braces are to be installed as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 68, entitled, "Diagonal Bracing of Exterior Stud Walls," and part 3, page 69, entitled, "Corner Bracing of Exterior Stud Walls," at all external corners of exterior stud-framed walls, and securely nailed to all members over which they are applied, except that corner or diagonal braces may be omitted where their omission is specifically authorized in the illustrations in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 74, entitled, "Diagonal Wood Sheathing on Exterior Stud Walls"; part 3, page 75, entitled, "Plywood Sheathing on Exterior Stud Walls"; part 3, page 76, entitled, "Fiberboard Sheathing on Exterior Stud Walls"; part 3, page 76, entitled, "Fiberboard Sheathing on Exterior Stud Walls"; part 3, page 77, entitled, "Gypsum-Board Sheathing on Exterior Stud Walls."

6—Sills and girders supported on top of foundation walls or piers are to be leveled and grouted with Portland cement grout. Wood may not be used for permanent shims. Sills and girders on hollow unit masonry foundation walls and piers, are to bear on a minimum of 4 inches of solid masonry units whose core holes have been filled with mortar. On solid



unit masonry foundation walls and piers, the top course is to have all core holes filled with mortar.

7—Studs are to be doubled at the sides of openings in exterior stud walls and bearing partitions, the inner stud extending in one piece from bearing to header and nailed to the outer stud; except that equivalent solid members may be used in lieu of double studs or, where allowable stresses in single studs are not exceeded and approved formed metal or other supports and fastenings are provided at lintels, openings may be framed with single studs. For lintels in exterior stud-bearing walls, see illustration in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 70, entitled, "Lintels in Exterior Stud-Bearing Walls."

8—All lintels are to be designed to support the superimposed load and are to have bearing of at least 11/2 inches. See illustration in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 70, entitled, "Lintels in Exterior Stud-Bearing Walls."

9—Plates of exterior stud walls and of stud-bearing partitions may be not less than two 2-inch members of the same width as the studs, lapped at corners and intersecting partitions; except that where bearing members are placed directly above studs below, a single top plate may be used. Where plates are cut for piping or duct work, an approved tie is to be provided, as illustrated in section AM 301b Structural Standards—General Requirements— Wood Construction, part 3, page 71, entitled, "Ties for Plates Cut for Passage of Ducts or Pipes."

10—Sill members of bearing partitions may be not less than 2 inches in thickness. If properly firestopped, studs may run through floors and rest on girders or on partition plates.

11—In frame construction of two or three stories, where diagonal sheathing is not provided and the exterior studs are not continuous from sill to roof, other sheathing or connections so designed and arranged as to supply adequate structural continuity between the first and second stories, and between the second and third stories, are to be provided.

12—Ribbon boards used to support joists may be not less than 1 by 4 inches, and cut into the studs and securely nailed to each stud with not less than two 10-penny nails. The ends of joists adjoining studs are to be securely spiked to the studs. Wood blocking is to be inserted at the ends of joists not adjoining studs, and the joists nailed to the blocking, and the blocking to the studs.

13—Notching of Studs: In bearing walls or partitions no stud is to be cut more than one third its depth to receive piping or duct work, or for other purposes, unless approved supplementary framing or supports are provided.

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#### Wall Sheathing and Unsheathed Walls

#### 1-General

(a)-Exterior finish which may be installed directly on stude includes the following:

Exterior type plywood  $\frac{3}{8}$ -inch thick on 16-inch stud centers,  $\frac{1}{2}$ -inch thick on 20-inch stud centers,  $\frac{5}{8}$ -inch thick on 24-inch stud centers, provided that vertical joints occur over studs, horizontal joints are supported on blocking between studs, and the maximum spacing of nails along edges is 6 inches, and is 12 inches at intermediate bearings.

Three-coat Portland cement stucco, back plastered on metal lath supported  $\frac{1}{4}$  inch from stud face and extending back between studs at least  $\frac{1}{4}$  inch, provided diagonal bracing or corner bracing is installed.

Mill-matched wood siding  $\frac{5}{8}$  inch or more in actual thickness, provided diagonal bracing or corner bracing is installed.

(b)—Sheathing, where approved exterior finish is incapable of supplying adequate bracing and weather protection, is required to be installed on all exterior stud framed walls in back of the exterior finish.

(c)—Exterior wall sheathing is to consist of either wood boards, plywood, fiberboard, or gypsum board, conforming to the requirements hereinafter included.

#### 2—Wood Sheathing

(a)—Wood sheathing is to be installed as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 73, entitled, "Horizontal Wood Sheathing on Exterior Stud Walls"; and part 3, page 74, entitled, "Diagonal Wood Sheathing on Exterior Stud Walls."

(b)-Wood sheathing, when used, is to be applied horizontally under stucco finish.

(c)—All other types of exterior finish may be nailed directly to wood sheathing, using noncorrodible nails.

#### 3—Plywood Sheathing

(a)—Plywood sheathing is to be installed as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 75, entitled, "Plywood Sheathing on Exterior Stud Walls."

(b)—Wood shingles applied over plywood sheathing less than 3/8-inch thick is to be fastened to wood or other approved nailing strips, but nailing strips may be omitted if barbed nails or other approved fastenings are used. Nails are to be noncorrodible.

(c)—Asbestos-cement siding and shingles, asphalt shingles, and insulating siding panels, applied over plywood sheathing less than  $\frac{3}{8}$ -inch thick, are to be fastened with barbed nails or other approved fastenings. Nails are to be noncorrodible.

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## 4—Fiberboard Sheathing

Fiberboard sheathing is to be installed as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 76, entitled, "Fiberboard Sheathing on Exterior Stud Walls."

## 5—Gypsum-Board Sheathing

Gypsum-board sheathing is to be installed as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 77, entitled, "Gypsum-Board Sheathing on Exterior Stud Walls."

## Sheathing Paper

1—Except as provided in the following paragraph, water-resistant building paper or asphalt-saturated felt is to be applied over all exterior wall sheathing. Whenever conditions are such that moisture due to condensation may accumulate within the wall assembly, the water-resistant sheathing paper is to be vapor permeable.

2—Exceptions: The enforcement officer may approve the omission of sheathing paper where the exterior finish is metal, and in other instances where it is not deemed necessary by him for the protection of the sheathing or structure; and sheathing paper need not be required between exterior finish and either plywood sheathing or sheathing that has been covered or treated in an approved manner to render it water repellent, provided that the sheathing material is closely fitted, and cut ends which expose an absorbent core to moisture are sealed by caulking or covered with water-resistant building paper or asphaltsaturated felt.

#### Floors and Roofs

## 1—Floor and Roof Framing

(a)—All girders, beams, and rafters are required to be adequate to support the loads prescribed by the Code without exceeding the allowable stresses specified in this standard.
(b)—Members are to be designed so that deflections specified in the Code will not be exceeded.

(c)—When supported by masonry, joists are to have ample bearing of not less than 3 inches. When there is masonry above the bearing, the joists are to have a 2-inch minimum cut or bevel.

(d)—Masonry walls are to be securely anchored to each tier of wood joists or wood beams and to girders and trusses bearing on them as specified in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, pages 27 and 28, entitled, "Miscellaneous Construction Requirements."

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(e)—When enclosing walls are of wood, each joist, beam, and girder supported by the wall is to be securely spiked or anchored to the wall construction, so as to remain in place and to resist safely all lifts and lateral pressures specified as design loads in the Code.

(f)-Girders are to be fastened to each other where they intersect or abut.

(g)—Floor joists framing into the side of wood girders or headers are to be supported on metal joist hangers or on a bearing strip or ledger board of adequate size fastened to the side of the girders or headers or by other approved equivalent support. See illustrations in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 78, entitled, "Joists Framed Flush With Top of Girders"; part 3, page 81, entitled, "Joists Notched Over Girders"; and part 3, page 84, entitled, "Framing Trimmers, Headers, and Tail Beams."

(h)—The ends of joists, whether resting upon girders or bearing partitions, or abutted against girders, are to be either securely tied to the girders or to each other, or lapped and spiked together, on not more than 4-foot centers, so as to resist safely an outward thrust on the walls equal to the assumed wind pressure, or the spreading action of the roof, whichever is greater. Ties for masonry enclosed buildings are to be provided on each line of joists that is anchored to enclosing masonry. See illustrations in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 78, entitled, "Joists Framed Flush With Top of Girders"; part 3, page 79, entitled, "Joists Tie at Butted Joint Over Plate or Girder"; and part 3, page 81, entitled, "Joists Notched Over Girders."

(i)—All joists are to be spiked to the bearing when the bearing is of wood.

(j)—All joints of solid or built-up girders forming simple spans, except joints in approved glued laminated girders, are to be made over column or pier supports. For girders made up of joists nailed together side by side and continuous on three or more supports, see illustration in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 82, entitled, "Continuous Built-Up Girders, Three or More Supports."

(k)—Except where single members are adequate for the load, joists supporting one-story nonbearing partitions which are parallel to the joists are to be doubled and nailed together with 10-penny nails, staggered, 32 inches between nails in a horizontal line. Members supporting nonbearing partitions more than one story in height, or bearing partitions, are to be designed to support safely the superimposed load. Joists supporting a partition parallel to the joists which are spaced apart to permit the passage of piping or duct work are to be blocked on not more than 16-inch intervals to provide support for bearing par-

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titions, and 32 inches for nonbearing partitions. See illustration in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 72, entitled, "Openings for Pipes or Ducts in Partition Framing Parallel to Joists."

(1)—Holes may be bored in joists and joists may be notched, to the extent illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 83, entitled, "Notching and Holes in Joists." The enforcement officer may approve notches and holes of other sizes and in other locations when he determines that they will not impair the required bearing capacity of the joist.

(m)—All framing around openings is to be designed for the loads supported. In general, all headers and trimmers are to be doubled. Framing members at openings, when doubled are to be supported as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 84, entitled, "Framing Trimmers, Headers, and Tail Beams." Headers 4 feet or less in length may be single members. Trimmers may be single members when header is 4 feet or less in length, and opening occurs in end quarter span of trimmer.

(n)—Support of Rafters: Rafters are to be vertically supported or tied as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 85, entitled, "Roof Framing." If the spread of the rafters is prevented by ties not at the plate line, the size of the rafters is to be increased to take care of the additional bending moment induced by the ties. Framing around roof openings, and hip and valley rafters, are to be designed for the loads supported. In general, double rafters and headers are to be used around roof openings unless single members are adequate for the load.

(o)—Bridging: Floor and flat-roof joists and beams are to be securely bridged as illustrated in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 86, entitled, "Bridging for Floor and Flat Roof Joists and Beams." Where the required depth of rafters is more than six times the breadth, the rafters are to be bridged as required for floor joists.

#### 2—Roof Sheathing

(a)-Roof sheathing is required to be of wood, or of plywood, or of other approved material providing secure attachment for the roofing.

(b)—Wood Roof Sheathing: Wood roof sheathing is to have a minimum nominal thickness of 1 inch. It is to be applied over maximum rafter spacing of 24 inches on centers and nailed with minimum of two 8-penny nails for boards 6 inches and less in width, and minimum of three 8-penny nails for wider boards. Joints are to be over rafters unless end-matched boards are used; if end-matched boards are used, no two adjoining boards are to break joints over the same rafter space, and each board is to bear on at least two rafters.

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(c)—Plywood Roof Sheathing: Plywood roof sheathing is to be applied with the grain of the outer plies at right angles to the rafters, and is to have thickness not less than that given in the following table:

Type of roof and roofing material	Rafters, maximum spacing (in inches)	Plywood, minimum . thickness (in inches)
Pitched roofs: wood or asphalt shingles	16 20 24	$     \frac{5/16}{3/8}     \frac{3/8}{1/2} 1 $
Pitched roofs: slate, tile, or asbestos-cement.	16 20 24	1/2 1/2 1/2 5/8
Flat roofs: built-up bituminous, or metal	16 20 24	3/8 1/2 5/8

<sup>1</sup> 3%-inch plywood may be used provided that snow load on the roof sheathing does not exceed 40 psf normal to the roof surface and the plywood is continuous over two or more spans.

Wood shingles applied over plywood roof sheathing less than  $\frac{1}{2}$ -inch thick, are to be fastened to wood or other approved nailing strips. Plywood roof sheathing may be not less than sheathing grade for interior type conforming to the requirements for such material included in CS, *Douglas Fir Plywood*, listed in AM appendix A. Plywood roof sheathing not of the exterior type may have no surface or edge exposed to the weather. Plywood roof sheathing is to be nailed at all edges with nails spaced a maximum of 6 inches on centers, and to intermediate rafters with nails spaced a maximum of 12 inches on centers. Six-penny nails minimum are to be used for plywood  $\frac{1}{2}$  inch or less in thickness, and 8-penny minimum nails for plywood over  $\frac{1}{2}$ -inch thick. When other than wood shingles are to be installed, support is to be provided by cut-in blocking for all edges not supported by rafters.

(d)—Underlay: Underlay between sheathing and exterior finish is to be provided wherever other than wood shingles or metal roofs are installed.

#### 3—Flooring

1—In all buildings with wood-framed floor construction where strip wood finished flooring less than  $\frac{3}{4}$ -inch actual thickness, or other finish, is installed, subflooring of wood not less than 1-inch nominal thickness, laid either at right angles to, or diagonal to, the joists, or plywood not less than  $\frac{5}{8}$ -inch thick with face plies perpendicular to joists, is to be provided. 2—Wood flooring is to be of such thickness that it will safely support design loads without deflection exceeding that specified in section A 305-1 of the Code.



# Anchors and Nailing for Exterior Stud Walls



<sup>2</sup>max. I foot

#### Anchors

**Location**—1-foot maximum from each end of sill and 8-feet maximum on centers. Minimum of two anchor bolts in each sill.

Size – Minimum  $\frac{1}{2}$ - inch round stock, or bolts minimum  $\frac{1}{2}$  inch in diameter.

**Embedment**-Minimum 6 inches in cast-in-place concrete; 15 inches in unit masonry.

**Types**—Anchors may be of hooked, plate, or eye-and-pin type, as illustrated below.

Nailing-Studs of exterior walls are to be nailed to a sole with a minimum of three 16-penny nails, or four 8-penny nails. Sole plate to be nailed to joists or header through subflooring with 16-penny nails, staggered.





Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



# Diagonal Bracing of Exterior Stud Walls



#### Diagonal Bracing

Minimum size-1 by 4 inches square-edged stock.

**Nailing**—Braces are to be let into face of framing members and nailed at each stud crossing with not less than two 10-penny nails, and at ends with not less than three 10-penny nails.

Diagonal bracing is preferable and is to be used unless openings near the corners prevent its use, except that corner and diagonal bracing may be omitted where omission is authorized in illustrations in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, pages 74 to 77.



ALTERNATE DIAGONAL BRACING WHERE OPENINGS OCCUR AT CORNERS

Note: Dotted lines indicate alternate locations of diagonal bracing.





#### **Corner Bracing**

Minimum size-1 by 4 inches square-edged stock.

Nailing-Braces are to be let into face of framing members and nailed at each stud crossing with not less than two 10-penny nails, and at ends with not less than three 10-penny nails.

Note: Corner bracing is to be used where openings which prevent the use of diagonal bracing occur near corners, except that corner and diagonal bracing may be omitted where omission is authorized in illustrations in section AM 301b Structural Standards-General Requirements --- Wood Construction, part 3, page 74, entitled, "Diagonal Wood Sheathing on Exterior Stud Walls"; part 3, page 75, entitled, "Plywood Sheathing on Exterior Stud Walls"; part 3, page 76, entitled, "Fiberboard Sheathing on Exterior Stud Walls"; part 3, page 77, entitled, "Gypsum-Board Sheathing on Exterior Stud Walls."





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## Lintels in Exterior Stud-Bearing Walls



LINTELS SUPPORTED ON 2 OR MORE STUDS

Fastening of Lintels: Continuous long studs abutting ends of lintels shall be nailed through studs to each member of lintel with a minimum of two 10-penny nails.



LINTELS SUPPORTED ON SINGLE STUDS









INTERIOR BEARING PARTITION

#### Ties

Exterior stud walls—Where a member is cut to permit the passage of ducts and pipes, the space is to be temporarily spanned by a member of the same cross-sectional area to provide structural continuity until the sheathing is installed. Interior bearing partition minimum cross section—Wood ties to be 1-inch by 4-inch nominal; metal ties, 1/8 inch by 3 inches. Minimum length—Sufficient to extend on each side at least one stud spacing beyond opening. Nailing of ties—Ties are to have a minimum of four 8-penny nails at each side of opening.





# Horizontal Wood Sheathing on Exterior Stud Walls



#### Wood Sheathing

Minimum thickness 5% inch, actual.

Nailing—For boards 8 inches or less in width, use two 8-penny nails at each stud crossing. For wider boards use not less than three 8-penny nails at each stud crossing.

Structural continuity—Sheathing boards are to be of such widths and so placed that junctions between sills and headers and between headers and studs are spanned by boards; or structural continuity for the stud walls is provided by other approved equivalent methods.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



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# Plywood Sheathing on Exterior Stud Walls



## Plywood Sheathing

Minimum thickness 5/16 inch on studs spaced up to 16 inches on centers;  $\frac{3}{8}$  inch on studs spaced up to 24 inches on centers.

Quality—Conforming to interior type, sheathing grade or approved equivalent in CS, *Douglas Fir Ply*wood, listed in AM appendix A.

Nailing-Use 6-penny nails located at least  $\frac{3}{8}$  inch from edges, and spaced not more than 6 inches apart along edges and not more than 12 inches apart along other bearings; or use approved equivalent fastenings.

Corner or diagonal bracing is not required where plywood sheathing not less than 18 inches wide is used and is nailed on all edges and at intermediate bearings.

Attachment of exterior finish-See text in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, page 62, under heading, "3—Plywood Sheathing."



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Bracing may be omitted on one-story dwellings, and on the second story of two-story dwellings, where 50 per cent or more of the wall surface is without openings and fiberboard not less than 1/2-inch thick in sheets 4 feet by 8 feet is applied with the 8-foot dimension vertical.

but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

insulating siding panels may be di-

rectly attached, using approved fastenings such as special clinch-type

nails. Nails are to be noncorridible.

Constructions illustrated or described herein are acceptable under the State Building Construction Code,



Attachment of Exterior Finish—Gypsum-board sheathing may not be used as a nailing base for the direct attachment of finish, and such finish is to be nailed either to the studding through the gypsum-board sheathing or is to be attached to wood or other approved nailing strips; except that wood, asbestos or asphalt shingles or asphalt insulating siding panels may be directly attached, using approved fastenings, such as special clinch-type nails. Nails are to be noncorrodible.

openings, bracing may be omitted.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



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# Joist Tie at Butted Joint over Plate or Girder



#### Ties

Size-Wood scabs 1 inch by 24 inches, or metal ties 1 inch wide by  $\frac{1}{8}$  inch thick by 24 inches long.

Maximum spacing 4 feet on centers.

Nailing-Wood ties to be secured to each joist with three 8-penny nails each side of the butt joint.

Metal ties are to be secured to each joist with three 8-penny nails each side of the butt joint. Joists are to be spiked to the plate, partition cap, or girder with at least two 10-penny nails on the near side and at least one on the far side, toe-nailed into the bearing member.

Constructions illustrated or described herein are acceptable under the State Building Construction Code. but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



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Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.







For notches, the net depth is not less than the depth required for the span and load if in the middle onehalf span, and the net depth is not less than 5/6th of the depth required for the span and load if in the outer one-quarter span;

For bored holes, the net depth reduced by  $2\frac{1}{2}$  inches is not less than that required for the span and load.

#### In no case are:

Notches to be placed in both the top and bottom edges if the near sides of such notches are closer than 12 inches horizontally;

The near sides of notches and bored holes to be placed closer than 12 inches horizontally;

Bored holes to be placed near both the top and bottom edges if the near sides of such holes are closer than 12 inches horizontally.

Note: For end-bearing notches, see illustration in section AM 301b Structural Standards—General Requirements – Wood Construction, part 3, page 84, entitled, "Framing Trimmers, Headers, and Tail Beams."

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Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

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## AM 301b Stressed Plywood Construction

### General

The requirements for stressed plywood construction, and the allowable stresses in such construction, given in this standard, are based on tests made by an authoritative agency. Stressed plywood construction assembled as described in this standard is acceptable under the State Building Construction Code applicable to one- and two-family dwellings.

## Material

1—Plywood exposed to weather or to severe conditions of service shall meet the requirements established for exterior type in CS, *Douglas Fir Plywood*, or for type I in CS, *Hard*wood Plywood, listed in AM appendix A.

2—Plywood for interior use above ground and not subject to severe conditions of service is to meet the requirements established for interior type in CS, *Douglas Fir Plywood*, or for types II or III in CS, *Hardwood Plywood*, listed in AM appendix A.

3—Type A glues are required to maintain satisfactory bond under all conditions of atmospheric moisture and moisture content of assembled parts, and under all temperatures from  $-10^{\circ}$  F. to  $120^{\circ}$  F.

4-Glues conforming to the following specifications are classified as type A glues listed in AM appendix A:

(a)—Joint Army-Navy (JAN) Specification, Adhesives; Thermosetting-Resin, Room-Temperature and Intermediate-Temperature Setting, Waterproof (Phenolic, Resorcinol, and Melamine Base). (For wood).

(b)—Military (MIL) Specification, Adhesive; High Temperature Setting Resin (Phenol, Melamine and Resorcinol Base).

5—Type B glues are to maintain satisfactory bond under all conditions where the moisture content of the assembled parts does not exceed 18 per cent by weight computed as a percentage of the oven-dry weight of the wood, and under all temperatures from  $-10^{\circ}$  F. to  $120^{\circ}$  F.

6—Glues conforming to the following specifications are classified as type B glues listed in AM appendix A: Federal Specification for Glue—Casein Type, Water Resistant; Federal Specification for Glue—Resin Type (Liquid and Powder); Army Air Forces Specification, Glue—Water and Mold Resistant Casein.

