DENVER BUILDING CODE

CENTENNIAL ISSUE 1976
BUILDING CODE

OF THE CITY AND COUNTY OF

DENVER

Ordinance No. 690 of the Series of 1976
February 1, 1977

ERRATA TO 1976 DENVER BUILDING CODE

Section 301(c)1 and 2: Change the word "shall" to read "may." (Typo error)

Section 702(b)3 to read: Division 3 occupancies located in a basement or above the first story shall be of at least one hour fire resistance construction. (Typo error)

Section 3909(e)7A to read: Accurate logs shall be maintained on the premises indicating box numbers, location and type of devices tested. Any defect, modification, or repair shall be recorded in the log. Logs shall be made available to the Fire Department. (Typo error)

Section 3815(a) Exception 2 to read: Special extinguishing systems unless otherwise required. See Section 3812(a)1-E. (Typo error)
ACKNOWLEDGEMENTS

In this year of the Bi-Centennial and the Colorado Centennial, the revision of this Building Code was completed. The work of writing and reviewing the 61 Chapters encompassed herein was begun on May 16, 1973 and completed on September 23, 1976 by the Building Code Committee, 11 Sub-Committees and 30 Task Forces. All in all, more than 230 individuals were engaged in this writing. These Committees represented the various segments of the construction industry, including, without limitation, the following: Denver Building, Fire and Health Departments; Colorado State Health Department; Labor organizations; Architects; Engineers; Real Estate; Appraisers; Contractors; Financial Institutions; Suppliers; Manufacturers; and many others too numerous to list. Acknowledgement is also made to the International Conference of Building Officials for the use of the Uniform Building Code in the development of our Building Code, and to City Council who spent endless hours in assisting us prior to enactment and during enactment. An expression of sincere thanks is extended to all those enumerated herein and to the following for making this fine effort possible:

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Secretary
Representing the City Attorney’s Office
Representing the City Attorney’s Office
Former member representing Engineers (Structural)
Former member representing Labor

[Signature]
William H. McNichols, Jr.
Mayor
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ADMINISTRATIVE AND BOARD OF APPEALS

SECTION 100. TITLE. The title of this Ordinance shall be, and this Ordinance shall be cited and referred to as, THE BUILDING CODE or the BUILDING CODE OF THE CITY AND COUNTY OF DENVER.

SECTION 101. PURPOSE OF THE BUILDING CODE. The purpose of this Building Code is to provide minimum standards to maintain and promote the public health, safety and welfare by regulating and controlling the design, use, occupancy, construction, quality of materials, location, and maintenance of all buildings and structures within the City and County of Denver, and certain equipment specifically regulated herein.

SECTION 102. SCOPE OF THE BUILDING CODE. This Building Code shall extend to and govern the following:

(a) **New Buildings, Structures and Utilities.** Construction, addition, alteration, repair, demolition, removal, moving, occupancy, use, and maintenance of any building, structure, or utility hereafter erected within the City.

(b) **Existing Buildings, Structures, or Utilities.** Alteration, addition, repair, demolition, removal, moving, change of occupancy, and maintenance of any existing building, structure, or utility heretofore erected within the City.

(c) **Most Restrictive.** Wherever in any specific case the requirements of different Sections of this Building Code vary, the most restrictive shall govern.

SECTION 103. ORGANIZATION OF THE BUILDING INSPECTION DIVISION.

(a) **General.** There shall be and hereby is established, as an Agency under the Manager of Public Works, a Building Inspection Division. Within this Building Code, this Agency shall be referred to as the Department. See Chapter 4 for definition.

(b) **Director.** The Department shall be administered by a Director, appointed by the Mayor, with powers and duties as hereinafter defined. The Director shall be a professional engineer registered by the State of Colorado; an architect licensed by the State of Colorado; or a person holding a current Construction Class A Supervisor certificate and who has been employed as a Project Manager for a Class A Construction firm for at least 5 years.

(c) **Employees.** The Director shall authorize or appoint various individuals to carry out duties and exercise powers delegated to him by this Building Code.

(d) **Authorization and Identification.** Each employee of the Department shall be provided with an identification card bearing information required by the Director. This card shall be carried upon the person identified, and shall be displayed when necessary to identify the person properly to perform official duties.
SECTION 104. GENERAL POWERS AND DUTIES OF THE BUILDING DEPARTMENT.