7—Satisfactory bond, required under paragraphs designated 3 and 5 above, is to be determined by test methods for exterior type and interior type plywood, respectively, specified in CS, *Douglas Fir Plywood* listed in AM appendix A.

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### Allowable Stresses

1—Allowable stresses for plywood are to be established in the manner set forth by the Forest Products Laboratory report, Approximate Methods of Calculating the Strength of Plywood, listed in AM appendix A.

2—Allowable stresses for Douglas fir plywood conforming to CS, Douglas Fir Plywood listed in AM appendix A, are to be as shown in the table in section AM 301b Structural Standards—General Requirements—Stressed Plywood Construction, part 3, page 89, entitled, "Douglas Fir Plywood, Allowable Unit Stresses."

### Plywood Glued to Framing Members

1—Where used for exterior facing of exterior walls or where subject to severe conditions of exposure, plywood glued to framing members is to be glued with type A glue.

2-Where used for interior walls or ceilings subject to normal conditions of service, plywood glued to framing members is to be glued with type A or type B glue.

3—Either type A or type B glue may be used for floor assemblies where adequate ventilation is provided.

### **Stressed Skin Construction**

1-Stressed skin construction is to be designed in accordance with principles outlined by the Forest Products Laboratory report, *The Designing for Strength of Flat Panels with Stressed Coverings*, listed in AM appendix A.

2—All stressed skin construction is to conform to the following requirements: the plywood laminations are to be well glued together; the plywood coverings are to be securely glued to the frames; the longitudinal members of the frames may be not less than twice as thick (cross-sectional dimension in contact with covering) as the covering; spaced headers for lateral support are to be provided between longitudinal members whose ratio of height to thickness is 2 to 1 or more.

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Structural Standards – General **Requirements – Stressed Plywood** Construction

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#### DOUGLAS FIR PLYWOOD, ALLOWABLE UNIT STRESSES For grades and thicknesses listed in CS, Douglas Fir Plywood see AM Appendix A In bending, tension and compression (except bearing and 45-degree stresses) consider only those plies with their grain direction parallel to the principal stress. DRY LOCATION

	Type and grade of Douglas fir plywood				
Type of stress	EXT-DFPA · A-A ³	EXT-DFPA· A-B EXT-DFPA· plyshield· (A-C)	EXT-DFPA· utility·(B-C) EXT-DFPA· sheathing·(C-C) EXT-DFPA· concrete form· (B-B) Plyform·(B-B) Plyscord· (C-D)	Interior A-A Interior A-B Plypanel (A-D) Plybase (B-D) (Apply the following percentages to the stresses for the cor- responding exterior grade. See example at bottom of page.)	
Extreme fiber in bending: Face grain parallel to span Face grain perpendicular to span	2188 1875	2000 1875	1875 1875	100 30	
Tension:Parallel to face grain (3-ply only 1)Perpendicular to face grain	2188 1875 337	2000 1875 320	1875 1875 310	100 4 80 85	
Compression: Parallel to face grain (3-ply only <sup>1</sup> ) Perpendicular to face grain 45° to face grain	1605 1375 496	1460 1375 472	1375 1375 460	100 <b>4</b> 70 80	
Bearing (on face)	405	405	405	100	
Shear, rolling, in plane of plies <sup>2</sup> Parallel or perpendicular to face grain 45° to face grain	79 105	72 96	68 90	75 75	
Shear, in plane perpendicular to plies: <sup>2</sup> Parallel or perpendicular to face grain 45° to face grain	210 420	192 384	180 360	85 85	
Modulus of elasticity in bending: Face grain parallel to span Face grain perpendicular to span	1,600,000 1,600,000	1,600,000 1,600,000	1,600,000 1,600,000	100 70	

 $^1$  For tension or compression, parallel to grain, in 5-ply or thicker, use values for 3-ply, but in next lower grade.

<sup>2</sup> For certain conditions where stress concentrations exist these working stresses for rolling shear should be reduced by 50 per cent. See table 1, FPL Bulletin, Approximate Methods of Cal-

culating the Strength of Plywood.

<sup>3</sup> This abbreviation stands for exterior grade, Douglas Fir Plywood Association.

<sup>4</sup> For 5 or more plies, use 90 per cent.

#### WET OR DAMP LOCATION

Where moisture content will exceed 16 per cent, decrease by 20 per cent values shown for dry location for following properties: Extreme fiber in bending, tension and compression both parallel and perpendicular to the grain and at 45°, and bearing. (No change in values for shear or modulus of elasticity.)

Example: The working stress in compression parallel

for plypanel 5-ply (1238 psi) is found by multiplying the value for EXT-DFPA plyshield 5-ply, 1375 psi, by 90 per cent, the reduction factor shown in the last column and footnotes 1 and 4.

From 1948 edition, Douglas Fir Plywood Association, Technical Data on Plywood, as listed in AM appendix A.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

#### part 3 page 89



## **Plywood Gussets and Webs**

Plywood used structurally as gussets for truss assemblies, splice plates, or as webs for built-up girders, or for similar purposes, is required to maintain bond of plies under conditions specified for type A glues, and not delaminate under heat or fire or burn more rapidly than solid wood of the same species under comparable conditions of exposure. Plywood glued with type A glue, or with adhesive meeting the performance requirements and fire test specified for exterior type in CS, *Douglas Fir Plywood* listed in AM appendix A, is deemed acceptable for this purpose.

## Integration

All structural assemblies wholly or partly of plywood are to be assembled and connected so as to provide a well integrated structure in which stresses may not exceed allowable stresses specified in this standard. Code Manual——State Building Code Commission

Structural Standards – General Requirements – Protection Against Detrimental Conditions, Frost, and Termites



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## AM 301c Protection Against Detrimental Conditions

## AM 301c Protection Against Frost

For depth of foundation affected by frost see section AM 301b Structural Standards— General Requirements—Foundations, part 3, page 11.

## AM 301c Protection of Wood Construction

For protection of wood construction against detrimental conditions see section AM 301c Structural Standards—General Requirements—Protection Against Detrimental Conditions, Frost, and Termites, part 3, pages 91 to 98.

## **301c Protection Against Termites**

### General

Wood structural material and assemblies attacked by termites may become structurally unsound. In localities where such insects are known to exist, suitable protection against infestation and destruction is to be provided. Protection in conformity with this standard is acceptable under the State Building Construction Code applicable to one- and two-family dwellings. For protection against ground water in crawl spaces, see section AM 301d Structural Standards—General Requirements—Protection Against Ground Water, part 3, page 97, under heading, "Crawl Spaces." For other means of condensation control of crawl spaces, see illustration in section AM 204 Space Standards—Attics, Crawl Spaces, Flat Roofs, part 2, page 11, entitled, "Ventilation of Crawl Spaces." For condensation control of attic spaces and flat roofs, see illustration in section AM 204 Space Standards—Attics, Crawl Spaces, Flat Roofs, part 2, page 10, entitled, "Ventilation of Attics and Flat Roofs." For protection of below-grade wood members, and for detrimental vapor condensation control, see section AM 301c Structural Standards—General Requirements—Protection Against Detrimental Conditions, part 3, pages 91 to 98.

### Recommendations

**Drainage:** The site of the building should be well drained. Moist soil conditions are favorable to termites.

**Foundations:** Foundation walls should be without voids through which termites can travel. Poured concrete is the most satisfactory, as long as no cracks develop. Block or brick walls or piers should have all joints well filled with mortar, and should be capped with a continuous slab of reinforced concrete, 4 inches thick. Walls containing voids should be faced down to the footings with cement mortar.



Wood and Paper Refuse: All wood and paper scraps, wood concrete forms, wood spreaders in concrete walls, and all stumps, within or under buildings and accessible to termites, should be removed.

**Inspection by Owner:** Periodic inspections will reveal termite infestation before damage has been done. Provisions should be made to facilitate such inspection, especially in locations where major structural members are accessible to termites. Spaces under porches should be inspected regularly.

## **Required Protection**

**Distance Above Ground:** Major structural members, such as wood sills and wood girders, are to be not less than 6 inches above the exterior ground surface, and not less than 18 inches above an interior ground surface, such as the ground surface of a crawl space.

**Members to be Protected:** Protection is to be provided to wood sills, girders, and joists above crawl spaces, and to wood sills which are less than 18 inches above an exterior ground surface; also to wood sills which are in locations accessible to termite shelter tubes, where such tubes cannot be observed readily. Wood sills accessible from ground surface under porches are to be protected.

## Acceptable Forms of Protection

Where required above, one of the following forms of protection is to be provided: poisoning of the adjoining soil; use of wood inherently termite resistant; use of wood treated to be termite resistant; or use of properly installed metal termite shields.

Soil Poisoning: Soil poisons give protection for five years or more. Acceptable soil poisons are: sodium arsenite, coal-tar creosote, trichlorobenzene, orthodichlorobenzene, and pentachlorophenol. Dosage for deep foundations is to be 1 gallon of chemical per linear foot of trench, and, for shallow foundations,  $\frac{1}{2}$  gallon of chemical per linear foot of trench, or dosage equivalent to 2 gallons of chemical per 5 cubic foot of soil. Application of soil poisons is to be in accordance with recommendations contained in U. S. Department of Agriculture Farmers' Bulletin, *Preventing Damage to Buildings by Subterranean Termites, and Their Control* listed in AM appendix A.

It should be noted that sodium arsenite is extremely poisonous, and that the other chemicals are irritant to the skin. They are also injurious to plants. Chemicals that have strong odors should not be used where food is stored, or in basement apartments, cellars, or other places where there is poor ventilation. They should not be used near a well or other exposed source of drinking water because once the chemicals reach it, the water will absorb their odors and may become unfit for use for a long time. Open packages or containers of soil poisons should not be stored where children or pets can get to them. Soil poisons dissolved in flammable liquids are fire hazardous. Care should be taken to avoid open flames or

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electric sparks when applying flammable soil poisons, such as mixtures containing fuel oil, in confined poorly ventilated spaces.

## Woods Resistant to Termites

Woods naturally resistant to termites include: foundation grade California redwood, allheart tidewater red cypress, very pitchy or lightwood longleaf yellow pine, and eastern red cedar.

## **Treated Wood**

Treated wood, to be acceptable, is required to be pressure impregnated with wood preservative, as specified for wood not in contact with the ground nor in water, in *Federal Specification, Wood Preservative; Recommended Treating Practice* listed in AM appendix A. Recommended minimum net retention of preservative: 6 pounds per cubic foot of coal-tar creosote and creosote coal-tar solutions, and 7 pounds per cubic foot of creosote petroleum solution.

## **Metal Termite Shields**

Metal termite shields are to be installed as illustrated in section AM 301c Structural Standards—General Requirements—Protection Against Termites, part 3, page 94, entitled, "Termite Shields," and as recommended in U. S. Department of Agriculture Farmers' Bulletin, Preventing Damage to Buildings by Subterranean Termites, and Their Control listed in AM appendix A.

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Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

Code Manual——State Building Code Commission Structural Standards – General Requirements – Protection Against Ground Water



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## AM 301d Protection Against Ground Water

### Variables to be Considered

1—The extent of protection against flow of ground water into basements, cellars, and habitable spaces depends upon many variables determinable only locally, and sometimes only at the building site. Such variables include:

(a)—The contour of the ground surface and the extent to which water is conducted thereby to collect against below-grade construction.

(b)—The character of the subsoil and the extent to which natural drainage of the subsoil carries away ground water before it accumulates against below-grade construction in sufficient quantity to penetrate the building.

(c)—The ground water level.

(d)-Provisions made to remove ground water from the area adjacent to below-grade construction.

(e)—The character of below-grade construction; whether it is permeable, water resistant, or waterproof.

2—It is, therefore, impractical to establish hard and fast standards for required protection against inflow of ground water. Acceptability of proposed construction to meet Code requirements is largely a matter for determination by the enforcement officer on the basis of local conditions.

### Inflow of Ground Water

The Code requires construction so that "ground water will not flow into habitable spaces, basements, and cellars." This applies only to type of flow commonly known as "leakage," and definitely does not apply to moisture due to condensation, which results from a combination of humidity and temperature, and not from inflow. It does not apply to moderate amounts of surface moisture due to capillarity of the construction. Both condensation, and moisture from capillarity, are undesirable, but normally do not affect structural safety.

### Hydrostatic Pressure

1—Water which accumulates against below-ground structures creates hydrostatic pressure directly proportionate to the height to which water collects above the level of the structure; and the pressure is uniformly distributed against all parts in contact with, and below the level of the surface of, the water. For each foot of height, the imposed pressure is  $621/_2$  pounds per square foot. If the water level rises 3 feet above a basement floor, the upward



pressure on the floor is  $187\frac{1}{2}$  psf. This is tar more than the weight of the usual 4-inch thick concrete floor (weight approximately 45 psf). Corresponding lateral pressure is exerted wherever ground water collects against foundation walls, the pressure varying with the height of the water above the level under consideration.

2—Wherever foundations, or basement or cellar floors, are subject to hydrostatic pressure, the affected structural elements are required to be designed to resist safely such pressure. Wherever the weight of a basement or cellar floor, or the inherent lateral stability of a foundation wall, is insufficient to resist such pressure, it is to be reinforced and restrained so that the construction will not be overstressed.

## Ground Water Drainage

1—Where practicable, ground water is to be removed preferably by subsoil drains before it can accumulate and create hydrostatic pressure, or flow into basements or cellars. A customary method is by footing drains, which should be backfilled with coarse fill.

2—In some cases, in lieu of footing drains, subsoil drains are installed underneath basement or cellar floor constructions. Subsoil drains may not be installed where there is no suitable method for disposing of water drained off by them.

## Dampproofing

Where conditions are such that water will not exert pressure against the floors and walls of the structure, but moisture exists in the soil in such quantity as would pass through the walls and floors, they are to be dampproofed. See illustration in section AM 301d Structural Standards—General Requirements—Protection Against Ground Water, part 3, page 98, entitled, "Foundation Dampproofing and Waterproofing."

## Waterproofing

Where conditions are such that water will exert pressure against floors and walls, they are to be rendered waterproof by the integral method or by the application of waterproofing coatings to the surfaces of floors and walls. See illustration in section AM 301d Structural Standards—General Requirements—Protection Against Ground Water, part 3, page 98, entitled, "Foundation Dampproofing and Waterproofing."

## Concrete Floors on Grade

In houses, concrete floors on grade and located above adjacent grade level will usually not be subjected to water accumulation under the floor or to leakage through the floor. A layer of roofing felt between the concrete floor and the subgrade will prevent upward

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capillary conductance of moisture. Where the subgrade is dense and compact and will not drain off ground water with reasonable rapidity, a fill of coarse granular material under the floor slab is advisable. Where floors of habitable spaces are partially or wholly below grade level, ground water may accumulate under the floor construction, and it may then be advisable to provide a suitably reinforced concrete slab and membrane waterproofing in lieu of roofing felt. See illustration in section AM 301d Structural Standards—General Requirements—Protection Against Ground Water, part 3, page 98, entitled, "Foundation Dampproofing and Waterproofing."

## **Crawl Spaces**

1—In buildings or parts of buildings without basements or cellars, with first floors constructed of either wood or metal framing, an air space not less than 18 inches in height is required to be provided below the bottom of the floor framing, and access to the crawl space for the inspection of deterioration is to be provided.

2-Where subject to water accumulation, the ground area within the air space is to be drained.

3—For other means of condensation control of crawl spaces, see illustration in section AM 204 Space Standards—Attics, Crawl Spaces, Flat Roofs, part 2, page 11, entitled, "Ventilation of Crawl Spaces."

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### AM 302-1 Soil Bearing Value, Determination

#### General

1-The presumptive soil bearing values given in this standard are in conformity with generally accepted standards.

2—Except where the bearing value of soil is determined by field loading tests or by laboratory determination as provided in sections A 302-1a and A 302-1b of the Code, and except where other bearing values are established by local practice and experience, or because of special conditions, soil bearing values are not to exceed the following, on undisturbed soil (see section AM 302-1 Structural Standards—Soil Bearing Value, Determination, part 3, page 100, under heading, "Modification of Bearing Value").

Class	Material	Allowable bearing value, tons per square foot <sup>1</sup>
1	Massive crystalline bed rocks, such as granite, gneiss, trap rock, etc.; in sound condition	100
2	Foliated rocks, such as schist and slate, in sound con- dition	40
3	Sedimentary rocks, such as hard shales, siltstones, or sandstones, in sound condition	15
4	Exceptionally compacted gravels or sands	10
5	Gravel; sand-gravel mixtures; compact	6
6	Gravel, loose; coarse sand, compact	4
7	Coarse sand, loose; sand-gravel mixtures, loose; fine sand, compact; coarse sand, wet (confined)	3
8	Fine sand, loose; fine sand, wet (confined)	2
9	Stiff clay	-4
10	Medium stiff clay	2
11	Soft clay	1
12	Fill, organic material, or silt	See footnote 2

#### PRESUMPTIVE UNIT SOIL BEARING VALUES

 $^1$  Presumptive bearing values apply to loading at the surface or where permanent lateral support for the bearing soil is not provided.

<sup>2</sup> Except in cases where, in the opinion of the enforcement officer, the bearing value is adequate for light frame structures, fill material, organic material, and silt shall be deemed to be without presumptive bearing value. The bearing value of such material may be fixed on the basis of tests or other satisfactory evidence.



## Modification of Bearing Value

## 1—Variation in Underlying Soils

Where the bearing materials directly under a foundation overlie stratum having smaller allowable bearing value, such smaller value may not be exceeded at the level of such stratum. Computation of the vertical pressure in the bearing materials at any depth below a foundation is to be made on the assumption that the load is spread uniformly at an angle of 1 horizontal to 2 vertical.

## 2-Loosened Bearing Materials

Wherever bearing material is loosened or disturbed by a flow of water, the bearing value is to be reduced to the allowable bearing value of the loosened material, unless the loosened material is removed. Where the flow of water is controlled by well points, or by other method, so that the bearing material is not disturbed or loosened, the full bearing value of the unloosened material may be assumed.

## 3—Foundations on Laterally Supported Soil

The presumptive unit bearing values given above may be increased for load on soil where, because of depth below ground level and permanent lateral support of the bearing soil, greater bearing values are justified. Such greater bearing values may be used only with the approval of the enforcement officer.

## AM 302-1a Soil Bearing Load Test

## Procedure

1—Tests are to be made and interpreted so as to take into account all significant factors, such as the presence of soft underlying strata, variations in size of footings, and the compressibility of the soils encountered. When there is material variation in size of proposed footings, loading tests are to be made on several different sized areas as a guide to determining the allowable bearing values for the related footing sizes.

2—Tests are to be made where surface water conditions and ground water conditions are representative for the bearing soil, and when the soil tested is free from frost.

3—The test is to be made on leveled but otherwise undisturbed portions of foundation bearing material. Where tests are made materially below the ground level, any unexcavated material immediately adjoining the test location is to be removed, so as to eliminate effect of surcharge or reinforcing.

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4—The test assembly is to consist of a vertical timber or post, with or without braced timber footing, resting upon the soil to be tested and supporting a platform on which the test loads are to be placed. The exact area resting upon the soil is to be ascertained, and may be not less than 1 square foot for bearing materials of classes 1 to 4 inclusive as indicated in the table in section AM 302-1 *Structural Standards—Soil Bearing Value*, *Determination*, part 3, page 99, entitled, "Presumptive Unit Soil Bearing Values," and not less than 4 square feet for other bearing materials. The platform is to be symmetrical in respect to the post, and as close to the bearing soil as practicable. The post is to be maintained in a vertical position by guys or wedges. Load may be any convenient material which can be applied in the increments required, such as cement or sand in bags, or pig iron or steel in bars. In applying the load, precautions are to be taken to prevent jar or movement of the post. See illustration in section AM 302-1a *Structural Standards—Soil Bearing Value*, *Determination*, part 3, page 102, entitled, "Test Assembly for Bearing Materials of Classes 5 to 12."

5—Settlement readings shall be taken at least once every 24 hours at a point which shall remain undisturbed during the test, and the settlement shall be plotted against time. The proposed allowable load per square foot shall be applied and allowed to remain undisturbed until there has been no settlement for 24 hours. An excess load of 50 per cent of the proposed allowable load shall then be applied and allowed to remain undisturbed until there has been no settlement for 24 hours.



Test Assembly for Bearing Materials of Classes 5 to 12



Note: For required bearing area on bearing materials of classes 1 to 4 see table in section AM 302-1 Structural Standards—Soil Bearing Value, Determination, part 3, page 99, entitled, "Presumptive Unit Soil Bearing Values."



**Procedure**-Apply loads in accordance with the requirements of section AM 302-1a Structural Standards—Soil Bearing Value, Determination, part 3, page 100, under the heading, "Soil Bearing Load Test." For the assembly illustrated, the load per square foot on the soil equals  $\frac{1}{4}$  of the load on the platform times Y/Z, plus approximately 500 pounds for the test assembly. Establish the bench mark before steel plate and the 6-by-8s are placed in position in order to include the weight of the test assembly.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

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Code Manual——State Building Code Commission Structural Standards – Soil Bearing Value, Performance Criteria	AM 302-2	3

## AM 302-2 Performance Criteria

### Acceptance Basis

1—For acceptance of the proposed allowable load per square foot, the total settlement under that load shall not exceed  $\frac{3}{4}$  inch, and the increase in settlement due to the 50 per cent excess load shall not exceed 60 per cent of the settlement due to the proposed allowable load per square foot.

2—In the event of failure of the soil test to meet the above requirements, either a new test at a reduced load is to be made on a new undisturbed area, or the results previously obtained are to be evaluated and the proposed allowable load reduced accordingly by the enforcement officer.

3	AM 303	Code Manual——State Building Code Commission Structural Standards – Analysis and Test Procedures
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## AM 303 Analysis and Test Procedures

## AM 303-1a Design Analysis

Reinforced Concrete (see section AM 301b Structural Standards-General Requirements -Reinforced Concrete, part 3, page 39, entitled, "Reinforced Concrete").

Stucco (see section AM 301b Structural Standards—General Requirements—Stucco, part 3, page 39, entitled, "Stucco").

Reinforced Gypsum Concrete (see section AM 301b Structural Standards—General Requirements—Reinforced Gypsum Concrete, part 3, page 39, entitled, "Reinforced Gypsum Concrete").

Structural Steel (see section AM 301b Structural Standards-General Requirements-Structural Steel, part 3, page 40, entitled, "Structural Steel").

Steel Joists (see section AM 301b Structural Standards-General Requirements-Steel Joists, part 3, page 40, entitled, 'Steel Joists").

Formed Steel Construction (see section AM 301b Structural Standards—General Requirements—Formed Steel Construction, part 3, page 41, entitled, "Formed Steel Construction").

Masonry (see table in section AM 301b Structural Standards—General Requirements —Masonry Construction, part 3, page 22, entitled, "Allowable Stresses for Masonry Bearing Walls").

Wood (see tables in section AM 301b Structural Standards—General Requirements—Wood Construction, part 3, pages 45, 46, 47, 48, and 49, entitled, "Yard Lumber, Allowable Unit Stresses," and "Working Stresses for Stress-Grade Lumber."

Stressed Plywood (see table in section AM 301b Structural Standards-General Requirements-Stressed Plywood Construction, part 3, page 89, entitled, "Douglas Fir Plywood, Allowable Unit Stresses."

## AM 303-1b Tests

## Acceptable Test Procedures

## 1—Wall, Partition, Floor and Roof Panels

Tests are to be made in conformity with the procedures specified in ASTM, Tentative Methods of Conducting Strength Tests of Panels for Building Construction listed in AM appendix A.

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## 2-Columns, Piers, and Posts: Compressive Load

(a)—The load is to be applied as an eccentric load at the upper end, with the lower end resting, as a "flat end," on the platen of the testing machine.

(b)—If the structural specimen is symmetrical about a longitudinal axis, the eccentric load is to be applied at a distance from the longitudinal axis equal to one third the distance from the axis to the outer fiber of the structural specimen.

(c)—If the structural specimen is not symmetrical about a longitudinal axis, the centroidal axis of the cross section of the structural specimen for the least moment of inertia is to be determined, and the eccentric load is to be applied along a line parallel to the centroidal axis, at a distance from it equal to one third the distance from that axis to the more remote extreme fiber of the structural specimen. Loads are to be applied, and measurements to determine behavior under load are to be taken, as specified for wall panels in ASTM, *Tentative Methods of Conducting Strength Tests of Panels for Building Construction* listed in AM appendix A.

## **3**—Evaluation of Test Results

(a)—Uniformity: The uniformity of test results and of materials tested is to be taken into account in evaluation of test results. Each test is to be made on at least three respective specimens, and the results plotted. The average value derived from such tests is to govern. When there is reasonable doubt that workmanship in the field will be equal to workmanship in test specimens, test results are to be evaluated accordingly.

(b)—Duration of Test Period: Each increment of test load is to remain in place for a minimum of 15 minutes, and readings to be taken thereafter. When it is apparent that continued application of load may result in increasing deformation, or in structural damage or structural failure, the test load is to be maintained for a minimum of 24 hours.

(c)—Temperature and Humidity Conditions: When it is apparent that extremes of temperature or humidity conditions experienced in use, or rapid variations in temperature within the range which may be experienced, may result in greater deformation, or in structural damage or structural failure, test conditions are to simulate, so far as practicable, the most severe conditions of use.

3	AM 304	Code Manual——State Building Code Commission Structural Standards – Design Loads
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## AM 304 Design Loads

## AM 304-4d Uplift Due to Hydrostatic Loads

See section AM 301d Structural Standards—General Requirements—Protection Against Ground Water, part 3, pages 95 to 98.

## AM 304-10 Loads Imposed During Construction

The loads imposed during construction are to be resisted if necessary by temporary supports so that the requirements as set forth in this standard with regard to stresses and deflection of floors, to the stresses and unbraced lengths and heights of walls, may not be exceeded.

## AM 305-5 Performance Criteria for Racking Loads

No panel subject to racking loads is to be deemed acceptable which deforms, while under the load, more than 1/800 of the height of panel under a load of 100 pounds per linear foot of panel.

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Code Manual——State Building Code Commission Structural Standards – Safety During Construction	AM 306	3

## AM 306 Safety During Construction

Safety measures during construction in conformity with the requirements of New York State Department of Labor, Industrial Code Rules Relating to Protection of Persons Employed in the Erection, Repair and Demolition of Buildings or Structures, listed in AM appendix A, are acceptable under this Code.

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## **STATE BUILDING CONSTRUCTION CODE** applicable to One- and Two-Family Dwellings

#### Part 4

#### **Fire-Safety Requirements**

#### A 401 PREVENTION OF EXTERIOR FIRE SPREAD

#### A 401-1 General Requirements

Buildings shall be located and constructed so that the distance between buildings and the fire resistance of exterior walls and of roof coverings are commensurate with the extent and degree of the fire hazard involved in order to retard the rapid spread of fire.

#### A 401-2 Fire Limits

Fire limits established by municipalities shall for the purposes of this Code be classified as follows:

a----Fire limits A comprising the areas containing highly congested business, commercial and, or industrial occupancies wherein the fire hazard is severe.

b----Fire limits B comprising the areas containing residential, business and, or commercial occupancies or in which such uses are developing, wherein the fire hazard incident to congestion and use is moderate.

#### A 401-2.1 Outside Fire Limits

All those areas not included in fire limits A and B are designated herein as outside fire limits.

#### A 401-2.2 Municipalities Having No Fire Limits

Buildings and structures located in municipalities which do not designate any particular area or areas within their boundaries as a fire limit shall be constructed in accordance with the requirements of section A 401 applicable to buildings located outside fire limits.

#### A 401-2.3 Municipalities Having Fire Limits

Buildings and structures located in municipalities which designate one or more areas within their boundaries as fire limits, shall be constructed in accordance with the requirements of section A-401 applicable to buildings located in fire limits,

#### A 401-3 Distance Separations

#### A 401-3.1 General Requirements

a——Distance separation shall be the clear distance between buildings or between the proposed building and the line on which a building may lawfully be built on adjacent property in order to retard the spread of fire. Distance separation shall be measured from the outside face of exterior walls.

b----Distance separations shall apply only to buildings having an above-grade building volume of 1000 cubic feet or more. Where zoning ordinances, or health ordinances or regulations require greater distance separations, such greater distance requirements shall govern. c——Those walls or portions thereof located outside of the required distance separation shall be exempt from any requirements imposed by distance separations.

#### A 401-3.2 When Required

Distance separations shall be required when the exterior walls of buildings are of:

a----Noncombustible construction having a fire-resistance rating of less than  $\frac{3}{4}$  hour.

b——Combustible construction without noncombustible exterior facing providing at least <sup>3</sup>/<sub>4</sub>-hour fire protection; except when located outside fire limits, and of combustible construction without noncombustible facing and with an over-all fire-resistance rating of less than <sup>3</sup>/<sub>4</sub> hour. (See section A 401-3.4.)

#### A 401-3.3 Minimum Distance Separations

a——Distance separations in table A 401-3.3 are the minima required. b——Minimum distance separations in table A 401-3.3 applicable to combustible exterior walls shall apply where the exterior walls of either the proposed building or an existing building are of combustible construction, except that in any case the distance required shall be for the building having the greater above-grade building volume.

TABLE A 401-3.3.——MINIMUM DISTANCE SEPARATIO In feet	N

	In fire limits A		In fire limits B		Outside fire limits	
Above-grade building volume in cubic feet	Noncombustible exterior walls	Combustible exterior walls (See section A 401-3.4)	Noncombustible exterior walls	Combustible exterior walls (See section A 401-3.4)	Noncombustible exterior walls	Combustible exterior walls
1000 to 4000 4001 to 8000 8001 or more	3 5 10	5 10 Not per- mitted	0 3 8	3 5 10	0 3 5	3 5 5

#### A 401-3.4 Construction Limitations

a-----Within fire limits A and B, all exterior walls of wood frame construction, except that in any case the distance required shall be for least  $\frac{3}{4}$ -hour fire protection.

b——Within fire limits A, dwellings of wood frame construction shall not exceed one story in height nor an above-grade building volume of 8000 cubic feet.

c-----Within fire limits B, dwellings of wood frame construction shall not exceed two stories in height.

#### A 401-3.5 Alternate Protective Construction

In lieu of the fire-resistive construction required for walls or parts thereof in conformity with distance separations, such walls or parts thereof within distance separations may be shielded by protective walls having the required fire-resistive construction.
#### A 401-4 **Openings in Exterior Walls**

Exterior walls within a distance separation of less than 3 feet shall either be without openings, or openings in such walls shall be equipped with opening protectives having minimum fire-resistance rating of 20 minutes.

b--Exterior walls extending across a common lot line or a common line between two adjoining dwellings, and having openings within  $1\frac{1}{2}$ feet of such lines, shall have such openings equipped with opening protectives having minimum fire-resistance rating of 20 minutes unless such openings are shielded by protective walls in conformity with section A 401-3.5.

-Opening protectives shall not be required where the floor area in two or more buildings on the same premises totals no more than the maximum floor area set forth in section A 402-2.1.

#### **Miscellaneous Requirements Within Fire Limits** A 401-5

-Within fire limits, open porches, enclosed porches containing 50 per cent or more of glass area, and balconies of wood frame construction, extending outward not more than 10 feet from the building face and upward not more than 3 feet above the second story level, may be attached to a dwelling or row house provided the distance from similar constructions attached to adjacent buildings is 3 feet or more.

b-–Within fire limits, exterior eaves, and main exterior cornices or trim, may be of wood except when the distance between buildings is less than 3 feet.

#### A 401-6 Eaves, Cornices, and Trim

-Eaves and main exterior cornices may project beyond the building face not more than one third of the required distance separations, but this regulation shall not be deemed to authorize any projection beyond the lot line.

-Building trim may project beyond the building face not more b-than one sixth of the required distance separation, but this regulation shall not be deemed to authorize any projection beyond the lot line.

#### A 401-7 **Roof Coverings**

All roof coverings shall be capable of resisting fire commensurate with the severity of exposure and shall be installed in conformity with generally accepted standards, and shall be securely fastened and weathertight.

#### A 401.7.1 Classification

Roof coverings shall be classified in accordance with generally accepted standards, as follows:

-Class I roof coverings shall be effective against severe fire **a**-exposure and, under such exposure, shall not be readily flammable; shall not carry or communicate fire; shall afford a fairly high degree of heat insulation to the roof deck; shall not slip from position; shall possess no flying-brand hazard; and shall not require frequent repairs in order to maintain fire-resistive properties.

-Class 2 roof coverings shall be effective against moderate fire hexposure and under such exposure shall be similar to class 1 roof coverings except to afford a moderate degree of heat insulation to the roof deck and require only infrequent repair in order to maintain fireresistive properties.

State Building Construction Code applicable to One- and Two-Family Dwellings | Fire-Safety Requirements

Class 3 roof coverings shall be effective against light fire exposure and under such exposure shall be similar to class 2 roof coverings except to afford at least a slight degree of heat insulation to the roof deck and require only occasional repairs in order to maintain fire-resistive properties.

d--Class 4 roof coverings shall be at least moderately effective against light fire exposure, but do not include such coverings as wood shingles or those lightweight felt roll roofings which are readily ignitable and likely to give off flying brands.

#### A 401-7.2 Limitation of Use

-Within fire limits, roof coverings shall be classes 1, 2, or 3; except a--that where the distance separation is more than 5 feet and the abovegrade building volume does not exceed 8000 cubic feet, class 4 roof coverings may be used.

-Outside fire limits, roof coverings shall be classes 1, 2, 3, or 4; b except that lightweight roll roofing or wood shingles are permitted only on buildings with an above-grade building volume of not more than 8000 cubic feet and a distance separation of not less than 5 feet, and on buildings with an above-grade building volume of more than 8000 cubic feet and a distance separation of not less than 10 feet.

#### A 402 **PREVENTION OF INTERIOR FIRE SPREAD**

#### **General Requirements** A 402-1

Dwellings shall be constructed, arranged, and of such floor area so as to confine and restrict the spread of fire.

#### A 402-2 **Division by Fire Partitions**

#### A 402-2.1 **Maximum** Areas

The maximum floor areas in dwellings or a group of attached dwellings, within exterior walls, or within exterior walls and a fire partition, or within fire partitions, shall not exceed the following:

Construction classification	Fire-resistance of structural elements	One-story buildings	Two-story buildings	Three-story buildings
Туре 1 <sup>2</sup>	1½ hr. or more	14,000	12,000	10,000
Туре 2	<sup>3</sup> ⁄4 hr. or more	12,000	10,000	8,000
	Less than <sup>3</sup> ⁄4 hr.	9,000	7,000	5,000
Туре 3	3/4 hr. or more	10,000	8,500	7,500
Туре 4	<sup>3</sup> ⁄ <sub>4</sub> hr. or more	10,000	8,500	7,500
	Less than <sup>3</sup> ⁄ <sub>4</sub> hr.	7,500	6,500	5,500
Туре 5	<sup>3</sup> ⁄ <sub>4</sub> hr. or more	6,000	5,000	4,500
	Less than <sup>3</sup> ⁄ <sub>4</sub> hr.	4,000	3,500	3,000

TABLE A 402-2.1.----MAXIMUM FLOOR AREA PER STORY1 In square feet

<sup>1</sup> The area of any one story may be increased to that permitted for a one-story building provided the total area of the building does not exceed the total area permitted. <sup>2</sup> Areas of type I fire-resistive construction may be unlimited when structural elements have a fire-resistance rating of 3 hours or more.

**Fire-Safety Requirements** 

### State Building Construction Code applicable to One- and Two-Family Dwellings

#### A 402-2.2 Construction

-Fire partitions shall be designed and constructed in conformity awith the structural requirements of part 3 of this Code, maintain stability and stay in place to prevent the passage of fire from one side of the partition to the other.

-Fire partitions shall be constructed of noncombustible materials and shall extend to the outer facing of all walls having lower fire resistance than the fire partition, except that such partition shall not be required to extend through the outer facing of the exterior wall.

-In dwellings of other than type I fire-resistive construction, the fire partitions shall be continuous from the foundation to the roof level, except that fire partitions may be offset provided the offset floor construction and the wall support shall be constructed of noncombustible materials with a fire-resistance rating of not less than that required for the fire partition.

-Fire partitions shall extend not less than 6 inches through the roof, except when such partitions are built smoketight to the underside of the roof construction and the roof is of noncombustible construction or firestopped and protected by noncombustible material for a distance of 18 inches on each side of the fire partition.

#### **Required Fire Resistance** A 402-2.3

-Fire partitions in dwellings of type I fire-resistive construction shall have a minimum fire-resistance rating of  $1\frac{1}{2}$  hours.

b--Fire partitions in all dwellings other than type I fire-resistive construction shall have the following minimum fire-resistance ratings:

Height of dwelling in stories	Basement	First story	Second story	Third story
One story		1		
One story and basement	2	1 1/2		
Two story		2	1 1/2	
Two story and basement	3	2	1 1⁄2	
Three story	_	3	2	1 1/2
Three story and basement	3	2	1 1/2	1 1/2

TABLE A. 402-2.3.--FIRE-RESISTANCE RATINGS<sup>1</sup> In hours

<sup>1</sup> The fire-resistance ratings shall apply to that part of the fire partition from the underside of the floor construction to the underside of the floor or ceiling construction directly above.

#### A 402-3 **Division by Party Walls**

#### A 402-3.1 **General Requirements**

When dwellings are joined at a common lot line, and are not separated by a fire partition, such dwellings shall be separated by party walls in conformity with the requirements set forth in this section.

#### A 402-3.2 Construction

-Party walls shall be designed and constructed in conformity awith the structural requirements of part 3 of this Code; shall form a continuous fire and smoke barrier between adjoining buildings from foundation to or through the roof as set forth in section A 402-2.2d; and shall not in the event of removal or collapse of supported construction on one side endanger the support of construction on the opposite side.

-Within fire limits, party walls shall be of noncombustible conb---struction.

-Outside fire limits, party walls shall be of noncombustible construction below the level of the first floor construction.

#### A 402-3.3 **Fire Resistance**

The fire-resistance ratings of party walls shall be 3/4 hour or more for those portions above the bottom of the first floor construction, and  $1\frac{1}{2}$  hours or more below that level.

#### A 402-4 **Division by Fire Separation**

#### A 402-4.1 **General Requirements**

-Fire separations shall be provided and so arranged between a--each two dwelling units to prevent the spread of fire into adjoining dwelling units.

-Stairways and passageways serving in common two dwelling units and leading to an exit shall be enclosed by fire separations. Stairways and passageways leading to an exit and passing through or adjoining another dwelling unit shall be separated therefrom by a fire separation.

#### A 402-4.2 Construction

a-Fire separations and their supporting constructions shall be designed and constructed in conformity with the structural requirements of part 3 of this Code and shall form a continuous fire and smoke barrier.

b------Fire separations required between each two dwelling units shall be in conformity with the requirements set forth in section A 402-4.2a, and shall be continuous from foundation to the underside of the roof construction.

#### A 402-4.3 **Fire Resistance**

Fire separations shall have fire-resistance rating of  $\frac{3}{4}$  hour or more for those portions above the bottom of the first floor construction, and below that level, shall be of noncombustible construction having a fireresistance rating of  $1\frac{1}{2}$  hours or more.

#### A 402.5 **Openings in Fire Partitions, Party Walls**

#### and Fire Separations

-Openings shall not be permitted in party walls.

-Openings in fire partitions and fire separations having a fireresistance rating of 11/2 hours or more, shall be equipped with selfclosing opening protectives having a fire-resistance rating of 11/2 hours or more.

-Openings in fire separations having a fire-resistance rating of C-3/4 hour, shall be equipped with self-closing opening protectives having a fire-resistance rating of 20 minutes or more.

#### A 403 **PREVENTION OF FIRE SPREAD WITHIN**

### DWELLING UNIT

#### **General Requirements** A 403-1

Concealed spaces within wall, partition, floor, stair, attic, or cornice constructions, and around chimney, pipe and duct openings in such constructions through which flames or hot gases may spread within a dwelling, or from one dwelling to another, shall be firestopped to prevent the rapid spread of fire.

## Fire-Safety Requirements | State Building Construction Code applicable to One- and Two-Family Dwellings

#### A 403-2 Location of Firestopping

a——Concealed vertical spaces shall be firestopped at each floor level and at the ceiling of the uppermost floor, and so as not to communicate with concealed horizontal spaces. Concealed horizontal spaces shall not extend more than 20 feet.

b——Spaces concealed by combustible surface finishes shall be firestopped at intervals not exceeding 8 feet horizontally and vertically. c——Concealed spaces in cornices shall be firestopped at intervals not exceeding 20 feet, and at the ends of fire partitions, party walls, or fire separations.

d——Attics and roof spaces shall be firestopped so that no undivided area exceeds 3000 square feet.

e——Concealed space between stair stringers shall be firestopped at least once near the middle of each run.

#### A 403-3 Material for Firestopping

Wood blocking, wood construction, or noncombustible material which can be firmly fixed in position to prevent the passage of flames and hot gases for a period of time equal to or greater than that provided by wood of 2-inch nominal thickness, is acceptable for firestopping, except that noncombustible firestopping materials shall be used in noncombustible constructions.

#### A 403-4 Attic Fire Shutters

Ventilating shutters in interior walls and ceilings through which air is discharged into or supplied from attic spaces, shall close automatically in case of fire in order to prevent the spread of fire to the attic.

#### A 404 INTERIOR FINISHES

#### A 404-1 General Requirements

Interior finish materials, in burning, shall not give off gases which are harmful or toxic in small concentrations, nor shall they exceed the flame-spread ratings set forth in section A 404-2.

#### A 404-2 Limitation of Use

a----Interior finish materials in hallways, stairways, or exitways that are required to have <sup>3</sup>/<sub>4</sub>-hour fire separations, shall have a flamespread rating not exceeding 90 as determined by the tunnel type test set forth in paragraph designated d of this section.

b——Interior finish materials in all spaces other than as provided for in section A 404-2a, shall have a flame-spread rating not exceeding 250 as determined by the tunnel type test set forth in paragraph designated d of this section.

c——Interior finish materials which can be shown by other test methods to have flame-spread ratings equivalent to those set forth in paragraphs designated a and b of this section shall be acceptable.

d——Tunnel type test: Flame-spread ratings shall be given as a comparative value on a scale for which the zero and 100 points are separately and arbitrarily established by subjecting cement-asbestos board and select grade A red oak, lining the top of the inside of a tunnel type test furnace, to flame and draft at the inlet and so regulated that flame will spread on the surface of the red oak test material to reach the outlet end of the 25-foot long tunnel furnace after 6 minutes of exposure to the igniting flame. State Building Construction Code applicable to One- and Two-Family Dwellings | Fire-Safety Requirements

#### A 405 FIREPLACES

#### A 405-1 General Requirements

Fireplaces and similar constructions intended for burning fuel in open fires shall be designed and constructed of noncombustible materials, shall be stable and structurally safe, shall be connected to flues in conformity with the requirements set forth in section A 503-3, and under conditions of use shall not ignite attached or adjacent combustible material.

#### A 405-2 Hearths and Linings

Hearths and linings or other parts of fireplaces exposed directly to flame shall be of materials that will not melt, disintegrate, spall, or shatter at temperatures up to 2000° F.

#### A 405-3 Mantels and Trim

Wood mantels and trim on fireplaces shall be attached so that they cannot be heated to temperatures in excess of 175° F. or ignited by sparks or embers from the fire.

#### A 405-4 Adjacent Combustible Building Members

Fireplaces shall be constructed and insulated so that, when they are in use, adjacent or nearby combustible material shall not be heated to temperatures in excess of 175° F. or be exposed to sparks or embers from the fire.