(a) Powers and Duties. This Department, administered by the Director, shall administer and enforce this Building Code and all other Ordinances which are or may hereafter be assigned to the Department for enforcement and administration. There is hereby vested in the Department the duties of enforcing and administering this Building Code, and the power necessary for such enforcement.

(b) Authority to Inspect. The Department shall have the authority to inspect, or cause to be inspected, for compliance to this Building Code, all buildings, structures, or utilities.

(c) Investigations and Surveys. Incidental to any of these duties and powers, but without limitation of the same, the Department shall conduct investigations or surveys to determine compliance or non compliance with the provisions of this Building Code; and further shall investigate or cause to be investigated all accidents pertaining to buildings, structures, or utilities. All investigations or surveys shall be conducted to establish whether the requirements of this Building Code have been met or violated.

(d) Right of Entry. Incidental to such inspections, investigations and surveys, an authorized representative of the Department may enter into and upon, and cause any land, building, structure, or utility to be inspected and examined. A failure or refusal to permit the entry and inspection, after issuance by the Department of an order therefore, shall constitute a violation of this Building Code. Additionally, the right to entry and inspection may be enforced by application to, and proper orders from a court of proper jurisdiction.

(e) Stop Orders. Whenever any work is being performed contrary to the provisions of this Building Code, or any of the several Codes or Ordinances enforced or administered by this Department, the Department may order the work stopped by issuing a notice or order in writing, served on any person engaged in the work and/or causing the work to be performed. The order or notice shall be given to the owner or the licensee or their agents. It shall be unlawful for any person to proceed with the work until the corrective action required to be performed by the notice or order is accomplished or otherwise resolved.

(f) Rules and Regulations. The Director shall have the full power to adopt in reference to this Building Code, any rules, restrictions or measures that may, by the said Director, be advisable.

SECTION 105. SERVICE AND NOTICE. Service of any notice may be by personal service, as defined in the Colorado Rules of Civil Procedure, or may be made by registered or certified mail, return receipt requested, and service shall be deemed complete upon delivery. In the event the address of a person to be notified is unknown, or the receipt of a notice which has been mailed is returned unsigned, the notice may be served by posting the same in a conspicuous place on the premises upon which the violation of this Building Code is alleged. Service shall be deemed complete as of the moment of posting.

SECTION 106. APPLICATION TO EXISTING BUILDINGS.

(a) General. Existing buildings, structures, or utilities to which additions, alterations, or repairs are made or required to be made pursuant to Sec-
tions 107, 108, and 109 of this Building Code, shall be made to comply with all requirements for new buildings, structures, or utilities, unless otherwise specifically provided for in this Building Code.

(b) **Additions, Alterations, or Repairs of 50 percent or More.** When additions, alterations, or repairs of 50 percent or more of the value of an existing building or structure, the entire building or structure shall be made to conform to the requirements of new buildings or structures.

(c) **Additions, Alterations, or Repairs of Less than 50 Percent.** When additions, alterations, or repairs less than 50 percent of the value of an existing building or structure are made, the new construction shall conform to the requirements of this Building Code. The building or structure, including new additions, shall not exceed the areas and heights specified in this Building Code.

(d) **Nonstructural Alterations and Repairs of 25 Percent or Less.** Alterations or repairs not exceeding 25 percent of the value of an existing building or structure, and which are nonstructural and do not affect any member or part of the building or structure having the required fire resistance, may be made with the same materials of which the building or structure is constructed.

**EXCEPTION:** The installation or replacement of glass in hazardous locations, as specified in Chapter 54, shall be as required for new installations.

(e) **Existing Utilities.** All utilities used within or on all buildings or structures, now existing, shall be made to conform to the requirements of this Building Code when alterations, additions, or repairs exceed 50 percent of the valuation of the existing utility being added to, altered, or repaired.

(f) **Existing Occupancy.**

1. Buildings in existence at the time of the passage of this Building Code may have their existing use or occupancy continued, if such use or occupancy was legal at the time of the passage of this Building Code, provided such continued use is not dangerous to life.

2. Any change in the use or occupancy of any existing building or structure shall comply with the provisions of Chapters 3 and 5 of this Building Code.