#### A 405-5 Chimneys

Fireplaces shall be connected to chimneys or flues in conformity with the requirements of this Code.

#### FIRE PROTECTION FROM HEAT PRODUCING A 406 EQUIPMENT

#### A 406-1 **General Requirements**

-Heat producing equipment shall be mounted on noncombustible floor constructions, or on protected combustible floor constructions; shall be installed with sufficient clearance from adjacent wood and other combustible constructions to prevent their ignition; and the ceiling shall be protected for a distance of 3 feet on all sides of the heat producing equipment by a noncombustible material providing 10 minutes or more of fire protection, except when such ceiling is constructed of noncombustible material and has a fire-resistance rating of  $\frac{3}{4}$  hour or more.

-Where heat producing equipment is installed on the first floor b or above and is located in an enclosed space, such space shall have enclosure walls, floors, and ceilings with an over-all fire-resistance rating of 3/4 hour or more and a noncombustible interior finish providing 10 minutes or more of fire protection to the combustible members. Such space shall not have exposed openings to other parts of the dwelling interior except a door opening equipped with a selfclosing door having a fire-resistance rating of 20 minutes or more. Such enclosed space shall have ventilation to the outside of the dwelling either through openings in the exterior walls or through flues or vents leading directly to the outside.

-Heat producing equipment shall not be installed in attics except when of an approved type installed to conform with the requirements of this section.

### Fire-Safety Requirements

### A 407 PRIVATE GARAGES

#### A 407-1 General Requirements

a———Private garages which are attached to or form part of dwellings shall be separated from adjoining or adjacent parts of dwellings by distance, or by fire-protective materials and constructions, to retard the spread of fire from within a garage to the dwelling.

b——Floors of private garages shall be placed or arranged so that heavier-than-air flammable vapors cannot spread to fixed sources of ignition. Such floors shall be of materials that will not absorb flammable liquids nor be ignited.

c——Construction of private garages and arrangement of fixed installations shall be such that toxic gases originating within garages shall not spread to the dwellings, nor shall air for heating, ventilation and such uses be circulated through garages to dwellings.

### A 407-2 Separation Requirements

a——An open breezeway 5 feet or more in length shall be acceptable as distance separation, providing a draft stop is placed between the roof and ceiling in the garage end of the breezeway. A draft stop may be of 2-inch nominal thickness of wood or one faced with noncombustible material on the garage side.

b——When the open breezeway is less than 5 feet in length the distance separation shall not be acceptable and separation by fireprotective materials and constructions shall be required. Such constructions shall be smoketight and of noncombustible finish materials on the garage side of walls, partitions, floors and ceilings extending over an area of 5 feet from or in common with the dwelling, provided such finish will prevent the ignition of combustible members of such protected parts for 10 minutes or more. Parts of garage walls, floors and ceilings that are in common with dwelling walls, floors or ceilings, shall have a combined fire-resistance rating of 30 minutes or more.

### A 407-3 Passageway to Dwellings

a——Passage between an attached or built-in garage and a dwelling shall be through a door-opening equipped with a self-closing door having a fire-resistance rating of not less than 20 minutes. Such door shall not open directly into a room used for sleeping purposes.

b——The top of the sill of a door-opening between a garage and dwelling shall be at least 8 inches above the level of the garage floor.

### A 407-4 Permissible Equipment

Any permanent heating or other appliance with an open flame, for use within a garage, shall be of an approved type and installed not less than 6 feet above the floor level. Code Manual——State Building Code Commission Fire-Safety Standards – Distance Separations



### AM 401-3 Distance Separations

# AM 401-3.1 General Requirements

1—Buildings with an above-grade building volume of 1000 cubic feet or more shall be separated from each other by a distance or construction sufficient to prevent the spread of fire from one to another. The required distance separation is commensurate with the fire hazard involved. The fire hazard or likelihood of spread of fire from building to building is governed by the size of the building or the size of the fire, by the construction of the exterior wall, and by the general location of the group of buildings within or outside fire limits.

2—Distance separations set forth in table A 401-3.3 of the Code shall be applied and measured as illustrated in section AM 401-3 *Fire-Safety Standards—Distance Separations*, part 4, page 14, entitled, "Distance Separations: Relation to Buildings and Building Line."

3—Those walls or portions thereof located outside of the required distance separation shall be exempt from any requirements imposed by distance separations. This requirement shall be interpreted to mean that those parts of the walls outside of the minimum distance separations for combustible exterior walls may be combustible and those parts within the minimum distance separations shall be of noncombustible construction as illustrated in section AM 401-3.3 *Fire-Safety Standards—Minimum Distance Separations*, part 4, page 15, entitled, "Minimum Distance Separation: Relation to Construction."

# AM 401-3.2 When Required

1—Distance separations are required when the exterior walls have an over-all fire-resistance rating of less than  $\frac{3}{4}$  hour even though they are constructed entirely of noncombustible materials. The fire-resistance requirement implies an exterior fire exposure which all masonry walls, at least 6 inches thick, constructed in conformity with the structural standards of this Manual, will readily resist for  $\frac{3}{4}$  hour or more. Thin sheet metal constructions will not meet this requirement unless well insulated.

2-Within fire limits, distance separations are also required when the exterior walls of combustible construction are not faced on the exterior side with noncombustible material providing  $\frac{3}{4}$ -hour fire protection to the combustible framing. Brick veneering having a nominal thickness of 4 inches is one of many exterior facing constructions providing  $\frac{3}{4}$ -hour fire protection to the combustible framing of exterior walls. Noncombustible facings of slate, asbestos-cement board or shingles, sheet metal, stucco or thin veneers will not give  $\frac{3}{4}$ -hour fire protection to combustible framing of exterior walls.



### SEPARATION TO LINE TO WHICH BUILDING ON ADJACENT PROPERTY MAY LAWFULLY BE BUILT

EXTERIOR WALL REQUIREMENTS OUTSIDE OF DISTANCE SEPARATIONS

Note: When there is no building on adjacent property, an existing building of the same size and construction as the proposed building shall be assumed. In such cases, the distance from the proposed building to the common lot line shall be one half of the distance separation.



b-Minimum distance separations in table A 401-3.3 applicable to combustible exterior walls shall apply where the exterior walls of either the proposed building or an existing building are of combustible construction, except that in any case the distance required shall be for the building having the greater above-grade building volume.

building with large above-grade building volume building with same type of exterior walls as adjacent, but with small above-grade building volume

distance separation

distance separation

SEPARATION FOR BUILDING WITH GREATER VOLUME APPLIES

SEPARATION FOR BUILDING WITH

COMBUSTIBLE WALLS APPLIES



SEPARATION FOR BUILDING WITH NONCOMBUSTIBLE EXTERIOR WALLS APPLIES BECAUSE OF ITS LARGER BUILDING VOLUME



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# Alternate Protective Construction: Shielding Walls



DISTANCE SEPARATION

# Shielding Walls

Walls within distance separation which do not meet the requirements imposed by such separation may be shielded by walls of fire-resistive construction. Such shielding walls should be extended as far beyond the wall to be shielded as the building protrudes within the distance separation but not less than 16 inches.

Code Manual——State Building Code Commission Fire-Safety Standards – Openings in Exterior Walls



NOVEMBER 1951

# AM 401-4 Openings in Exterior Walls

# General

The provisions of this section apply only to required opening protectives.

# Acceptable Tests

The fire-resistance ratings of opening protectives are determined by subjecting representative doors, shutters, windows, etc., with their attachments and frames to fire tests made in accordance with ASTM, *Standard Methods of Fire Tests of Door Assemblies*, (see AM appendix A), or by reasonable extension and interpretation of information derived from fire tests of similar assemblies.

# Opening Protectives Having Fire-Resistance Rating of 20 Minutes or More

## 1—Windows

Windows and other glazed openings conforming to the following requirements shall be deemed to have a fire-resistance rating of 20 minutes or more:

### Size of Opening

Single Sash: Maximum window opening area, 35 square feet, with neither dimension being more than 10 feet horizontally or vertically.

Multiple Sash: Maximum window opening area, 70 square feet, with neither dimension being more than 10 feet horizontally or vertically.

Glass—Wired glass having a thickness of not less than  $\frac{1}{4}$  inch and each individual glass light being not more than 54 inches horizontally or vertically.

Frame—Noncombustible frame providing a secure and rigid support for individual glass and having firm anchorage in the wall opening.

# 2-Glass Block Panels

Glass block panels conforming to the following requirements shall be deemed to have a fire-resistance rating of 20 minutes or more:

Size of Opening-Maximum area, 120 square feet, with neither dimension being more than 12 feet horizontally or vertically.

Size of Glass Block—Maximum nominal size, 8 by 8 by 4 inches.

Construction—Blocks shall be laid with  $\frac{1}{4}$  to  $\frac{3}{8}$ -inch mortar joints using type B mortar as described in section AM 301b Structural Standards—General Requirements—Masonry Construction, part 3, page 19, under the heading, "Mortar Proportions by Volume."



The horizontal mortar joints, except those between the two top rows of block, should be reinforced for their full length with 2-by-8-inch galvanized wire mesh made with Nos. 9 and 14 Washburn & Moen gage steel wire. In masonry walls, glass block panels should extend approximately  $1\frac{1}{4}$  inches into  $2\frac{1}{4}$ -inch deep grooves in the jambs and at the head of the opening, and the remaining space in the grooves filled with glass or mineral wool to permit unrestricted expansion of the panel. Such grooves for expansion may also be formed with steel shapes fastened to the construction at the edge of the opening in such a manner as to permit the steel to expand when heated.

## 3—Doors

Doors, frames and hardware meeting the 20-minute fire-resistance requirement are illustrated in section AM 402-5 Fire-Safety Standards—Openings in Fire Partitions, Party Walls, and Fire Separations, part 4, page 33, entitled, "Wood Doors for 20-Minute Opening Protectives," and part 4, page 34, entitled, "Frames and Hardware for 20-Minute Opening Protectives." Where the fire-resistance rating of doors in exterior openings is dependent upon an applied protection, that protection shall be applied on the exterior side of the door.





### Code Excerpt A 401-5 Miscellaneous Requirements Within Fire Limits

a-Within fire limits, open porches, enclosed porches containing 50 per cent or more of glass area, and balconies of wood frame construction, extending outward not more than 10 feet from the building face and upward not more than 3 feet above the second story level, may be attached to a dwelling or row house provided the distance from similar constructions attached to adjacent buildings is 3 feet or more.

D-REQUIRED DISTANCE FROM SIMILAR CONSTRUCTIONS

### BALCONY OF WOOD FRAME CONSTRUCTION



D-REQUIRED DISTANCE FROM SIMILAR CONSTRUCTIONS

### PORCH OF WOOD FRAME CONSTRUCTION



**D**-required distance separation

# Code Excerpt A 401-6 Eaves, Cornices, and Trim

a-Eaves and main exterior cornices may project beyond the building face not more than one third of the required distance separations, but this regulation shall not be deemed to authorize any projection beyond the lot line.

b-Building trim may project beyond the building face not more than one sixth of the required distance separation, but this regulation shall not be deemed to authorize any projection beyond the lot line.

Code Manual——State Building Code Commission		
Fire-Safety Standards – Roof Coverings – Classification	AM 401-7.1	4

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# AM 401-7.1 Roof Coverings—Classification

### General

1—The classifications of roof coverings are based on tests made by subjecting representative roofings applied on wood decks to:

Brand test, wherein flaming brands are used to determine the degree of protection against ignition of the combustible deck.

Flame exposure test, wherein an exposing flame is intermittently applied to determine the degree of protection to the combustible deck.

Flame spread test, wherein an exposing flame is continuously applied to determine the resistance to spread of flame over the surface of the roof covering.

2—Code Classifications: Built-up and prepared roof coverings generally fall under the inspection and label service of the Underwriters' Laboratories. When such roof coverings are assembled in conformity with the manufacturer's directions, and subjected to the Underwriters' Laboratories tests, they are designated as class A, class B, and class C. Underwriters' Laboratories class A, class B, and class C are acceptable under Code classifications as class 1, class 2, and class 3, respectively, except that certain lightweight roll roof coverings falling under the Underwriters' Laboratories class C do not meet the requirements of the Code for class 3, and therefore must be designated as class 4. Some noncombustible roof coverings, such as slate, tile, and concrete, are not classified by the Underwriters' Laboratories. Certain other materials, such as wood shingles and lightweight felt roll roofings, which do not meet the test requirements for class 4 roof coverings, are not classified under the Code.

3—All roof coverings must be weathertight and securely fastened. They should be installed according to the manufacturer's recommendation, and are required to be installed and fastened as the test sample used for the determination of classification.

4-See AM appendix B for roof coverings, by classification, meeting the requirements of the Code.

### **Test Assemblies**

1—The test assemblies shall consist of wood decks covered by the roofing to be tested. The decks, 3 feet 4 inches wide and 4 feet 4 inches long, shall be made of 1-by-8-inch boards spaced  $\frac{1}{4}$  inch apart and nailed at the ends to 2-by-4-inch rafters with two 6- or 8-penny nails at each end of each board. The lumber shall be of kiln-dried No. 1 common pine having moisture content not exceeding 15 per cent. It shall be free from sapwood and rot, edge knots, and other large or loose knots.

4	AM 401-7.1	Code Manual——State Building Code Commission Fire-Safety Standards – Roof Coverings – Classification
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2—Roof coverings shall be applied to the decks in accordance with the manufacturer's specifications, and not less than 30 nor more than 60 days after they are manufactured. After the roof covering is applied, the test assembly shall be aged for 30 to 60 days at temperatures of  $50^{\circ}$  to  $90^{\circ}$  F.

3—The test decks shall be set up for test at the maximum slope which the manufacturer recommends for installation of the roof covering, except that the slope shall not exceed 5 inches vertical to 12 inches horizontal.

4—During the tests, and until all evidence of flame, glow, and smoke has disappeared, the test shall be subjected to an air current, nearly parallel to the inclined surface of the roof covering, and having a velocity of approximately 12 miles per hour and an initial temperature of  $50^{\circ}$  to  $90^{\circ}$  F. The velocity and temperature of the air current shall be measured at the center and edges of the test deck, midway up the slope of the deck.

## Test Procedures

Test assemblies shall be subjected to each of three types of tests: brand tests, flame exposure tests, and flame spread tests.

## 1—Brand Tests

(a)—The brands used shall vary in size and type depending upon the classification for which the roof covering is being tested.

**Brands for Class 1 Roof Coverings**—Thirty-six 12-inch long, 1-by-1-inch nominal dressed wood strips of kiln-dried white (ponderosa) pine or Douglas fir spaced apart  $\frac{1}{4}$  inch, assembled to form a 12-by-12-inch three-ply panel approximately 2 11/32 inches thick. See illustration in section AM 401-7.1 *Fire-Safety Standards*—*Roof Coverings*—*Classification*, part 4, page 25, entitled, "Roof Coverings: Test Brands, Test Panels."

Brands for Class 2 Roof Coverings—Eighteen 6-inch long, 1-by-1-inch nominal dressed wood strips of kiln-dried white (ponderosa) pine or Douglas fir, spaced apart  $\frac{1}{4}$  inch, assembled to form a 6-by-6-inch three-ply panel approximately 211/32 inches thick. See illustration in section AM 401-7.1 *Fire-Safety Standards—Roof Coverings—Classification*, part 4, page 25, entitled, "Roof Coverings: Test Brands, Test Panels."

**Brands for Class 3 Roof Coverings**—Dressed two-inch square pieces of nominal 1-inch thick white (ponderosa) pine or Douglas fir pieces having ½-inch wide saw cuts or kerfs extending at right angles to each other and half way through the piece from each side. See illustration in section AM 401-7.1 *Fire-Safety Standards—Roof Coverings—Classi-fication*, part 4, page 25, entitled, "Roof Coverings: Test Brands, Test Panels."

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Brands for Class 4 Roof Coverings—Dressed  $1\frac{1}{2}$ -inch square pieces of nominal 1-inch thick white (ponderosa) pine or Douglas fir pieces having  $\frac{1}{8}$ -inch wide saw cuts or kerfs extending at right angles to each other and half way through the piece from each side. See illustration in section AM 401-7.1 *Fire-Safety Standards—Roof Coverings—Classification*, part 4, page 25, entitled, "Roof Coverings: Test Brands, Test Panels."

(b)—Ignition and Application of Test Brands—The brands shall be individually ignited in a gas furnace for a length of time that will assure complete burning when they are applied to the test roof covering, but for not more than 5 minutes. For roof coverings of the shingle type, the brands shall be placed just below the vertical joint between adjacent shingles.

### (c)—Acceptance Basis

### **Class 1 and 2 Roof Coverings**

For at least two out of three brands, no flame shall appear on the underside of the combustible deck. Flaming or glowing brands shall not be given off and there shall be no slippage of the roof covering.

### **Class 3 and 4 Roof Coverings**

For at least six out of nine brands, no flame shall appear on the underside of the combustible deck. Flaming or glowing brands shall not be given off and there shall be no slippage of the roof covering.

### 2—Flame-Exposure Tests

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The flame-exposure test shall be made by intermittent application of a luminous gas flame. The gas burner shall consist of a 2-inch gas pipe capped at one end and with a  $\frac{1}{2}$ -inch-wide slot along 3 feet of its length. The test panel shall be mounted with a noncombustible apron extending downward at least 18 inches from the lower edge of the panel to represent an exterior wall of the building at the roof. The burner shall be set so its flame impinges on the noncombustible apron and moves up around the eaves, and, under the influence of the air current, envelops the surface of the roofing. The gas input shall be adjusted so that the resulting flame, if not augmented by burning of the roof covering, will extend along the roof surface practically to the upper edge of the test deck.

### Acceptance Basis

### **Class 1 Roof Coverings**

Upon 15 flame applications, each of 2-minute duration and with 2-minute intervals between them, there shall be: no flame on the underside of the test deck; no flaming or glowing brands given off by the roof covering; and no slippage of roof covering.

4	AM 401-7.1	Code Manual——State Building Code Commission Fire-Safety Standards – Roof Coverings – Classification
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# Class 2 Roof Coverings

The test procedure and acceptance basis for class 2 roof coverings shall be the same as for class 1 roof coverings, except that only eight 2-minute flame applications shall be applied.

# **Class 3 Roof Coverings**

The test procedure and acceptance basis for class 3 roof coverings shall be the same as for class 1 roof coverings, except that only three 1-minute flame applications shall be applied.

# **Class 4 Roof Coverings**

The test procedure and acceptance basis for class 4 roof coverings shall be the same as for class 1 roof coverings, except as follows: only two 1-minute flame applications shall be applied; and some flaming or glowing brands may be given off.

# 3—Flame-Spread Tests

Three test decks arranged to provide a test assembly of 3 feet 4 inches wide and 13 feet long, as illustrated in section AM 401-7.1 *Fire-Safety Standards—Roof Coverings—Classification*, part 4, page 25, entitled, "Roof Coverings: Test Brands, Test Panels," shall be used for the flame-spread test.

The same gas burner with the same set-up used for the flame-exposure test shall be adjusted so that the resulting flame, if not augmented by burning of the roof covering, will extend to the top edge of the lower of the three decks making up the test assembly.

Measurements of flame spread shall be made after all flaming and glowing have ceased. Acceptance Basis

Class 1 Roof Coverings—With a 10-minute continuous application, the flame-spread shall be less than 9 feet upward from the lower edge of the assembly.

Class 2 Roof Coverings--With a 10-minute continuous application, the flame-spread shall be less than 13 feet up from the lower edge of the assembly.

Class 3 Roof Coverings—With a 4-minute continuous application, the flame-spread shall be less than 13 feet up from the lower edge of the assembly.

Class 4 Roof Coverings—With a 3-minute continuous application, the flame-spread shall be less than 13 feet up from the lower edge of the assembly.



4	AM 402-2	Code Manual——State Building Code Commission Fire-Safety Standards – Division by Fire Partitions
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# AM 402-2.1 Maximum Areas

Fire partitions serve to divide a building into the maximum floor area in which a fire can be confined. The permissible maximum floor areas are set forth in table A 402-2.1 of the Code.

# AM 402-2.2 Construction

1—Combustible members framed into fire partitions require not less than 4 inches of solid masonry or solid noncombustible material between them.

2—Additional construction details are illustrated in section AM 402-2.2 Fire-Safety Standards—Division by Fire Partitions—Construction, part 4, page 27, entitled, "Arrangement and Construction of Fire Partitions," and part 4, page 28, entitled, "Construction of Fire Partitions at Intersections."

## AM 402-2.3 Required Fire Resistance

1—In multistory buildings, increased fire resistance is required for fire partitions at the lower stories to allow for the combustibles added to lower stories when upper story constructions collapse. Fire-resistance ratings for fire partitions are set forth in table A 402-2.3 in the Code.

2—Minimum constructions which meet the fire-resistance ratings required for fire partitions are illustrated in AM appendix C of the Manual.



Arrangement and Construction of Fire Partitions



### Code Excerpt A 402-2.2 Construction

c—In dwellings of other than type l fire-resistive construction, the fire partitions shall be continuous from the foundation to the roof level, except that fire partitions may be offset provided the offset floor construction and the wall support shall be constructed of noncombustible materials with a fire-resistance rating of not less than that required for the fire partition.

d-Fire partitions shall extend not less than 6 inches through the roof, except when such partitions are built smoketight to the underside of the roof construction and the roof is of noncombustible construction or firestopped and protected by noncombustible material for a distance of 18 inches on each side of the fire partition.



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CONSTRUCTION WITH MASONRY VENEERED COMBUSTIBLE EXTERIOR WALLS

Code Manual——State Building Code Commission Fire-Safety Standards – Division by Party Walls



### AM 402-3 Division By Party Walls

### AM 402-3.2 Construction

1-Walls constructed in conformity with the requirements for fire partitions given in section AM 402-2.2 Fire-Safety Standards-Division by Fire Partitions-Construction, part 4, page 27, entitled, "Arrangement and Construction of Fire Partitions," and part 4, page 28, entitled, "Construction of Fire Partitions at Intersections," shall be deemed to meet the requirements of the Code.

2—Combustible party walls should be so constructed that fire cannot enter the space between the structural members supporting the adjoining building when the building or construction on one side is destroyed.

3—Party walls finished at the roof line and bonded with abutting constructions of lesser fire resistance in the same manner as required for fire partitions and illustrated in section AM 402-2.2 Fire-Safety Standards—Division by Fire Partitions—Construction, part 4, page 27, entitled, "Arrangement and Construction of Fire Partitions," and part 4, page 28, entitled, "Construction of Fire Partitions at Intersections," shall be deemed to meet the requirements of the Code.

### AM 402-3.3 Fire Resistance

Minimum constructions which meet the fire-resistance ratings required for party walls are illustrated in AM appendix C of the Manual.

4	AM 402-4	Code Manual——State Building Code Commission Fire-Safety Standards – Division by Fire Separation
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# AM 402-4 Division by Fire Separation

# AM 402-4.1b General Requirements

Fire separations for stairways and passageways are illustrated in section AM 402-4.1b Fire-Safety Standards—Division by Fire Separation, part 4, page 31, entitled, "Protection of Stairways and Passageways."

# AM 402-4.2 Construction

1—Fire separations between each two dwelling units are required to extend from the foundation to the underside of noncombustible roof construction or to the underside of the sheathing of combustible roof construction. The construction details as illustrated in section AM 402-2.2 Fire-Safety Standards—Division by Fire Partitions—Construction, part 4, page 27, entitled, "Arrangement and Construction of Fire Partitions," and part 4, page 28, entitled, "Construction of Fire Partitions at Intersections," shall be deemed to meet the requirements of the Code.

2—Concealed spaces in fire separations or in constructions adjacent to or framed into them are required to be firestopped to prevent the spread of fire into adjoining dwelling units. 3—Fire separations shall include the floor and stair constructions when such constructions form a part of the enclosure or separation.

# AM 402-4.3 Fire Resistance

Minimum constructions which meet the fire-resistance ratings required for fire separations are illustrated in AM appendix C of the Manual.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

SERVING TWO FAMILIES

SERVING ONE FAMILY



# AM 402-5 Openings in Fire Partitions, Party Walls, and Fire Separations

# Rating of Opening Protectives

1—The fire-resistance ratings of opening protectives shall be determined by the time that representative assemblies subjected to fire tests in accordance with ASTM, Standard Methods of Fire Tests of Door Assemblies (see AM appendix A) will prevent the passage of flame or appreciable amounts of fumes and smoke, prevent an excessive temperature rise on or near the unexposed surface, and for ratings of 1 hour or more, withstand the hose stream test. A temperature rise during the first 30 minutes of the test shall be considered excessive when it is greater than  $650^{\circ}$  F. as measured by thermocouples protected by standard fire-felt pads attached to the unexposed surface of the test door, or greater than  $350^{\circ}$  F. as measured by unprotected thermocouples suspended 36 inches in front of the center of the door.

2—Hollow metal doors, metal covered doors not less than 13% inches thick, and solid wood core flush doors, battened built-up wood doors and modified paneled doors illustrated in section AM 402-5 Fire-Safety Standards—Opening in Fire Partitions, Party Walls, and Fire Separations, part 4, page 33, entitled, "Wood Doors for 20-Minute Opening Protectives," shall be acceptable for 20-minute opening protectives when used with frames and hardware illustrated in section AM 402-5 Fire-Safety Standards—Openings in Fire Partitions, Party Walls, and Fire Separations, part 4, page 34, entitled, "Frames and Hardware for 20-Minute Opening Protectives."

3—Opening protectives labeled for use in class B openings by the Underwriters' Laboratories, Inc., or other approved testing organizations, shall be deemed to meet the requirements of the Code for 11/2-hour opening protectives.



when sheet metal is on one side of door only, panel areas shall be protected with 1/8-inch minimum asbestos millboard or 3/8-inch gypsum wallboard



PROTECTED PANEL DOORS



# Frames and Hardware for 20-Minute Opening Protectives



### Required Frames and Hardware

Frames shall be of fire-retardant treated wood, of untreated wood with fire-retardant treated stops of dimensions illustrated, of metalcovered wood, or of pressed or rolled steel.

### Hardware

Butts shall be not less than 4 inches by 4 inches, or equivalent, with not less than one butt for each 2-foot 6-inch height of door.

Self-closing devices shall automatically close and latch the door. Rectangular latch cases shall not exceed  $\frac{3}{4}$  inch in thickness; tubular latch cases shall not exceed 1inch in diameter; throw of latch shall be not less than  $\frac{3}{8}$  inch.

Where door stile containing latch is less than  $1\frac{1}{2}$  inches in thickness, the stile shall be covered at the latch in minimum 28-gage sheet copper or steel.

Acceptable doors for 20-minute opening protectives-Standard or modified wood doors (see illustration in section AM 402-5 Fire Safety Standards-Openings in Fire Partitions, Party Walls, and Fire Separations, part 4, page 33, entitled, "Wood Doors for 20-Minute Opening Protectives"); conventional hollow metal or metal-covered wood doors having not less than 13%-inch thickness: such others as meet the requirements of the standard methods of fire tests of door assemblies of the American Society of Testing Materials.

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



# **Platform Frame Construction**



For details of firestopping in numbered locations see the following pages of this section. Any firestopping material listed in section AM 403-3 may be substituted for wood firestopping shown above.



# **Balloon Frame Construction**



For details of firestopping in numbered locations see the following pages of this section. Any firestopping material listed in section AM 403-3 may be substituted for wood firestopping shown above.





Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.





8 The header serves as firestopping.

**9** Two-inch wood blocking or the equivalent shall be added between studs in partition adjacent to stringer to serve as firestopping.

10 Two-inch wood blocking or the equivalent shall be added between stringers at midlength to serve as firestopping. Partition intersecting stair: Two-inch wood blocking shall be added between stringers to serve as firestopping where partition intersects stairs.

11 The space between a chimney and combustible floor framing shall be firestopped at the bottom with approximately 1-inch depth of noncombustible material held in place by metal lath or wire fabric. Such firestopping shall not be required when the bottom of the vertical opening is sealed by plaster on the ceiling and chimney. The space above the firestopping shall be left unfilled so that heat from the chimney can be carried away by air currents moving upward and out through normal shrinkage cracks of the interior finish.

Plaster ceiling on noncombustible lath, extending to chimney faces, will serve as firestopping.





# AM 403-3 Material for Firestopping

1—Either combustible or noncombustible firestopping materials may be used in combustible walls, floors, etc. Noncombustible material is required for firestopping around all chimneys, flues, vents, pipes, and ducts, and at all locations in noncombustible walls, floors, etc.

2-Noncombustible materials are those which cannot be classified as combustible on the basis of the definition of combustible material. Among them, the following materials are classified as noncombustible: solid masonry; gypsum concrete or plaster; Portland cement concrete or plaster; mortar; asbestos millboard or wallboard (minimum 1/4-inch thick); sheet iron or steel (minimum 24 U. S. gage); mineral wool; rock wool, or slag wool. 3-Metal reinforcement or support, such as metal lath, shall be provided where necessary to hold firestopping material in place.
4	AM 403-4	Code Manual——State Building Code Commission Fire-Safety Standards – Attic Fire Shutters
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# AM 403-4 Attic Fire Shutters

Wall and ceiling openings through which air from habitable spaces is discharged into an unfinished or unprotected attic shall be firestopped with shutters which close automatically in case of fire. The automatic closing device for such shutters shall have the activating mechanism installed in the air stream and shall operate at air temperatures of from  $135^{\circ}$  F. to  $165^{\circ}$  F.

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Code Manual——State Building Code Commission Fire-Safety Standards – Interior Finishes	<u>AM 404</u>	4

# AM 404 Interior Finishes

The flame-spread ratings of interior finish materials are established by the tunnel type test, ASTM, *Tentative Method of Fire Hazard Classification of Building Materials* (see AM appendix A). When flame-spread ratings are not available or cannot be immediately made available, acceptance of interior finish materials may be based on the results of tests made in conformity to the fire-test methods described in *Federal Specifications for Acoustical-Units; Prefabricated* (see AM appendix A).

Interior finish materials in hallways, stairways, and exit ways are limited to "slow burning" or better, when tested in conformity to the Federal Specifications test. Interior finish material in other locations in one- and two-family dwellings is limited to those combustible materials on which the flame requires more than 5 minutes to reach the angle frame or the border of the test specimen used in making tests by the method described in *Federal Specifications for Acoustical-Units*.



# **Clearances from Combustible Construction**



Acceptable Materials

Materials acceptable as a lining capable of withstanding  $2000^{\circ}$  F. temperature are clay brick other than shale, fire brick, soapstone, cast iron.

Where wood mantels and trim are used they shall be attached so that they cannot be heated to temperatures in excess of  $175^{\circ}$  F., or ignited by sparks or embers.

Fireplaces shall be constructed so that, when they are in use, adjacent or nearby combustible material shall not be heated to temperatures in excess of 175° F. or be exposed to sparks or embers.



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# AM 406 Fire Protection from Heat Producing Equipment

## AM 406-1 General Requirements

1—Heating equipment should be mounted on noncombustible floors or on protected combustible floors. The floor protection varies with the type of heater as illustrated in section AM 503-2.2 Equipment Standards—Heat Producing Equipment—Clearance, part 5, pages 29 and 30, entitled, "Clearance for Furnaces, Boilers, and Incinerators."

2—Clearances between the heating equipment and nearby combustible construction should be such that, in continuous operation of the heating equipment, the temperature of the combustible material will not be more than 175° F. The required clearances will be governed by the type of heating equipment and should be as illustrated in section AM 503-2.2 Equipment Standards—Heat Producing Equipment—Clearance, part 5, pages 29 and 30, entitled, "Clearance for Furnaces, Boilers, and Incinerators," except when lesser clearances with specially designed heating equipment have been shown by simulated service tests by recognized laboratories to be safe.

3—Protection of 10 minutes to combustible material is provided by the following materials, among others: asbestos millboard, asbestos-cement board, and plaster on gypsum or metal lath.

add paragraph See additions sheet





Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.



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# AM 407-2b Separation Requirements

1-Wall and floor constructions which have fire-resistance ratings of 30 minutes or more are illustrated in AM appendix C.

2—Materials to provide fire protection to the combustible structural members for 10 minutes or more shall include, among others, plaster on gypsum or metal lath, 3/8-inch or thicker gypsum wallboard, asbestos-cement board over gypsum sheathing, and sheet metal over gypsum, or noncombustible sheathing. Sheet metal in contact with the combustible members does not give 10 minutes' fire protection, and is acceptable as an interior finish for garages only when used over materials such as gypsum sheathing or wallboard.

# AM 407-3 Passageway to Dwellings

Any opening for direct passage from an attached or built-in garage to a dwelling is required to be equipped with a self-closing door having a fire-resistance rating of 20 minutes or more. Such doors are described in section AM 402-5 *Fire-Safety Standards—Openings in Fire Partitions, Party Walls, and Fire Separations, part 4, page 33, entitled, "Wood Doors* for 20-Minute Opening Protectives," and part 4, page 34, entitled, "Frames and Hardware for 20-Minute Opening Protectives."



# STATE BUILDING CONSTRUCTION CODE applicable to One- and Two-Family Dwellings

### Part 5

# **Equipment Requirements**

### A 501 PLUMBING

### A 501-1 General Requirements

a----Every dwelling shall have access to a source of potable water, and shall have approved facilities on the premises for the sanitary disposal of sewage.

b——Every row house shall be equipped with a plumbing system to supply potable water and remove sanitary wastes.

c——Every plumbing system shall be designed and installed in conformity with the requirements set forth in section A 501 in order to: supply water in a manner free from health and physical hazards; convey sewage to a public sewer, or where a public sewer is not available, to an approved private sewage disposal system in a manner free from health hazards, and without creating a nuisance; and perform its required functions without need for frequent major replacements.

### A 501-2 Public Water Supply or Public Sewer:

### When Deemed Available

Public water supply, or a public sewer, shall be deemed available to a dwelling located within 100 feet of a suitable public water supply, or a suitable public sewer, respectively, to which connections may lawfully be made.

### A 501-3 Minimum Facilities

a-----In every row house, and wherever public water supply is available to a one- or two-family dwelling, there shall be provided in each dwelling unit and connected to a plumbing system at least:

One kitchen sink,

One water closet,

One bathtub or shower, and

One lavatory

b——Wherever public water supply is not available, there shall be provided on the premises, for each dwelling unit, means for sanitary disposal of sewage without health hazard or nuisance, and in conformity with generally accepted standards.

### A 501-4 Fixtures

Plumbing fixtures and other receptacles for receiving wastes shall be of smooth, nonabsorbent material, resistant to detrimental action of conveyed wastes, and free from concealed fouling surfaces.

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#### A 501-5 Water Supply System

#### A 501-5.1 Water Source

Every water supply system shall be connected to a public water supply wherever such is available; where not available, then to an approved private supply.

#### A 501-5.2 Adequate Quantity

-Every water supply system shall supply water in adequate quanatity for household needs and, where a plumbing system is installed, for operation and cleansing of the plumbing fixtures, and for removal and conveyance of sewage.

-Capacity of the water supply system shall be sufficient for opberation during periods of peak use as determined by the maximum probable simultaneous use of fixtures.

#### A 501-5.3 Minimum Rate of Flow

Every water supply system shall be designed and installed to provide during periods of peak use the following minimum rates of flow at fixture supply outlets:

Kitchen sinks, laundry trays	5 gpm
Water closets, tank operated	3 gpm
Water closets, valve operated	25 gpm
Lavatories	3 gpm
Bathtubs, showers	6 gpm

#### A 501-5.4 **Minimum Residual Pressures**

Every water supply system shall be designed and installed to provide during periods of peak use, at the point of outlet discharge, the following minimum residual pressures:

Water closet flush valves	15	psi
Faucets, or water closet flush tanks	8	psi

#### A 501-5.5 Material and Installation

Every water supply system shall be of approved materials and designed and installed so as to be safe, operative, and watertight under the maximum expected pressure.

#### A 501-5.6 **Pollution**

Every water supply system shall be free of potential pollution from all sources, including cross connections, backflow, and solution or suspension of deleterious matter.

#### A 501-5.7 Hot Water Safety Precautions

Every hot water supply system shall be provided with means to safely relieve hazardous pressures and temperatures so as to prevent scalding, explosions, and collapse of tanks.

#### A 501-6 Sewage Drainage System

#### A 501-6.1 **General Requirements**

A sewage drainage system shall be provided wherever sewage is conveyed and removed by water. The sewage drainage system shall include all soil and waste piping, and vent piping forming part thereof.

#### A 501-6.2 Where Public Sewer is Available

Where a public sewer is available, every sewage drainage system shall be connected thereto.

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### A 501-6.3 Where Public Sewer is Not Available

Where public sewer is not available, means shall be provided to receive and dispose of sewage without health hazard or nuisance in conformity with generally accepted standards.

### A 501-6.4 Capacity

Capacity of every sewage drainage system shall be sufficient for proper operation during periods of peak use as determined by the maximum probable simultaneous use of fixtures. During such periods of peak use the sewage drainage system shall operate without abnormal retardation of flow and without development of pressure against water seals in excess of the requirements set forth in section A 501-6.6.

### A 501-6.5 Piping and Pipe Slope

a——Every sewage drainage system shall be of approved materials and designed and installed so as to be watertight and operative, and so that stoppage due to fouling, corrosion, frost, or deposit of solids, will not occur under normal conditions of use.

b——Sewage drainage piping shall have slope to provide velocities adequate to prevent deposit of solids, and fouling.

### A 501-6.6 Pressure Differential

Sewage drainage piping shall be designed and installed so as to prevent excessive pressure differences within the piping during periods of peak use. Pressure differential to which any water seal is subjected shall be not more than I inch of water. Provision shall be made to prevent or relieve a pressure differential of more than I inch of water which may develop and tend to cause loss of water seal.

### A 501-6.7 Water Seals

Sewage drainage piping shall be separated from fixtures connected thereto by water seals normally maintained at a minimum depth of 2 inches. The maximum depth of water seals and the formation of the water seal shall be such as will not result in fouling, or in odors from fluids or solids in the seals. Under conditions of peak use tending to cause loss of seal through surge, self-siphonage, aspiration or back pressure, the minimum depth of residual static trap seal shall be sufficient to resist the normal disturbance caused by the discharge of other fixtures on the system, and in any instance shall not be less than  $\frac{1}{2}$ inch. Water seals shall be located as close to the fixtures as possible. No trap seal shall be used where seal depends upon the action of movable parts.

### A 501-6.8 Materials

Every private sewage disposal system shall be of such materials and designed and installed so as to remain operative under normal conditions of use with a minimum of maintenance other than occasional clearance of stoppage and removal of sludge.

### A 502 GAS PIPING

### A 502-1 General Requirements

Every gas piping system shall be designed and installed in conformity with generally accepted standards, and so as to be free from health and physical hazards under normal conditions of use.

#### A 502-2 Adequate Supply

Every gas piping system shall be designed and installed so as to provide a supply of gas sufficient to meet the maximum expected demand of the installed gas-burning appliances connected thereto.

#### A 502-3 Materials

Every gas piping system shall be of approved materials resistant to the corrosive effects of gases conveyed by them, and designed and installed so as to remain with a minimum of maintenance, gastight, safe, frost-free, and operative under normal conditions of use.

#### A 502-4 Shut-Off Valve

Every gas piping system shall have a value in an accessible location for shutting off all gas to the system.

#### A 503 HEATING

#### A 503-1 General Requirements

Dwellings intended for occupancy between the first day of November and the first day of May of the following year shall be provided with heating facilities capable of maintaining in all habitable spaces, and bathrooms and toilet rooms, an indoor temperature, at a 5-foot level above the floor, of not less than 65° F. whenever the outdoor temperature is 50° or less. The capability of the heating facilities to maintain such indoor temperature shall be based on the outside design temperature for the locality. The outside design temperature shall be the average of the minimum annual outside temperatures.

-Heating facilities shall be designed and installed in conformity with generally accepted standards so as to be free from any fire, health, and physical hazards under conditions of normal use.

-Heating facilities, in order to meet the requirements set forth in section A 503, shall not be forced to operate beyond the safe capacity for which they have been designed.

#### A 503-2 Heat Producing Equipment

#### A 503-2.1 **General Requirements**

Heat producing equipment shall be designed, constructed and installed so as to meet the requirements set forth in section A 503-1.

#### A 503-2.2 Clearance

Where heat producing equipment is installed on, or adjacent to, combustible materials, the location, construction, control, or insulation of the equipment, or the protection of the combustible materials, severally or in combination, shall be such that the temperature on the surface of the combustible materials at no time shall exceed 175° F. above the initial temperature.

#### A 503-2.3 Air for Combustion

An adequate supply of air for combustion shall be available to directfired heat producing equipment. Air for combustion shall be supplied from outdoors, or from indoor spaces which are supplied directly or indirectly with outdoor air. When an adequate supply of air is not assured at all times, permanent openings shall be installed to provide a clear ventilating area equal to not less than the cross-sectional area of the smoke pipe where it enters the flue.

## **Equipment Requirements** State Building Construction Code applicable to One- and Two-Family Dwellings

### A 503-2.4 Removal of Products of Combustion

Heat producing equipment shall be connected to a suitable chimney or flue or, in the case of gas-fired equipment, to a suitable gasvent, when the discharge of products of combustion into the space where the equipment is installed would be a health or physical hazard.

### A 503-2.5 Safety Devices

a——Heat producing equipment and auxiliary equipment capable of developing hazardous pressures or temperatures shall be provided with means to relieve safely such pressures and temperatures whenever they exceed the normal operating conditions.

b-----Controls of mechanical equipment used in connection with heating facilities shall be provided as follows: when failure or interruption of flame or ignition occurs, the fuel supply shall be cut off; when a predetermined temperature or pressure is exceeded, the delivery of additional heat to the boiler shall be prevented or reduced to a safe minimum rate of combustion; when the water level in a steam boiler drops below a predetermined level, the fuel supply shall be cut off.

### A 503-2.6 Fuel Storage

All fuels required and stored on the premises for the operation of heat producing equipment and appliances shall be stored in accordance with generally accepted standards.

### A 503-3 Chimneys, Flues, and Gasvents

### A 503-3.1 General Requirements

a----Chimneys, flues, and gasvents shall be located, designed, and constructed to convey, effectively and without nuisance, products of combustion to the outer air, and shall not be potential sources of ignition to adjacent combustible materials, nor be health hazards. b----Chimneys, flues, and gasvents shall have adequate foundations and supports and shall be designed and constructed so as to be stable, structurally safe, durable and tight.

### A 503-3.2 Draft

Chimneys, flues, and gasvents shall be located, designed, and constructed to provide sufficient draft to develop the rated output of the equipment served.

### A 503-3.3 Fire Safety

Chimneys, flues, and gasvents shall be located, designed and constructed so as not to increase, under conditions of use, the temperature on any combustible materials adjacent thereto or in contact therewith beyond 175° F. above the initial temperature.

### A 503-3.4 Outlets

Flue and gasvent outlets shall be located so as not to be lower than the level of the top of any window or other exterior opening which is within 15 feet measured horizontally from the outlet, nor shall such outlets be located less than 2 feet above the level of any unprotected combustible part of any building or construction when such part is within 10 feet of the outlet, except as otherwise set forth in generally accepted standards.

### A 504 ELECTRICAL WIRING AND EQUIPMENT

### A 504-1 General Requirements

Electrical wiring and equipment shall be designed and installed so as

not to be a potential source of ignition of combustible material or a potential source of electrical hazard.

#### A 504-2 Installation

Installation of electrical wiring and equipment in conformity with generally accepted standards shall be deemed to comply with this Code.