(g) **Maintenance.** All buildings, structures, or utilities, existing or new, and all parts thereof, shall be maintained in a safe condition. All devices, utilities, or safeguards which are required by this Building Code, or which were required to have been erected or installed pursuant to any previous Code or Ordinance, relating to use, construction, or quality of materials, shall be maintained in good working condition. The owner or his designated agent shall be responsible for the maintenance of such buildings, structures, or utilities.

**SECTION 107. UNSAFE BUILDINGS OR STRUCTURES.**

(a) **General.** An unsafe building or structure is one which constitutes a fire hazard or hazard to life, health, property, or public welfare by reason of use, construction, disaster damage, vandalism, quality of materials, inadequate maintenance, dilapidation, or abandonment. However, without limitation of the foregoing, any building or structure in which any one or more of the following conditions exists shall be deemed conclusively to be an unsafe building or structure.
(b) **Plumb.** Those buildings or structures in which a wall or other vertical structural members lists, leans, or buckles to such an extent that a plumb line passing through the center of gravity falls outside of the middle third of the base.

(c) **Structural.** Those buildings or structures which show damage or deterioration to any structural or load bearing member or members to the extent that the members do not have sufficient strength to resist all applicable loads specified in Chapter 23. Also, those which show damage or deterioration of non-bearing exterior walls or enclosures to such an extent that they will not resist the wind pressure or lateral forces in accordance with the requirements of Chapter 23, or show damage or deterioration to any exposed exterior member or members to the extent that the member or members provide inadequate protection from the elements to the occupants of the building or structure.

(d) **Overloads.** Those buildings or structures in which the loads upon the floors or roofs exceed the maximum design limits specified in Chapter 23.

(e) **Egress.** Those buildings or structures having inadequate facilities for egress in case of fire or those having insufficient stairways, elevators, fire escapes or other means of communication.

(f) **Attachments.** Those buildings or structures which have parts attached in such a manner that they may fall and cause injury to the public or property.

(g) **Incomplete Buildings.** Uncompleted buildings or structures when the permit has been cancelled.

(h) **Open Excavations.** Open pits, open wells and open excavations of all types when such are determined to be hazardous by the Department.

(i) **Trenches or Ditches.** Trenches or ditches not properly shored or cribbed. See Chapters 29 and 50.

(j) **Vacant Buildings.** Vacant buildings which are not secure and to which entry may be made through opened or unlocked doors, windows or other openings.

**SECTION 108. UNSAFE UTILITY.**

(a) **General.** An unsafe utility is one which constitutes a fire hazard or a hazard to life, health, property, or public welfare by reason of use, construction, installation, obsolescence, disaster damage, deterioration, quality of materials, abandonment, or inadequate maintenance. However, without limitation of the foregoing, any utility in which any one or more of the following conditions exists shall be determined to be hazardous by the Department.

(b) **Fuel-Fired Equipment.** Gas fired, oil-fired, or solid fuel-fired appliances, devices, or apparatus which have any of the following defects:
1. Broken or cracked heat exchangers.
2. Defective or deteriorated vents, venting, or flues which permit leakage of flue products.
3. Defective or improperly installed fuel supply piping.
4. Insufficient air supply for the combustion of fuel.
5. Inadequate ventilation of the heating equipment room.
6. Defective, improperly installed, or maladjusted controls and appurtenances.
7. Defective or improperly installed heating equipment.
8. Equipment locations which constitute a fire or explosion hazard.
9. When a negative air pressure condition exists in a heating equipment room or area.
10. Excessive corrosion of combustion chambers where the original thickness of the metal is reduced 50 percent or more.
11. Warped or distorted combustion chambers or furnace-boiler firing doors which permit leakage of combustion products.
12. Field alteration or modification of a listed appliance or appurtenance.
13. Excessive scaling, corrosion, cracks in seams, tube, or shell of boilers.
14. Defective valves, gauges, or cocks of boilers.
15. Grooving or pitting of boilers.
16. Improperly installed or maladjusted controls and appurtenances of boilers.
17. Any unlisted appliance or appurtenance installed without the approval of the Department.
18. Appliances not provided with required safety controls.