#### A 505 **ELEVATORS**

#### A 505-1 **General Requirements**

Elevators and the appurtenances necessary for operation shall be designed and installed so as to be free from physical and fire hazards.

#### A 505-2 Installation

Installation of elevators and their appurtenances in conformity with generally accepted standards shall be deemed to comply with this Code.

Code Manual——State Building Code Commission Equipment Standards – Plumbing – Sewage Drainage System	AM 501 AM 501-6	5
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## AM 501 Plumbing

# AM 501-1 General Requirements

Plumbing systems installed in conformity with either one of the following codes are acceptable, but the Code permits lesser requirements which are described in this Manual: (1)—ASA, *Plumbing Code, Minimum Requirements for Plumbing* (not including administrative provisions). This code has been adopted by the New York State Department of Health (see AM appendix A).

(2)—Report of the Coordinating Committee for a National Plumbing Code, issued by the U. S. Department of Commerce (not including administrative provisions) (see AM appendix A).

# AM 501-6 Sewage Drainage System

## AM 501-6.3 Where Public Sewer is Not Avaiable

1—Where public sewer is not available, private sewage disposal systems shall conform to local regulations, if any, and should comply with State and county health regulations. Private sewage disposal systems should also conform to rules and regulations which are enacted by the local water authorities to prevent pollution of watershed areas. Information regarding such requirements can be obtained from the town, village, city, or county health authorities, or from any of the district offices of the State Department of Health, or from the Bureau of Environmental Sanitation, State Department of Health, Albany, New York. 2—Private sewage disposal systems, where a public sewer is not available and not subject to local regulations, are acceptable if constructed and installed in accordance with either of the following (see AM appendix A):

(a)—New York State Department of Health, Rules and Regulations for the Preparation and Submission of Plans for Systems of Sewerage and Sewage and Waste Disposal, part II.
(b)—Joint Committee on Rural Sanitation of the United States Public Health Service, Federal Security Agency, reprint No. 2461, Individual Sewage Disposal Systems.

3—Where other private sewage disposal systems receive ground garbage or other abnormal waste, the system should be designed and of a capacity to provide for such additional waste. When the capacity of the system has not been increased to provide for the additional waste, then maintenance of the system should be such as not to create a health hazard or nuisance.



Code Manual——State Building Code Commission Equipment Standards – Sewage Drainage System – Pressure Differential	<u>AM 501-6.6</u>	5
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# Maximum Unvented Lengths of Fixture Drains for Stack-Vented Lavatories and Flat-Bottom Fixtures - 1



TOP STACK-	BACK-VENTED
VENTED GROUP	<b>OR RE-VENTED</b>
	FIXTURE

TABLE 1.—MAXIMUM	VALUE	OF L	SHOWN	IN	SKETCH
------------------	-------	------	-------	----	--------

T2:	Diameter	<b>T</b>	Slope		
F ixture	drain in inches	fitting	1/4"	1/2"	
		Short-turn TY	4'-6"	3'-0"	
Loudom	1¼	Long-turn TY, or Y and ½ bend	2'-0"	1'-6"	
Lavatory		Short-turn TY	9'-6"	4'-6"	
	1½	Long-turn TY, or Y and ½ bend	7'-0"	3′-6″	
		Short-turn TY	12'-0"	6'0"	
Flat-bottom fixture <sup>1</sup>	1½	Long-turn TY, or Y and ½ bend	12'-0"	6'-0 <b>"</b>	
		Short-turn TY	10'0"	5'-6"	
	2	Long-turn TY, or Y and ½ bend	6'-6"	3'-6"	

<sup>1</sup> Flat-bottom fixtures include kitchen sinks, combination fixtures, bathtubs, and shower stalls.

TABLE 2.-MAXIMUM VALUE OF L SHOWN IN SKETCH

Values	of	L	-	given	în	table	ł	for	con-
ditions	ab	ov		•					

maximum of one lavatory or flatflat-bottom fixture bottom fixture



TOP STACK-VENTED GROUP

	Diameter	<b>—</b>	Slope		
Fixture	of trap and drain in inches	Type of vent fitting	34"	3⁄3″	
		Short-turn TY	4'-6"	3'-0"	
	11/4	Long-turn TY, or Y and ½ bend	2'-0"	1'-6"	
Lavatory		Short-turn TY	7'-0"	3'-6"	
	11/2	Long-turn TY, or Y and ½ bend	6′0″	3'-0"	
		Short-turn TY	10'-0"	5'-0"	
	11/2	Long-turn TY, or Y and ½ bend	8'-0"	4'-0"	
Flat-bottom	· · · · · · · · · · · · · · · · ·	Short-turn TY	10'-0"	5'-0"	
hxture <sup>1</sup>	2	Long-turn TY, or Y and ½ bend	6′-6″	3′6″	

Values of L are given in table 2 for conditions above

<sup>1</sup> Flat-bottom fixtures include kitchen sinks, combination fixtures, bathtubs, and shower stalls.





Flat-bottom fixtures include kitchen sinks, combination fixtures, bathtubs and shower stalls.

Diagrams indicate stack venting of top group of fixtures.

Values of L are given in table 2 on preceding page



Values of L are given in tables 1 and 2 on preceding page



# Maximum Unvented Lengths of Wet-Vented Fixture Drains



ditions above

#### WET-VENTED FIXTURE DRAIN

### WATER-CLOSET DRAIN

Fixture		Slope	
	Diameter of wet vent in inches	1/4"	1/2"
Flat-bottom fixture <sup>1</sup>	11/2	6'-0"	3'-0"
	2	8'-0"	4'-0"
		1	1

#### TABLE 3.-MAXIMUM VALUE OF L SHOWN IN SKETCH

<sup>1</sup> Flat-bottom fixtures include kitchen sinks, combination fixtures, bathtubs, and shower stalls.



# Wet-Vented Single Bathroom and Kitchen Fixture Group



Fixtures draining into wet vent	Diameter of wet vent
1 lavatory         1 kitchen sink         1 lavatory and 1 kitchen sink         (as illustrated)	1 <sup>1</sup> / <sub>2</sub> " 2" 2"

Note: A combination fixture may be substituted for the kitchen sink.

Note: Values for L are given in table 3, part 5, page 13.



ALTERNATE ANY FLOOR

ALTERNATE FOR TOP FLOOR ONLY





LOWER STORY

# FOUR GROUP-TWO-STORY



2'min:

min. 3" soil stack

TOP STACK-VENTED GROUP

sink or

combination fixture

min. 3" soil stack

lavatory

waste

Values of **e**, **b**, and **c** are given in table 4 for conditions above

branch

waste same size or

larger than branch

BACK-VENTED OR RE-VENTED FIXTURE

flat-bottom fixture

TOP STACK-VENTED GROUP

#### Table 4.-MAXIMUM VALUES OF c. b. AND c SHOWN IN SKETCHES

	Diameter			Type of vent	<b>a + c</b> Slope	
Fixture	drain in inches	a	Ь	fitting	1⁄4″	1⁄2"
Flat_		Be-	Not	Short-turn TY	10 ft	5 ft
bottom 1½ 2 fixture <sup>1</sup>		2 and 10 dia.	than 24 dia.	Long-turn TY or Y and ½ bend	8 ft	4 ft
				Short-turn TY	10 ft	5 ft
:	4		5 1 2	Long-turn TY or Y and ½ bend	6′6″	3′6″

<sup>1</sup> Flat-bottom fixtures include kitchen sinks, combination fixtures, bathtubs, and shower stalls.



To prevent fouling of the dry vent the junction with the branch drain shall be located above the hydraulic gradient or the imaginary line connecting the fixture outlet with the connection at the stack. Where the branch drain connects to the wet vent, clogging is prevented by the discharge surge from the fixtures above.



### FLOOR DRAIN CONNECTED DIRECTLY TO BUILDING DRAIN

Length of **a**, between 2 and 10 times the outlet diameter of floor drain.

Length of **b**, not more than 24 times the outlet diameter of floor drain.

Length of  $\mathbf{a} + \mathbf{c}$ , not more than 10 feet where slope of  $\mathbf{a}$  does not exceed  $\frac{1}{4}$  inch per foot; not more than 5 feet where slope of  $\mathbf{a}$  exceeds  $\frac{1}{4}$ inch per foot but does not exceed  $\frac{1}{2}$  inch per foot.

Fixtures connected directly to building drain need not be back-vented (re-vented) provided all of the following six conditions are met:

1—The house drain is not frequently submerged. Generally it discharges, above the invert level, into a street sewer which rarely runs full.

2—The total load on the building drain does not exceed one half that permissible under either of the plumbing codes listed in AM appendix A. 3—No house trap is installed in the building drain. 4—Total developed length of branch drain from trap weir to house drain does not exceed 10 feet where slope of horizontal portion is less than  $\frac{1}{4}$  inch per foot, and does not exceed 5 feet where slope of horizontal portion exceeds  $\frac{1}{4}$ inch per foot, but does not exceed  $\frac{1}{2}$  inch per foot.

5—The branch drain connection to the house drain is not less than 10 feet downstream from any vertical stack 3 inches or larger in diameter connected to the house drain.

6—Any direct-connected floor drain is not less than 2 inches in diameter.

Fittings—Other drainage and vent fittings serving the same purpose and acceptable under the plumbing codes listed in AM appendix A, may be substituted for cast and screwed fittings shown on this page.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

Code Manual-	State Build	ling (	Code	Commissio <b>n</b>
Equipment	Standards	– Ma	ater	ials

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# AM 501-6.8 Materials

### Pipe

1—In addition to the fittings listed in the reference standards set forth in section AM 501 *Equipment Standards*—*Plumbing*—*Sewage Drainage System*, part 5, page 9, galvanized malleable iron fittings may be used for above-ground drainage piping within buildings.

2—Underground building drains are required to be of cast iron standard weight except that cast iron extra heavy weight is required to be used for the following conditions:

(a)—Where drains pass through exterior wall or foundation and 2 feet on either side of same.

(b)-Where basement floor is subject to automobile or other heavy loads.

### Installation

1-Where underground building drains or sewer lines are installed under hard packed roads or driveways, adequate provisions should be made to protect them from frost. 2-Where underground building drains or sewer lines are installed in cinder fill, adequate

provision should be made to protect them against corrosion.

5	AM 502	Code Manual——State Building Code Commission Equipment Standards – Gas Piping
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# AM 502 Gas Piping

# AM 502-1 General Requirements

Gas piping designed and installed in accordance with the following standards is acceptable as in conformity with generally accepted standards:

# Installation for Gas Other Than Liquefied Petroleum Gas

ASA, Installation of Gas Piping and Gas Appliances in Buildings, listed in AM appendix A.

# Installations for Liquefied Petroleum Gas

1—Applicable provisions of NBFU, Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases listed in AM appendix A.

2—Containers should be set on firm foundation or otherwise firmly secured, and all rubbish, weeds and long dry grass removed from within 10 feet of installation.

3-Containers and regulating equipment should be located outside of the building.

4-Containers should not be buried below ground, nor should container or regulating equipment come in direct contact with ground.

5—Space where container is located should be drained, with lowest level of such space ventilated horizontally to outside air and with outlet from such space at least 5 feet from any building opening which is below level of space outlet.

6—Discharge from safety relief valve should not terminate in or beneath the building nor less than 5 feet horizontally from any building opening below level of discharge.

7—Pipe connection through building wall or foundation should be guarded against settlement.

# AM 503 Heating

# AM 503-1b Generally Accepted Standards

Heating facilities designed and installed in accordance with the following applicable standards, further identified in AM appendix A, are acceptable as being in conformity with generally accepted standards:

General design of heating systems: construction and installation—ASHVE, Heating Ventilating Air Conditioning Guide.

Code Manual——State Building Code Commission <b>Equipment Standards – Heating</b>	AM 503	5
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**Oil burners:** construction and installation—CS, Automatic Mechanical-Draft Oil Burners Designed for Domestic Installations;—installation—NBFU, Installation of Oil Burning Equipments.

**Miscellaneous oil burning equipment and accessories:** construction—ULI, List of Inspected Gas, Oil and Miscellaneous Appliances.

Fuel oil tanks: construction—ULI, Standard for Inside Tank Equipment for Oil Burners; Standard for Underground Storage Tanks; Standard for Horizontal and Vertical Above-Ground Storage Tanks for Hazardous Liquids;—installation—NBFU, Installation of Oil Burning Equipments.

Floor furnaces, oil: construction—CS, Oil-Burning Floor Furnaces Equipped with Vaporizing Pot-Type Burners.

**Space heaters, oil:** construction—CS, Flue-Connected Oil-Burning Space Heaters Equipped with Vaporizing Pot-Type Burners;—installation—NBFU, Installation of Heat Producing Appliances; Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems; Installation, Maintenance and Use of Small Heating and Cooking Appliances (Kerosene and Fuel Oil).

Small heating and cooking appliances, oil-fired: installation—NBFU, Installation, Maintenance and Use of Small Heating and Cooking Appliances (Kerosene and Fuel Oil); Installation of Oil Burners in Stoves and Ranges Originally Designed for Solid Fuels and for the Storage and Use of Oil Fuels in Connection Therewith.

**Central heating gas equipment:** construction—ASA, Approval Requirements for Central Heating Gas Appliances;—installation—ASA, Installation of Gas Piping and Gas Appliances in Buildings.

Gas conversion burners: construction—ASA, Listing Requirements for Domestic Gas Conversion Burners;—installation—ASA, Requirements for Installation of Domestic Gas Conversion Burners.

Gas fired room heaters: construction—ASA, Approval Requirements for Gas-Fired Room Heaters;—installation—ASA, Installation of Gas Piping and Gas Appliances in Buildings.

Gas floor furnaces: construction—CS, Gas Floor Furnaces—Gravity Circulating Type; —installation—ASA, Installation of Gas Piping and Gas Appliances in Buildings; NBFU, Installation of Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems.

**Gas unit heaters:** construction—ASA, Approval Requirements for Gas Unit Heaters; —installation—ASA, Installation of Gas Piping and Gas Appliances in Buildings.

Gas water heaters: construction—ASA, Approval Requirements for Gas Water Heaters; —installation—ASA, Installation of Gas Piping and Gas Appliances in Buildings.

5	AM 503	Code Manual——State Building Code Commission Equipment Standards – Heating

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**Domestic ranges, gas fired:** construction—ASA, Approval Requirements for Domestic Gas Ranges;—installation—ASA, Installation of Gas Piping and Gas Appliances in Buildings.

Gas appliances and accessories: construction—American Gas Association Laboratories, Directory of Approved Gas Appliances and Listed Accessories.

**Coal burners:** construction and installation—CS, *Domestic Burners for Pennsylvania* Anthracite (Underfeed Type).

**Boilers:** construction—ASME, Rules for Construction of Low-Pressure Heating Boilers; New York State Industrial Code Rule No. 14 as amended, Rules as Amended Relating to the Construction, Installation, Inspection and Maintenance of Steam Boilers; SPR, Steel Firebox Boilers and Steel Heating Boilers (Commercial and Residential Types);—installation—ASHVE, Heating Ventilating Air Conditioning Guide.

**Range boilers and tanks:** construction—SPR, Ferrous Range Boilers, Expansion Tanks and Solar Tanks; Nonferrous Range Boilers.

Warm air furnaces and warm air ducts: construction—CS, Warm Air Furnaces Equipped with Vaporizing-Type Oil Burners; CS, Solid-Fuel Burning Forced-Air Furnaces; SPR, Pipes, Ducts and Fittings for Warm Air Heating and Air Conditioning;—installation —NBFU, Installation of Air Conditioning, Warm-Air Heating, Air Cooling and Ventilating Systems, plus amendments.

Liquefied petroleum gas systems: construction and installation—NBFU, Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases.

Incinerators: construction—ASA, Approval Requirements for Domestic Gas-Fired Incinerators;—installation—NBFU, Incinerators.

Indirect hot water heaters: construction—ASME, Unfired Pressure Vessels.

# Warm Air Heating Systems

1-Warm air heating systems should be arranged so that a vertical stack serves no more than one dwelling unit.

2-Return air connections should not be made from bathrooms, garages, laundries, and basement sections not used for living quarters.

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Equipment Equipment	Standards – Heat Producing



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# AM 503-2 Heat Producing Equipment

## AM 503-2.1 General Requirements

Access: Heat producing equipment should be installed where readily accessible.

# Shut-Off Valve

A separate manual main fuel shut-off valve should be provided ahead of all automatic controls.

# **Rating of Gas Appliances**

Unless otherwise specifically stated by manufacturer, ratings indicated on gas-fired heat producing equipment are for localities where elevations are 2000 feet or less; for elevations above 2000 feet, such ratings should be reduced 4 per cent for each 1000 feet above sea level.

# AM 503-2.2 Clearance

1-Mounting conditions and minimum clearances to combustible materials as set forth and illustrated herein are in conformity with the Code.

2—Noncombustible facing provided to obtain lesser clearance than in instances where no such facing is provided shall extend beyond the projected outline of the heat producing equipment so that the distance from the heat producing equipment to the combustible material is not less than 18 inches for equipment operating without pressure or temperature limit controls, and 6 inches for equipment operating with limit controls.

3—Mounting conditions and lesser clearances may be acceptable for specific heat producing equipment when simulated service tests made by the American Gas Association, Underwriters' Laboratories, Inc., or other recognized laboratories, show that the temperature on the surface of the combustible material at no time exceeds 175° F. above the initial temperature.





# Mounting of Furnaces, Boilers, and Incinerators - 2



Furnaces, boilers and incinerators illustrated on this page are constructed so that flame or hot gases are not directly exposed to the base. Included are conventional type furnaces, boilers and incinerators having an ashpit or space beneath the burning fuel, and similar heat producing equipment where the base is not directly exposed to flame or hot gases.

Hollow masonry units should be laid with end joints matched and ends unsealed to provide free circulation of air through cells.

MOUNTINGS ON COMBUSTIBLE SUPPORT





# MOUNTINGS ON COMBUSTIBLE SUPPORT

Code Manual——State Building Code Commission Equipment Standards – Heat Producing Equipment – Clearance	AM 503-2.2	5
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# Clearance for Furnaces, Boilers, and Incinerators -1

NACES WITH 250° F. TEMPERATURE LIMIT CONTROLS, AND HOT WA-TER BOILERS AND STEAM BOILERS OPERATING AT NOT OVER 15 PSI GAGE PRESSURE

FIGURES I AND 4: WARM AIR FUR- FIGURES 2 AND 5: HAND-FIRED FURNACES AND BOILERS, AND GRAVITY WARM AIR FURNACES WITHOUT TEMPERATURE LIMIT CONTROLS

FIGURES 3 AND 6: MANUALLY CONTROLLED GAS FURNACES. GAS BOILERS, AND INCINERATORS



CLEARANCES TO UNPROTECTED COMBUSTIBLE MATERIAL



Front clearance, minimum 48 inches except that gas-fired and oil-fired furnaces and boilers shall have minimum front clearance of 18 inches

5	AM 503-2.2	Code Manual——State Building Code Commission Equipment Standards – Heat Producing Equipment – Clearance
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# Clearance for Furnaces, Boilers, and Incinerators - 2

FIGURES 7 AND 10: WARM AIR FURNACES WITH 250° F. TEMPERA-TURE LIMIT CONTROLS, AND HOT WATER BOILERS AND STEAM BOIL-ERS OPERATING AT NOT OVER 15 PSI GAGE PRESSURE

FURNACES AND BOILERS, AND GRAVITY WARM AIR FURNACES WITHOUT TEMPERATURE LIMIT CONTROLS

FIGURES 8 AND 11: HAND-FIRED FIGURES 9 AND 12: MANUALLY CONTROLLED GAS FURNACES, GAS BOILERS, AND INCINERATORS



Clearance dimensions are based upon protection to combustible material afforded by a minimum of 28 U.S. gage galvanized iron or equivalent bright metal spaced I inch from combustible material



Clearance dimensions are based upon covering applied to the heat producing equipment providing insulation equivalent to 1 1/2 inches of asbestos cement.

Front clearance, minimum 48 inches except that gas-fired and oil-fired furnaces and boilers shall have minimum front clearance of 18 inches.








# Clearance of Heating Appliances Burning Solid or Liquid Fuel



WATER HEATERS



RADIATING SPACE HEATERS, HEATING STOVES, COMBINATION HEATING STOVES, WATER HEATERS



CIRCULATING SPACE HEATERS



# DOMESTIC TYPE RANGES AND COOKING STOVES (SEE TABLE)

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

#### Notes

Illustrations shown are plan views.

All clearances indicated are minimum. Minimum clearance to controls should be 18 inches.

Minimum clearance of 36 inches above top of heating appliances to combustible material. Where underside of combustible material is protected with at least  $\frac{1}{4}$ -inch asbestos board covered with sheet metal of at least 28 U. S. gage which extends 9 inches beyond the sides, vertical clearance may be reduced to 24 inches.

Clearances for smoke pipes to ceiling combustible material should be the same as for smoke pipes illustrated in section AM 503-2.2 Equipment Standards— Heat Producing Equipment—Clearance, part 5, pages 29 and 30, entitled, "Clearance for Furnaces, Boilers, and Incinerators."

Туре	Minimum clearance		
	A	B	C
Solid fuel in firepot with- out clay lining	36″	18"	18"
Solid fuel in firepot with clay lining or liquid fuel	24″	18″	18″

5	AM 503-2.3 AM 503-2.4	Code Manual——State Building Code Commission Equipment Standards – Heat Producing Equipment – Air for Combustion – Removal of Products of Combustion

# AM 503-2.3 Air for Combustion

1—When direct-fired heat producing equipment is installed in a room or space which is ventilated by means of mechanical exhaust, air sufficient to replace that exhausted and that consumed by combustion shall be supplied.

2—In addition to air for combustion, enclosed spaces housing heat producing equipment should be provided with air for effective ventilation. Such air for effective ventilation can be provided through louvers or openings in doors, windows or walls.