(c) **Elevators, Escalators, Dumbwaiters, and Moving Walks.** Elevators, escalators, dumbwaiters, moving walks, or similar conveyances or apparatus which have any of the following defects:
1. Hoisting, counterweight, or governor ropes of cables with frayed or broken strands.
2. Operation in a hoistway used to store material other than elevator equipment. This shall also apply to elevator penthouses and pits when and where materials other than elevator equipment are maintained or stored.
3. Operation in a hoistway that is in danger as a result of dust or other highly combustible material on the mechanism or in the hoistway, penthouse, or pit.
4. Brake mechanism not functioning, or not functioning properly or safely.
5. Those not safety tested in accordance with the requirements of this Building Code, or where required safety devices have been disconnected or discontinued.
6. Those safety or operational devices provided in the elevator cab which are not functioning, or not functioning properly or safely.
7. Where hoistway entrance protection does not meet the requirements of this Building Code.

(d) **Electrical.** Electrical systems, appliances, devices, or apparatus which have any of the following defects:
1. Bare wiring.
2. Poor electrical connections.
3. Overloaded circuits, feeders, or services.
4. Equipment not properly grounded.
5. Disconnecting means not provided at the appliance.
6. Over-fused circuits.
7. Misuse of cord wiring.
8. Wiring not properly supported.
9. Non-approved wiring exposed to extreme heat, moisture, gases, or other harmful vapors or liquids.

(e) **Refrigeration.** Refrigeration systems which have any of the following defects:
1. Inadequate ventilation.
2. Inadequate venting of pressure relief valves.
3. Unauthorized fuel-fired equipment located in the same room designated for the refrigeration equipment.
4. Improperly installed cooling towers by reason of location, type, fan, water condition, controls, roof or floor overload.
5. Faulty controls.

(f) **Plumbing.** Plumbing systems of devices which have any of the following defects:
1. When the supply water does not meet the standards of potability as required by the Colorado State Department of Public Health and the City Department of Health and Hospitals.
2. Those water systems subjected to the hazards of back-flow or back-siphonage which might create a pollution to the potable water supply.
3. Where inadequate piping does not supply sufficient water to the various appliances.
4. Clogged sewers or drains.
5. Where a trap seal is not provided or is inadequate.
6. Inadequate venting.
7. Leaking water, sewage, or sewer gas within a building or structure.
8. Trenches or ditches not properly shored or cribbed.

SECTION 109. ABAITEMENT AND NOTICE OF UNSAFE BUILDINGS, STRUCTURES, OR UTILITIES

(a) **General.** If after inspection by the Department the building, structure, or utility is determined to be unsafe, the building, structure or utility shall be declared a nuisance. This nuisance shall be abated by repair, replacement, removal, or demolition upon notice by the Department to the persons having a record interest therein.

(b) **Unsafe Building or Structure.** In the case of an unsafe building or structure, the Department may order such building or structure or any buildings or structures placed in jeopardy by the unsafe building or structure, vacated immediately; and the unsafe buildings or structures shall be posted in accordance with other provisions of this Section. See Section 109(g).

(c) **Unsafe Utility.**
1. In the case of an unsafe utility, the Department shall attach or affix an approved warning tag on the unit declared to be unsafe. Where a utility is declared to be unsafe, the Department shall order the utility disconnected or its use discontinued until the nuisance created thereby is abated. In addition, the Department may order any building, structure, or utility which is placed in jeopardy by the unsafe utility to be vacated and/or disconnected, and these shall not be reoccupied or reconnected until declared safe by the Department.
2. It shall be unlawful for any person, firm, or corporation to mark any unsafe utility, as herein defined, with any type markings or tags declaring them to be unsafe, except as authorized by the Department.

(d) **Demolition or Securing by the City.** If the owner of an unsafe building, structure, or utility fails to carry out the repairs, rehabilitation, securing, or removal required to be carried out, on notice or order within
the time specified in the notice or order, the Department shall, upon
receiving competitive and responsible bids cause the demolition and/or
removal or securing of such building, structure, or utility. Recovery of
cost and expense shall be made as provided for in this Building Code. For
purposes of this Building Code, securing shall mean the closing of all
openings to prevent unauthorized entry and as approved by the Depart-
ment and Fire Department.