# AM 503-2.4 Removal of Products of Combustion

# **Required Smoke Pipes and Gasvent Connections**

1—All heat producing equipment using solid or liquid fuel, or which can be readily converted to the use of solid or liquid fuel, shall be connected to flues; excepting only liquid-fuel-fired appliances which are specifically approved for installation without flue connections. See illustration in section AM 503-2.4 Equipment Standards—Heat Producing Equipment—Removal of Products of Combustion, part 5, page 36, entitled, "Arrangement of Smoke Pipes and Gasvent Connections."

2—The following types of gas-fired heat producing equipment shall be connected to a flue or gasvent:

(a)-Equipment which produces flue gas temperatures in excess of 550° F.

(b)-Equipment having an input rating in excess of 50,000 Btu per hour.

(c)—Equipment with an input rating greater than 5000 Btu per hour but not equipped with automatic controls to reduce the gas supply to 30 per cent or less of the maximum demand.

(d)—Automatically controlled equipment with an input rating of less than 5000 Btu per hour, but which is not equipped with an automatic device to shut off the gas supply when flame or pilot is extinguished.

(e)—Each appliance, excluding domestic gas ranges, installed in the same room which would make the total input rating of the unvented gas appliances 30 Btu or more per hour per cubic foot of room content.

(f)—Water, room or space heaters in sleeping quarters, kitchens, kitchenettes, bathrooms, toilet rooms and in any space that is not adequately ventilated in accordance with the requirements set forth in section A 503-2.3 of the Code entitled, "Air for Combustion." (g)—Steam and hot water boilers used for heating space, warm air furnaces, floor furnaces, unit heaters and recessed heaters.

Code Manual——State Building Code Commission	
Equipment Standards — Heat Producing	
Equipment – Removal of Products of	
Compusitor	



(h)—Appliances which have draft hood supplied by the appliance manufacturer except automatic water heaters having a maximum input rating of no more than 5000 Btu per hour.
 (i)—All appliances having flue collars unless specifically approved for installation without

flue connection.

(j)—Gas-fired incinerators.

(k)—Gas ranges, clothes dryers and other heat producing equipment originally designed for solid- or liquid-fuel firing or arranged with bottom vent or U shaped vent passages.
3—Flues or gasvents are not required for gas ranges, clothes dryers originally designed for gas fuel, and appliances specifically approved for installation without flues or gasvents.
4—The arrangement of smoke pipes and gasvent connections should be as illustrated in section AM 503-2.4 Equipment Standards—Heat Producing Equipment—Removal of Products of Combustion, part 5, page 36, entitled, "Arrangement of Smoke Pipes and Gasvent Connections."



Equipment Standards – Heat Producing Equipment – Removal of Products of Combustion	Code Manual——State Building Code Commission Equipment Standards – Heat Producing Equipment – Removal of Products of Combustion	AM 503-2.4	5
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### **Construction of Smoke Pipes and Gasvent Connections**

1—Connections to flues and gasvents shall be made with tight joints, and shall be firmly secured to the heat producing equipment and thimble or flue ring.

2—Connections into chimneys shall enter through burned clay or metal thimbles, or flue rings of masonry.

3—Connections shall have metal or other approved noncombustible supports at intervals not exceeding 5 feet, and sections shall be fastened together with not less than 3 screws, bolts or other approved noncombustible fastening at each joint. Smoke pipe should be capable of withstanding puff-back. Cleanouts are recommended to permit cleaning without disassembly.

4-Minimum construction of smoke pipes and gasvent connections shall be as follows:

Diameter or greatest dimensions	U.S. gage number	
Up to 5 inches.           6 to 10 inches.           11 to 14 inches.           15 inches and over	26 24 22 20	

### 5—Size of Connections

(a)—For gas-fired heat producing equipment the minimum cross-sectional area of the gasvent connection should be equivalent to the cross-sectional area of a 3-inch diameter pipe. When heat producing equipment originally designed for fuel other than gas is converted to the use of gas fuel, the area of the vent connection for such appliance should be not less than 1 square inch for each 6500 Btu input rating; such connection may be smaller than the smoke outlet originally provided on the appliance. Minimum cross-sectional area of gasvent connection and hood for conversion of solid-fuel-burning furnaces and boilers should be equivalent to cross-sectional area of 5-inch diameter pipe.

(b)—For solid or liquid fuel-fired heat producing equipment the minimum cross-sectional area of the smoke pipe should be as recommended by the manufacturer of the equipment.

6—Connections should be as nearly square or round as possible. Where one cross-sectional dimension is more than twice the other cross-sectional dimension, the cross-sectional area of the connection should be increased to compensate for added friction loss.

7-No damper should be installed on any vent connection from gas-fired equipment. Turn dampers for solid or liquid fuel-fired heat producing equipment should have 20 per cent minimum opening to prevent complete shut-off of flue outlet.

8—Barometric dampers should automatically limit the draft at the outlet of the heat producing equipment to a maximum of 0.10 inches of water or to manufacturer's requirements, which ever is less.



9—Every vent connection to gas-fired heat producing equipment should be equipped with a draft hood unless such equipment has incorporated within it a device which meets the requirements of a draft hood; and except that draft hoods are not required on gas-fired incinerators, equipment designed for forced venting, or on appliances specifically designed and approved for installation without draft hoods.

# **Multiple Connections**

1—Two or more smoke pipes or gasvent connections may be joined or connected into a single flue or gasvent when such connections, flues, or gasvents are of sufficient size and proper type to serve the connected heat producing equipment and when all the connections are constructed to comply with the severest requirements for any one connection, except as follows:

(a)—Gasvent connections shall not be made into smoke pipes or flues which also serve solid or liquid fuel-fired appliances unless the gas-fired equipment so connected is manually controlled or is equipped with automatic devices which prevent the escape of unburned gas at the main burners and, for liquefied petroleum gas systems, at the pilot lights as well. When a gasvent is connected to a smoke pipe serving other equipment, the connection should be made in the direction of gas flow into a  $\mathbf{Y}$  fitting in the side of the smoke pipe located as close as practicable to the flue.

(b)—Smoke pipes and gasvent connections from heat producing equipment which may operate simultaneously may be made into the same flue or gasvent only when the aggregate areas of such connections do not exceed the net area of the flue or gasvent, and the height and location of such flue or gasvent is such as to provide adequate draft for all connected heat producing equipment under all probable conditions of operation.

(c)-No connection from any other heat producing equipment should be made into the flue of a flue-fed incinerator.

(d)—A maximum of 4 gas-fired hot water heaters may be connected to a common gasvent connection providing the following conditions are complied with: all water heaters are located on the same story; maximum length of branches connecting outlets from appliances to the main horizontal portion of connection does not exceed 3 feet; the flue height is increased to compensate for the added friction loss where the longest horizontal run exceeds 10 feet; minimum upward slope of 1 inch per foot is maintained; branches connect to the main horizontal portion in the direction of gas flow in a  $\Upsilon$  fitting in the side of the main; minimum diameter of main horizontal portion is 5 inches; minimum diameter is 6 inches where the maximum gas input rating of all connected heaters is over 100,000 Btu per hour and, or 4 units are connected.

Code Manual——State Building Code Commission Equipment Standards – Heat Producing Equipment – Removal of Products of Combustion	AM 503-2.4	5

### **Clearance from Combustible Construction**

1—Clearances are illustrated in section AM 503-2.4 Equipment Standards—Heat Producing Equipment—Removal of Products of Combustion, part 5, page 40, entitled, "Clearance for Smoke Pipes and Gasvent Connections Through Combustible Construction," and part 5, page 41, entitled, "Clearance for Gasvent Connections." Additional clearances for smoke pipes are illustrated in section AM 503-2.2 Equipment Standards—Heat Producing Equipment—Clearance, part 5, pages 29 and 30, entitled, "Clearance for Furnaces, Boilers, and Incinerators."

2—Clearances of smoke pipes and gasvents to combustible construction shall be as set forth herein, except that lesser clearances proved safe by test may be approved by the enforcement officer.

3—Gasvents for runs directly from the space in which heat producing equipment is located through a roof or exterior wall to the outer air may be installed as type C gasvents. 4—No smoke pipe should pass through a floor or ceiling of combustible material or construction. A smoke pipe may pass through a floor or ceiling of noncombustible construction only where no potential hazard is created.

5—Clearances for vent connections from gas-fired incinerators shall be those indicated for smoke pipes in section AM 503-2.2 Equipment Standards—Heat Producing Equipment —Clearance, part 5, pages 29 and 30, entitled, "Clearance for Furnaces, Boilers, and Incinerators."



# **Clearance for Smoke Pipes and Gasvent Connections** Through Combustible Construction



SMOKE PIPES AND INCINERATOR GASVENTS THROUGH COMBUSTIBLE WALLS



GASVENTS, OTHER THAN TYPE B AND INCINERATOR GASVENTS. THROUGH COMBUSTIBLE WALLS AND ROOFS

The illustration above for gasvents, other than type B, and gasvents used at temperatures above 550° F.

For clearance of type B gasvents through combustible conincinerator gasvents, serves also for type C gasvents and struction, see illustration entitled, "Clearance for Gasvent Connections," in this section of Manual.



# **Clearance for Gasvent Connections**

width (see

table 1)

clearance (see table 2)

clearance (see table 3)

width



construction:





clearance

28-gage minimum sheet metal

spaced out 1 inch with

limit of combustible

28-gage minimum sheet metal

spaced out 1 inch with noncombustible spacers

construction

line of outlet from draft hood-

line of outlet from draft hood

noncombustible spacers



GASVENT CONNECTIONS OTHER THAN TYPE B

3 ft

I" min

Note A—Not applicable to floor furnaces and incinerators. Note B—Clearance equals 6 inches for

flue gas up to 550° F., 9 inches for flue gas over 550° F., and 18 inches for incinerators.

Note C—For passage through combustible construction provide clearances indicated in notes A and B using noncombustible thimble and noncombustible caps or plates on both sides.

TABLE I

	Clearance	Width
Flue gas up to 550° F	2"	12"
Flue gas over 550° F	4"	18"
Incinerators	9"	30"

Note: Not applicable to floor furnaces.

TABLE 2

Type of floor furnace	Clearance
Approved floor furnace with type B gasvent	3 in. for 3 ft run, may reduce to 1 in. beyond 3 ft run
Others	9″

TA	BL	E	3
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Type of floor furnace	Clearance	Width
Approved floor furnace with type B gasvent	2″	6"
Others	4"	18″

FLOOR FURNACE GASVENT CONNECTIONS

5	AM 503-2.5	Code Manual——State Building Code Commission Equipment Standards – Heat Producing Equipment – Safety Devices

# AM 503-2.5 Safety Devices

# **Pressure Relief for Heat Producing Equipment**

1—All heat producing equipment supplying steam or hot water should be protected against excess pressure by means of a relief or safety valve.

2-Relief or safety valve should not be installed further than 5 feet from the heat producing equipment to be protected.

3-Shut-off valve should not be installed between the heat producing equipment and the relief or safety valve.

4-Relief or safety value should be provided with a device for testing while in service. The relieving pressure should be set to a safe maximum value.

5—The discharge from the relief or safety valve should be located so as not to constitute a potential physical hazard.

6—The system of a hot water heating boiler connected to an open expansion tank should be so installed as to prevent the freezing of the water in tank and connecting pipes. Overflow outlet from tank should be protected against freezing and obstruction.

# Safety Controls for Heat Producing Equipment

1—Automatically fired boilers and hot air furnaces should be provided with means to limit the input of heat to produce no more than 15 pounds pressure or 250° F.

2—Automatic controls, if any, for heat producing equipment should be so arranged that when the predetermined temperature or pressure is exceeded, the following operation should occur despite the possible failure of electric power or the action of other controls that demand continued operation of the equipment:

(a)-Hand-fired coal boilers: Close ash pit damper and open check damper.

(b)—Automatically fired boilers: Stop fuel supply, except that in forced hot water systems the circulator shall continue in operation.

(c)—Automatically fired hot air furnace systems: Stop fuel supply, except that in forced hot air systems the fan shall continue in operation.

3—Oil burner switch: Every oil burner should have a remote control provided whereby the flow of oil to the oil burner can be stopped, and such remote control should be located outside the entrance to the room in which the burner is installed and as near to such entrance as practical. When an outside location is impracticable such remote control may be provided immediately inside the room in which the burner is installed, if such location is accessible at all times. Such remote control should be legibly labeled, EMERGENCY CONTROL FOR OIL BURNER. On auxiliary storage tanks used with manually operated burners such remote control may be installed on feed lines between tank and burner.



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

5	AM 503-3	Code Manual——State Building Code Commission Equipment Standards – Chimneys, Flues, and Gasvents
	NOVEMBER 1951	

# AM 503-3 Chimneys, Flues, and Gasvents

# AM 503-3.1 General Requirements

### Area

1—The inside effective area of flue or gasvent should total the area of smoke or vent outlets of the individual or several smoke or vent outlets of heat producing equipment connected thereto, except where the flue or gasvent will produce adequate draft for all connected appliances under all probable conditions of operation.

2—The greater dimension of any rectangular or oval shaped flue should not be more than twice the lesser dimension. Where this ratio is exceeded, the cross-sectional area should be increased to compensate for the added friction loss.

3—Cross-sectional area of flue or gasvent should not be less than 1 square inch per 7500 hourly Btu input, and in no case less than the cross-sectional area of a 3-inch diameter pipe.

# Construction

Chimneys, flues, and gasvents should be constructed so that:

1-They are gastight, noncombustible, durable, and of sufficient thickness to withstand damage.

2—They bear on masonry, concrete or noncombustible supports designed to carry the load without settlement or cracking.

3—They do not support any other part of the structure.

4—They are stable, and, where of units, the assembly of the units should form a strong integral structure, securely supported and adequately braced or tied.

5—Portions exposed to weather or condensed moisture are corrosion resistant or protected against corrosion.

6—They run primarily vertical. If offset, the corbel should project not more than one third the height of the corbeled masonry unit, or the angle with the vertical should not exceed 20 degrees. If a chimney contains flues for fireplace and heating equipment, and if only one of these must be offset, offset should be made in fireplace flue, and flue from heating equipment should run straight. Corbeling should start first on the side where offset is desired in order to insure constant inside cross-sectional area without pockets or restrictions to break the streamline flow of gas. Liners should be properly beveled at changes in direction and at changes in cross-sectional dimensions to insure smooth, tight joints.

Code Manual——State Building Code Commission Equipment Standards – Chimneys, Flues, and Gasvents	AM 503-3	5

### Use and Maintenance

1—Flues and gasvents shall be maintained in a safe condition. Any flue or gasvent which becomes unsafe or dangerous should be replaced. Openings no longer required in flues or gasvents should be sealed with noncombustible material.

2-No newly installed heat producing equipment should be connected to an existing flue or gasvent not in conformity with the Code.

### Chimneys and Flues

1—Chimneys should comply with section AM 503-3 Equipment Standards—General Requirements, part 5, page 44, and as illustrated in section AM 503-3 Equipment Standards—Chimneys, Flues, and Gasvents, part 5, pages 50 and 51, entitled, "Chimney Construction," and part 5, page 52, entitled, "Clearance from Combustible Construction." 2—No chimney should be corbeled from a hollow wall or wall of hollow masonry units. Except where a chimney is corbeled equally on both sides of a wall, no solid masonry wall of less than 12-inch nominal thickness should be used to support a corbeled chimney. Corbeling should project not more than 6 inches from the wall, and the individual corbels should project not more than one third the height of the corbeled masonry unit.

3—Unless specifically designed to resist the lateral and dead loads, chimneys wholly or partly outside a building should be laterally supported at each floor line above the first floor and at the roof line, and the laterally unsupported height of the topmost portion of the chimney should not exceed 4 times its minimum horizontal dimension. Chimneys within the interior of a building should be braced at the roof line, and the laterally unsupported height of the topmost portion should not exceed 4 times its minimum horizontal dimension.

4—Masonry units and mortar used in chimney construction should conform to applicable requirements specified in section AM 301b Structural Standards—General Requirements —Masonry Construction, part 3, beginning on page 16.

5-Mortar shall be type A-2 or B, as described in section AM 301b Structural Standards -General Requirements-Masonry Construction, part 3, page 19, entitled, "Mortar."

6—For chimneys lined with formed burned clay flue lining, the masonry shall be built around each section of lining, with the lining placed in position first.

7—Iron or steel flue linings for type A flues should be not less than 22 U. S. gage when less than 7 inches in diameter; and not less than 20 U. S. gage when 7 inches or greater in diameter.

8-A suitable soot pocket and cleanout door should be provided at the base of every



type A flue except in such instances where arrangement of the heat producing equipment does not require such installation, as in fireplaces.

9—For tests to determine the acceptance of type A flues, see section AM 503-3 Equipment Standards—Chimneys, Flues, and Gasvents, part 5, page 47, entitled, "Acceptance Tests for Type A Flues and Type B Gasvents."

# **Type B Gasvents**

1-Type B gasvents should comply with section AM 503-3 Equipment Standards-Chimneys, Flues, and Gasvents, part 5, beginning on page 44.

2—A suitable boot and drain for the removal of condensation should be provided at the bottom of the gasvent assembly, except such boot and drain need not be provided where tests demonstrate that flue gas will not form condensation.

3—Joint cement should not deteriorate when subjected to flue gas temperatures up to 700° F.

4—Each type B gasvent should bear a permanently affixed label or legend, near the vent connection outlet, indicating the use to which it is limited.

5—The cross-sectional area of type B gasvents should be not less than the size of flue collar on equipment served. When more than one heat producing device is served, flue area should be not less than area of largest gasvent connection plus 50 per cent of the areas of the additional gasvent connections.

6—For tests to determine the acceptance of type B gasvents, see section AM 503-3 Equipment Standards—Chimneys, Flues, and Gasvents—General Requirements, part 5, page 47, entitled, "Acceptance Tests for Type A Flues and Type B Gasvents."

7—Clearance from combustible material and passage through combustible material should be as illustrated in section AM 503-2.4 Equipment Standards—Heat Producing Equipment —Removal of Products of Combustion, part 5, page 41, entitled, "Clearance for Gasvent Connections," and part 5, page 40, entitled, "Clearance for Smoke Pipes and Gasvent Connections Through Combustible Construction."

# Type C Gasvents

1—Type C gasvents shall serve gas-fired appliances only, for runs from the space in which the gas-fired appliance is located through a roof or exterior wall to the outer air, provided such gasvent shall not pass through any floor, attic, or concealed space. Type C gasvents should comply with section AM 503-3 Equipment Standards—Chimneys, Flues, and Gasvents, part 5, beginning on page 44.

2-Type C gasvents should be of sheet copper weighing not less than 16 ounces per

and Gasvents J	Code Manual—State Building Code Commission Equipment Standards – Chimneys, Flues, and Gasvents	AM 503-3	5
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square foot, or of galvanized iron not thinner than 20 U.S. gage, or of approved equivalent noncombustible material.

3—Clearances from combustible material should be the same as for smoke pipes as illustrated in section AM 503-2.2 Equipment Standards—Heat Producing Equipment—Clearance, part 5, pages 29 and 30, entitled, "Clearance for Furnaces, Boilers, and Incinerators." 4—Passage through combustible construction should be as illustrated in section AM 503-2.4 Equipment Standards—Heat Producing Equipment—Removal of Products of Combustion, part 5, page 40, entitled, "Clearance for Smoke Pipes and Gasvent Connections Through Combustible Construction."

## Acceptance Tests for Type A Flues and Type B Gasvents

### 1—General

(a)—Type A flues and type B gasvents of construction other than as set forth in section AM 503-3 Equipment Standards—Chimneys, Flues, and Gasvents, part 5, beginning on page 44, are acceptable provided such flues meet the temperature limitations set forth in the tests prescribed in this section, and provided further, that such flues and gasvents comply with those applicable general requirements not covered in the scope of the tests. (b)—Test assemblies for type A flues and type B gasvents representative with respect to size, shape, and construction of those for which approval is sought, shall be set up in the manner and with the clearances to combustible material illustrated in section AM 503-3 Equipment Standards—Chimneys, Flues, and Gasvents, part 5, page 48, entitled, "Test Assembly for Type A Flue," and part 5, page 49, entitled, "Test Assembly for Type B Gasvent," except that when approval with lesser clearances is proposed such lesser clearances shall be used in the test assembly.

### 2-Temperature Measurement

The temperatures for the test assemblies for type A flues and type B gasvents shall be measured at the locations indicated in the above mentioned illustrations.

### 3-Conditioning of Test Assembly

The test assemblies shall be conditioned by not less than two simulative test runs to thoroughly dry and prepare them for the acceptance tests.

### 4—Test Temperature Within Type A Flues

The test temperature as measured by two thermocouples within the flue opposite the combustible framing shall be raised to 1200° F. within 5 minutes and controlled to average between 1100° F. and 1300° F., with peaks not to exceed 1500° F. during the first 30

### Text continued on page 53, part 5



X—Thermocouple on combustible material and protected with thin mica sheets; 2 required.

**O**-Unprotected thermocouple, 4 required.

#### Notes

1 For rectangular flues place all thermocouples on the long side.

2 Finish floor may contact chimney for 2 inches at corners. Base or trim should be fastened to soldier grounds placed at corners.



1'-0"

-smoke

pipe

Н

Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.

heater



Constructions illustrated or described herein are acceptable under the State Building Construction Code, but shall not be interpreted to exclude other constructions which meet the requirements of the Code.







# weathertight 10 ft minimum cement wash or flue lining extended to masonry capproject above masonry 2 ft minimum limit of combustible construction roof 1/ floor construction floor joists firestopping firestopping iron or fire clay thimble joints smooth on inside lining 4 inches or more below smoke-pipe intake ledge for support of flue lining recommended. but not required cleanout door tight when closed LININGS masonry or concrete withes: minimum $3\frac{1}{2}$ inches actual thickness

# **Chimney Construction - 2**

LININGS masonry or concrete withes: minimum 31/2 inches actual thickness maximum of two flues between masonry withes minimum 1-inch mortar withe WITHES Flue Linings should be of clay. They should be free from cracks through the wall, and should have dimensions conforming to standards of the American Standards Association for sizes of clay flue linings. Upon installation, linings should be free from chips or openings which affect the tightness of the flue. They should be set in full mortar beds with joints struck off smooth on the inside.