(e) Emergency Demolition. In the event an emergency should occur
where in the continued use or existence of a building, structure, or utility
would constitute a hazard to life, health, property, or other property, the
Department may order and/or cause the building, structure, or utility to
be demolished, removed or disconnected at once by any means available
to the Department. Recovery of the cost and expense of the demolition
and/or removal or securing, if borne by the City shall be made as pro-
vided for in this Building Code.

(f) Emergency Barricades. If any building, structure or utility is declared
a hazard to life or safety or persons using a public walk or public way, the
public walk or way shall be provided with barricades to prevent public
use. The barricades shall be erected on order from the Department.
Recovery of cost and expense, if borne by the City, shall be made as pro-
vided for in this Building Code.

(g) Posting of Signs. When necessary to protect life, health and public
welfare, the Department may post signs which shall prohibit entry into
an unsafe building or structure; provided, however, that with permission
of the Department, it shall be lawful to enter the unsafe building or
structure for the purpose of effecting any required repairs, rehabilita-
tion, or demolition; or by members of the Fire Department. The signs
shall be provided and attached to the building or structure by the
Department and shall read, in addition to other information, "DANGER
KEEP OUT." See Section 112 for Prohibitions and Violations.

(h) City's Lien.
1. In the event the owner or owners fail to pay the costs and expenses
of demolition, removal, or securing, the Department shall serve
notice upon the person or persons having a recorded interest
therein, in the manner provided for in this Section as to the amount
of such costs and expenses, and that it will, at a time and place
specified in the notice, hold a hearing when and where such persons
shall be required to show cause why the amount should not be paid
or a lien should not be placed against the property.
2. In the event said persons fail to show cause as provided herein, the
amount shall constitute a lien against the real property upon which
the building or structure was or is situate. The Department shall
thereafter pay the cost and expense of demolition, removal, securing
barricading, from any appropriation made available for that pur-
pose, and shall certify a statement thereof to the Manager of
Revenue, who shall assess and charge the same against the property
involved and collect the same due, together with interest at the rate
of interest established by law for delinquent real property taxes.
3. The lien created thereby shall be superior and prior to other liens,
regardless of date, except liens for general and specific taxes.
4. For purposes of this Building Code, cost and expense shall include
the demolition, removal, securing, barricading, and all administrative costs incurred therewith.

SECTION 110. USED MATERIALS. Used materials may be permitted in the construction of any building, structure, or utility subject to approval of the Department.

SECTION 111. ALTERNATE MATERIALS AND METHODS OF CONSTRUCTION AND EQUIPMENT.

(a) General. The provisions of this Building Code shall not prevent the use of alternate methods, materials, or equipment which meet the standards of strength, safety, sanitation, and fire resistance required to be met in any building, structure, or utility to which this Building Code applies, provided the alternate has been approved by the Department.

(b) Application and Fee. An application for approval of an alternate material, method, or equipment shall be filed with the Department upon a form furnished by the Department. Information shall be that required by the Department and this Building Code. The application shall be accompanied by a fee of $50.00, payable to the Manager of Revenue, City and County of Denver, and shall be paid in the office of the Department.

(c) Department Approval. The Department shall give approval, in writing, for any such alternate methods, materials, or equipment, provided the proposed design is satisfactory and that the alternate is, for the purpose intended, at least the equivalent of that prescribed in this Building Code. The applicant may appeal the decision as outlined in the procedures of this Building Code.

(d) Requirements and Tests.
1. When a construction material, assembly, fixture, device, utility, or other article different from that provided for in this Building Code is proposed for use, plans, specifications, details, test data, samples and literature shall be furnished to the Department for examination.

2. In order that claims for alternate materials, methods, or equipment may be substantiated, the Department may require tests to be made at the expense of the applicant by an approved laboratory or agency. Test methods shall be as set forth by the Standards which are part of this Building Code, or by a test method established for a particular product by a nationally recognized agency. If there are no appropriate test methods or Standards set forth in this Building Code, the Department may determine acceptable test procedures.

(e) Listed National Agencies. At the discretion of the Department, new methods or materials approved by one or more of the following agencies may be acceptable, provided that the restrictions, limitations and quality assurance measured are followed and properly labeled. A copy of the agency approval report shall be submitted to the Department for approval. For purposes of this Section, the following agencies are approved:

1. International Conference of Building Officials (Research Reports).
2. Underwriters' Laboratories Listings.
SECTION 112. PROHIBITIONS-VIOLATIONS-PENALTIES-REMEDIES.