Withes-Where two or more flues are contained in the same chimney, withes of masonry or concrete not less than 3<sup>1</sup>/<sub>2</sub>-inch actual thickness should be provided at intervals not exceeding 30 inches horizontally. Not more than two flues should be installed without separation by masonry or concrete withes. Where the flue linings are not separated by masonry or concrete withes, mortar withes not less than 1-inch thick should be used. Flue linings on either side of mortar withe should be set so that the vertical distance between joints in adjacent flue linings is not less than 7 inches.

Cleanout door at base of flue is recommended but not required.



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### Text continued from page 47, part 5

minutes. After the first 30 minutes, the flue temperatures shall be reduced to 1000° F. and maintained at that temperature, plus or minus 10 degrees, until the rate of temperature increase of the combustible material is less than 5 degrees per hour. In any case the test need not be run for more than 8 hours.

## 5—Test Temperature Within Type B Gasvents

The test temperature as measured within the gasvent shall be raised to 550° F. within 5 minutes and maintained at that temperature, plus or minus 10 degrees, until the rate of temperature increase of the combustible material is less than 3 degrees per hour. In any case the test need not be run for more than 4 hours.

### 6—Acceptance Limitations

Acceptable test flues and gasvents shall not cause the temperature of any combustible material adjacent thereto or in contact therewith to increase more than 175° F. above the initial temperature.

## AM 503-3.2 Draft

1—The length or height of the vertical portion of chimney, flue, and gasvent should be measured from the level of the grate or burner; should not be less than 4 feet above the smoke outlet of the equipment vented; and should conform to the following:

Length of horizontal portion of smoke pipe or gas vent connection	Length of vertical portion above horizontal portion
12 feet or less	Not less than length of hori- zontal portion
More than 12 feet	Not less than 1½ times the length of horizontal portion

2—Height of chimneys, flues, and gasvents should be made in accordance with heat producing equipment manufacturer's recommendations with allowance for increase in height or cross-sectional area for locations having an elevation above sea level of 1000 feet or more.

3—Draft in combustion chamber for all operating conditions should be sufficient to assure that the products of combustion at all times will flow inward into the chimney, flue, or gasvent.



Code Manual——State Building Code Commission Equipment Standards – Electrical Wiring and Equipment	AM 504	5
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# AM 504 Electrical Wiring and Equipment

# AM 504-1 General Requirements

Electrical wiring and equipment materials listed in ULI, *Electrical Equipment List*, and installed in conformance with the applicable requirements of ASA, *National Electrical Code*, listed in AM appendix A, will be deemed to be in conformity with the requirements of the Code.

## **Television Antenna Installation**

1—Mast and supporting structure of television antenna should be substantially constructed so as to be capable of withstanding the wind and ice loads to which they will be subjected.

2—Antenna and lead-in should not be installed in close proximity to electric service lines. A sufficient distance is to be maintained so that no contact can be made in the event of antenna overturning.

3—Masts may be secured to side walls, parapet walls, or to chimneys in good structural condition. Attachment to chimneys is not recommended, but where unavoidable, should be made by means of 2 or more substantial iron straps encircling the chimney. Attachment should not be made to chimneys in poor structural condition or by means of any device inserted into drilled holes in the brick or mortar. It is recommended that masts extending more than 8 feet above the topmost support be guyed.

4—Mast and supporting structure, if of metal, should be effectively grounded in a permanent manner. If a system of lightning protection exists, the mast and structure should be bonded to the nearest lightning conductor; where such system does not exist, the mast and structure should be grounded. Grounding electrodes in the order of preference may be a continuous underground system of metallic water piping on street side of water meter, the metal frame of the building if effectively grounded, a continuous underground system of metallic gas piping on street side of gas meter, driven pipe, driven rod, buried plate or other device approved for the purpose.

5-Soil, waste, vent, drain or heating pipes should not be used for grounding purposes.

6-Electrical materials and installation, including grounding, should be in conformity with the ASA, *National Electrical Code* listed in AM appendix A.

5	AM 505	Code Manual——State Building Code Commission Equipment Standards – Elevators
	NOVEMBER 1951	

### AM 505 Elevators

1—Elevators constructed and installed in conformance with applicable provisions of the ASA, Safety Code for Elevators Dumbwaiters and Escalators listed in AM appendix A, are deemed to be in conformity with the requirements of the Code.

2—Fire-safety requirements for hoistway enclosure and opening protectives therein, are set forth in sections AM 402-4 Fire-Safety Standards—Division by Fire Separation, General Requirements, part 4, beginning on page 30, and in section AM 402-5 Fire-Safety Standards—Openings in Fire Partitions, Party Walls, and Fire Separations, part 4, beginning on page 32.

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Generally Accepted Standards	A
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### **Generally Accepted Standards**

Copies of the standards listed below may be obtained from the organizations at the addresses given excepting those of United States government agencies which may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. However, specifications identified by MIL or JAN and Army Air Force Specifications should be obtained from Commanding General, Air Material Command, Wright-Patterson Air Force Base, Dayton, Ohio.

#### American Concrete Institute 18263 West McNichols Road Detroit 19, Michigan

Building Code Requirements for Reinforced Concrete (318-1951). Specifications for Cast Stone (704-1944).

#### American Gas Association Laboratories 1032 East 62 Street Cleveland 3, Ohio

Directory of Approved Gas Appliances and Listed Accessories (1951).

## American Institute of Steel Construction, Inc. 101 Park Avenue

New York 17, New York

Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction) (Rev. June 1949).

#### American Iron and Steel Institute 350 Fifth Avenue New York 1, New York

Light Gage Steel Design Manual (1949). Steel Regulations (Bulletin V, 1949).

#### American Society of Heating and Ventilating Engineers 51 Madison Avenue New York 10, New York

Heating Ventilating Air Conditioning Guide (1951).

#### American Society of Mechanical Engineers 29 West 39 Street New York 18, New York

Rules for Construction of Low-Pressure Heating Boilers. Section IV ASME Boiler Construction Code (1949 edition).Unfired Pressure Vessels (1949 edition).



#### American Society for Testing Materials 1916 Race Street Philadelphia 3, Pennsylvania

Standard Specifications for Quicklime for Structural Purposes (C 5-1926). Tentative Specifications for Natural Cement (C 10-1949T). Standard Specifications for Gypsum (C 22-1950). Standard Specifications for Concrete Aggregates (C 33-1949). Standard Specifications for Structural Clay Load-Bearing Wall Tile (C 34-1950). Standard Specifications for Gypsum Partition Tile or Block (C 52-1941). Standard Specifications for Concrete Building Brick (C 55-1937). Standard Specifications for Structural Clay Non-Load-Bearing Tile (C 56-1950). Standard Specifications for Building Brick (Solid Masonry Units Made from Clay or Shale) (C 62-1950). Standard Specifications for Sand-Lime Building Brick (C 73-1939). Standard Specifications for Hollow Load-Bearing Concrete Masonry Units (C 90-1944). Standard Specifications for Masonry Cement (C 91-1949). Standard Specifications for Hollow Non-Load-Bearing Concrete Masonry Units (C 129-1939). Standard Specifications for Lightweight Aggregates for Concrete (C 130-1942). Standard Specifications for Hydraulic Hydrated Lime for Structural Purposes (C 141-1942). Standard Specifications for Aggregate for Masonry Mortar (C 144-1944). Standard Specifications for Solid Load-Bearing Concrete Masonry Units (C 145-1940). Standard Specifications for Portland Cement (C 150-1949). Tentative Specifications for Air-Entraining Portland Cement (C 175-1950T). Tentative Specifications for Portland Blast Furnace Slag Cement (C 205-1948T). Standard Specifications for Hydrated Lime for Masonry Purposes (C 207-1949). Tentative Specifications for Mortar for Unit Masonry (C 270-1951T). Tentative Methods for Establishing Structural Grades of Lumber (D 245-1949T). Tentative Methods of Conducting Strength Tests of Panels for Building Construction (E 72-1947T). Tentative Method of Fire Hazard Classification of Building Materials (E 84-1950T). Standard Methods of Fire Tests of Building Construction and Materials (E 119-1950). Standard Methods of Fire Tests of Door Assemblies (E 152-1941).

### American Standards Association, Inc. 70 East 45 Street

#### New York 17, New York

Safety Code for Elevators Dumbwaiters and Escalators. Rules for Construction, Inspection, Maintenance, and Operation (A 17.1-1937) (A 17.3-1942).
Plumbing Code; Minimum Requirements for Plumbing (A 40.7-1949).
Building Code Requirements for Masonry (A 41.1-1944).
Standard Specifications for Portland Cement Stucco (A 42.2-1946).
Building Code Requirements for Reinforced Gypsum Concrete (A 59.1-1945).
Sizes of Clay Flue Linings (A 62.4-1947).
Building Code Requirements for Steel Joist Construction (A 87.1-1947).
National Electrical Code (C 1-1951).
Approval Requirements for Domestic Gas Ranges (Z 21.1-1948) with addenda (Z 21.1a-1949).
Approval Requirements for Domestic Gas Conversion Burners (Z 21.8-1948).
Approval Requirements for Gas Water Heaters (Z 21.10-1950).

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- Approval Requirements for Gas-Fired Room Heaters (Z 21.11-1949) with addenda (Z 21.11a-1950).
- Approval Requirements for Central Heating Gas Appliances, Vol. I Steam and Hot Water Boilers (Z 21.13.1-1951).
- Approval Requirements for Central Heating Gas Appliances, Vol. II Gravity and Forced Air Central Furnaces (Z 21.13.2-1951).
- Approval Requirements for Central Heating Gas Appliances, Vol. III Gravity and Fan Type Floor Furnaces (Z 21.13.3-1951).
- Approval Requirements for Central Heating Gas Appliances, Vol. IV Gravity and Fan Type Vented Recessed Heaters (Z 21.13.4-1951).

Approval Requirements for Gas Unit Heaters (Z 21.16-1940, R. 1947).

Listing Requirements for Domestic Gas Conversion Burners (Z 21.17-1948).

Installation of Gas Piping and Gas Appliances in Buildings (Z 21.30-1950).

Approval Requirements for Gas-Fired Duct Furnaces (Z 21.34-1942, R. 1950).

#### Douglas Fir Plywood Association Tacoma 2, Washington

Technical Data on Plywood (1948 edition).

#### National Board of Fire Underwriters 85 John Street New York 7, New York

- Standards of the National Board of Fire Underwriters for the Installation of Oil Burning Equipments (pamphlet No. 31, 1950).
- Standards of the National Board of Fire Underwriters for the Installation of Oil Burners in Stoves and Ranges Originally Designed for Solid Fuels and for the Storage and Use of Oil Fuels in Connection Therewith (pamphlet No. 39, 1932).
- Standards of the National Board of Fire Underwriters for the Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases (pamphlet No. 58, 1950).
- Standards of the National Board of Fire Underwriters for Incinerators (pamphlet No. 82, 1938).
- Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems (pamphlet No. 90, 1950, with amendments).
- Standards of the National Board of Fire Underwriters for the Installation, Maintenance and Use of Small Heating and Cooking Appliances (Kerosene and Fuel Oil) (pamphlet No. 310, 1937).
- Building Code Standards of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems (1949).

#### National Lumber Manufacturers Association 1319 Eighteenth Street, N.W. Washington 6, D. C.

National Design Specification for Stress-Grade Lumber and Its Fastenings (1944, revised 1950). Working Stresses for Stress Grade Lumber (supplement No. 1, 1950, Wood Structural Design Data Vol. 1, 1948).



#### New York, State of, Department of Health Albany, New York

Rules and Regulations for the Preparation and Submission of Plans for Systems of Sewerage and Sewage and Waste Disposal (bulletin 1, 1947).

New York, State of, Department of Labor 80 Centre Street New York 13, New York

or

Bureau of Printing Room 912 State Office Building Albany 1, New York

> Rules as Amended Relating to the Construction, Inspection, and Maintenance of Steam Boilers (Industrial Code Rule No. 14, amended 1949).

> Rules Relating to the Protection of Persons Employed in the Erection, Repair and Demolition of Buildings or Structures (Industrial Code Rule No. 23, September 1951).

#### Underwriters' Laboratories, Inc. 207 East Ohio Street Chicago 11, Illinois

Electrical Equipment List (1951).
List of Inspected Fire Protection Equipment and Materials (1951).
List of Inspected Gas, Oil, and Miscellaneous Appliances (1950).
Standard for Underground Storage Tanks (subject 58, 1949).
Standard for Inside Tank Equipment for Oil Burners (subject 80, 1934).
Standard for Horizontal and Vertical Above-Ground Storage Tanks for Hazardous Liquids (subject 142, 1922).
Standard for Domestic Oil Burners (subject 296, 1934).

### UNITED STATES GOVERNMENT AGENCIES

#### Army and Navy Specifications

- Joint Army-Navy Specification: Adhesives, Thermosetting-Resin, Room-Temperature and Intermediate-Temperature Setting, Waterproof (Phenolic, Resorcinol, and Melamine Base) (For Wood) (JAN-A-397, 1946, with amendment, 1948).
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# **Classification of Roof Coverings**

The classification given in this appendix requires that roof coverings shall be assembled and applied in accordance with the following:

# **Prepared** Roof Coverings

1—Shingles, including slate and tile, sheet or roll roofing, shall be applied with sufficient lap to give the required number of thicknesses, and shall be sealed with cementing material where necessary to render the roofing weathertight.

2—Nailing for shingle or tile roofing shall be in conformity to the manufacturer's specifications, or shall be with corrosion-resistant 12-gage nails having not less than 3%-inch diameter heads long enough to penetrate the sheathing 3% inch.

3—Underlay for use with tile, shingle, or sheet metal roofing shall consist of one layer of type 15 asphalt-saturated asbestos felt or of two layers of type 15 asphalt-saturated rag felt or equivalent.

4—Shingle-type roofings shall be limited to inclines exceeding 4 inches per horizontal foot. 5—Asphalt-asbestos sheet roofing shall be limited to inclines exceeding 4 inches but not exceeding 12 inches per horizontal foot.

# **Built-Up Roof Coverings**

1—Built-up roof coverings shall be of the required number of layers of type 15 felt weighing, for each layer, approximately 15 pounds per 100 square feet of roof surface or of 30-pound or heavier felt providing that not more than one layer of heavier material is substituted for each two layers of type 15 felt.

2—Built-up roofing shall be mopped solidly between layers with not less than 20 pounds of hot asphalt, or 30 pounds of hot coal-tar pitch, or  $1\frac{1}{2}$  gallons of cold bituminous compound per 100 square feet of roof surface.

3—Base sheets for built-up roofing shall be applied to roof sheathing by nailing or by mopping the entire surface with cementing material of the same kind and amount of cement material used between the layers.

4-Nailing for base sheets of built-up roofing shall be with corrosion-resistant 12-gage nails with 9/16-inch diameter or larger heads long enough to penetrate the roof sheathing  $\frac{3}{4}$  inch, using one nail to each 1-1/3 square feet of roof surface.

5—Gravel, stone, or slag surfacing materials shall be of  $\frac{1}{2}$ -inch to  $\frac{1}{2}$ -inch size, and approximately 400 pounds of gravel or stone, or 300 pounds of slag, shall be used to each 100 square feet of roof surface.

6—Built-up roofing, without surfacing or surfaced with asphalt or other cement, shall be limited to inclines not exceeding 5 inches per horizontal foot; those surfaced with gravel, stone or slag shall be limited to inclines not exceeding 3 inches per horizontal foot.



# **Class 1 Roof Coverings**

# **Prepared Roof Coverings**

1-Clay or concrete deck tile, or reinforced concrete not less than 1-inch thick, laid in cement or in asphalt or tar mastic.

2-Clay or concrete roof tile with underlay.

3—Slate not less than  $\frac{3}{8}$ -inch thick.

4—Asbestos-cement shingles not less than <sup>3</sup>/<sub>8</sub>-inch thick, laid to give two or more thicknesses over underlay.

5—Asbestos protected sheet metal.

6—Asphalt asbestos-felt smooth surfaced sheet roofing made of 4 plies of asphalt and asbestos materials, laid in single thickness with 2-inch end lap and with 6-inch wide strips beneath butted edges of sheet to have a weight of not less than 80 pounds per 100 square feet of roof surface.

# **Built-Up Roof Coverings**

1-Five layers of type 15 asphalt-saturated asbestos-felt or equivalent, cemented together with asphalt, and surfaced with asphalt paint.

2—Four layers of type 15 asphalt- or tar-saturated asbestos felt or rag felt or equivalent, cemented with asphalt or tar, and finished with gravel, stone, or slag in asphalt or tar.

3—Three layers of type 15 asphalt-saturated rag felt or equivalent, cemented with asphalt, and finished with asphalt roof tile or with  $1\frac{1}{2}$ -inch asphalt impregnated fibrous board applied with mastic asphalt.

# Class 2 Roof Coverings

# Prepared Roof Coverings

1—Asbestos-cement shingles not less than  $\frac{3}{8}$ -inch thick, laid to provide one or more thicknesses over underlay.

2—Asphalt asbestos felt smooth surfaced sheet roofing made of 3 plies of asphalt and asbestos materials, laid in single thickness with 2-inch end lap and with 6-inch wide strips beneath butted edges of sheet to have a weight of not less than 60 pounds per 100 square feet of roof surface.

3—Asphalt asbestos felt shingles, surfaced with granular materials, laid to have a weight of not less than 180 pounds per 100 square feet of roof surface.

4-Asphalt mastic shingles surfaced with granular materials.

5-Sheet roofing of copper, galvanized iron, or tin-coated iron with underlay.

6—Tile or shingle pattern roofing of copper, galvanized iron, or tin-coated iron with underlay.

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# **Built-Up Roof Coverings**

1-Four layers of type 15 asphalt- or tar-saturated asbestos felt or rag felt or equivalent, cemented with asphalt, and finished with asphalt cement.

2—Three layers of type 15 asphalt- or tar-saturated rag felt or equivalent, cemented with asphalt, and finished with gravel, stone, or slag in asphalt or tar cement.

# **Class 3 Roof Coverings**

# **Prepared Roof Coverings**

1—Asphalt asbestos felt smooth surfaced sheet or roll roofing laid in single thickness with laps to have a weight of not less than 48 pounds per 100 square feet of roof surface.

2—Asphalt asbestos felt granular surfaced sheet or roll roofing laid in single thickness to have a weight of not less than 85 pounds per 100 square feet of roof surface.

3—Asphalt rag felt granular surfaced sheet or roll roofing, laid in double thicknesses with laps to have a weight of not less than 80 pounds per 100 square feet of roof surface.

4—Asphalt rag felt individual or strip shingles surfaced with granules, laid with lap to have a weight of not less than 180 pounds per 100 square feet of roof surface.

5—Sheet roofing of copper, galvanized iron, or tin-coated iron, without underlay or with underlay of rosin-sized paper.

6—Tile or shingle pattern roofing of copper, galvanized iron, or tin-coated iron, without underlay or with underlay of rosin-sized paper.

# **Built-Up Roof Coverings**

Three layers of type 15 asphalt-saturated rag felt or equivalent, cemented with asphalt, and finished with asphalt cement.

# **Class 4 Roof Coverings**

## **Prepared Roof Coverings**

1—Asphalt rag felt smooth surfaced roll roofing, laid in single thickness with laps to have a weight of not less than 45 pounds per 100 square feet of roof surface.

2—Asphalt rag felt granular surfaced roofing, laid in single thickness with laps to have a weight of not less than 80 pounds per 100 square feet of roof surface.

# **Built-Up Roof Coverings**

Two layers of type 15 asphalt- or tar-saturated rag felt, cemented with asphalt or tar, or such other combinations of roofing felts that do not meet the requirements of class 3 built-up roofing.

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## Fire-Resistance Ratings

Constructions illustrated in this appendix are of the minimum nominal thicknesses of materials or combinations of materials that will satisfy the fire-resistance requirements for one- and two-family dwellings and row houses. The materials shall be of the quality which meets generally accepted standards, and they shall be assembled to meet the requirements set forth in Structural Standards, part 3, of the Manual.









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— 8 inches, nominal

--- combustible joists

not less than 4 inches of solid noncombustible material below and on sides and ends of joists, or between joists framed in from opposite sides of the partitions

hollow brick or solid brick laid to give a hollow wall not less than 70 per cent solid

plaster not required



# WALLS OF CONCRETE MASONRY UNITS-COMBUSTIBLE FRAMED-IN MEMBERS

— 8 inches, nominal

∔ combustible joists

<sup>-</sup> 4 inches of solid noncombustible material below and on sides and ends of joists or between joists framed in from opposite sides

---- hollow load-bearing concrete masonry units

- 5%-inch Portland cement, sanded gypsum, perlite or vermiculite plaster; except that plaster shall not be required when units are made with cinders or other lightweight aggregates





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# Walls and Partitions: Minimum Constructions for 3-Hour Rating

## WALLS OF PLAIN OR REINFORCED CONCRETE-NONCOMBUS-TIBLE OR NO FRAMED-IN MEMBERS





plaster not required



plaster not required



# Floors: Minimum Constructions for <sup>3</sup>/<sub>4</sub>-Hour Rating

WOOD JOIST FLOORS



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## Floors: Minimum Constructions for 1-Hour Rating CONCRETE SLAB FLOORS

4-inch concrete slab with not less than 34-inch protection under the reinforcing steel

## WOOD JOIST FLOORS



#### double wood flooring

wood joists, not less than 2- by 8-inch, and spaced not more than 16 inches on center

1/2-inch perlite or vermiculite plaster on 3/8-inch perforated gypsum lath, or 7/8-inch cement plaster on metal lath

#### STEEL JOIST FLOORS









## STAIRS WITH STEEL STRINGERS



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