(a) Prohibitions. It shall be unlawful for any person, firm, or corporation to do or cause to be done, or to perform or cause to be performed, any act contrary to or in violation of the provisions of this Building Code, any other Code, Ordinance, Rule, or Regulation promulgated thereunder which is enforced and administered by the Department, and without limitation to the foregoing:

1. Alternate Methods, Materials, or Equipment. It shall be unlawful for any person, firm, or corporation to use any method, material, or equipment as an alternate to the methods, materials, or equipment permitted by this Building Code without first obtaining approval in the manner herein provided.

2. Licensing. It shall be unlawful for any person, firm, or corporation to erect, repair, construct, enlarge, remodel, alter, move, improve, convert, or demolish any building, structure, or utility without first obtaining a license and certificate in accordance with the requirements of Chapter 2 of this Building Code.

3. Licensee and Certificate Holder Responsibility. It shall be unlawful for any licensee or certificate holder to commit any violation of the responsibilities enumerated in this Building Code. See Chapter 2.

4. Drawings and Specifications. It shall be unlawful to make application for a permit without first having submitted drawings and specifications as required by Chapter 3 of this Building Code.

5. Permits. It shall be unlawful for any person, firm, or corporation to erect, construct, enlarge, remodel, alter, repair, move, improve, remove, convert, or demolish any building, structure, or utility without first having obtained a permit from the Department, as required by the provisions of this Building Code. See Chapter 3.

6. Certificate of Occupancy. It shall be unlawful for any person, firm, or corporation to occupy a new building or structure without first having obtained a Certificate of Occupancy from the Department as required by the provisions of this Building Code. A Certificate of Occupancy will not be required for remodeling or additions, unless there is a change of occupancy. See Chapters 3 and 5.

7. Unsafe Building, Structure, or Utility. It shall be unlawful for any person, firm, or corporation to maintain or permit to be maintained any building, structure, or utility which is unsafe as defined in this Chapter. These provisions shall apply to buildings, structures, or utilities which are new, existing, under construction, or being altered or demolished.

8. Enter, Occupy, or Inhabit an Unsafe Building or Structure. It shall be unlawful to enter, occupy, or inhabit any unsafe building or structure posted in accordance with the provisions of this Building Code.

9. Removal of Danger Sign(s). It shall be unlawful to remove or deface a sign required by Section 109 (g), without specific approval from the Department.

10. False Information. It shall be unlawful to furnish the Department any false information in any application for a License, Certificate or Permit required by this Building Code.
(b) **Violation.** Wherever, by the provisions of this Building Code, the performance of any act is prohibited, or wherever any regulation, dimension, or limitation is imposed on the erection, alteration, maintenance, or occupancy of any building, structure, or utility, each failure to comply with the provisions of this Building Code shall constitute a violation. Each day on which a violation exists shall constitute a separate offense and a separate violation.

(c) **Penalties.** Whenever, in any Section of this Building Code, or any Section of a Rule or Regulation promulgated hereunder, the performance of any act is required, prohibited, or declared to be unlawful, and no definite fine or penalty is provided for a violation thereof, any person, firm, or corporation convicted of a violation of any Section shall, for each offense, be fined a sum of not more than $300.00, or imprisoned not to exceed 90 days, or both so fined and imprisoned. The suspension or revocation of any license, certificate, permit, or other privileges conferred by the City shall not be regarded as a penalty for the purpose of this Building Code.

(d) **Remedies.** In the event any building, structure, or utility is erected, constructed, reconstructed, altered, repaired, converted, demolished, moved, or maintained; or any building, structure, or utility is used in violation of this Building Code, the City or any proper person may institute an appropriate action or proceedings to prevent the unlawful erection, construction, reconstruction, alteration, repair, conversion, maintenance, or occupancy, and to restrain, correct, or abate such violation, or to prevent the occupancy of said building, structure, or land. The imposition of any penalty hereunder shall not preclude the City or any proper person from instituting any appropriate action or proceeding to require compliance with the provisions of this Building Code, and with administrative orders and determination made hereunder.

**SECTIONS 113 THROUGH 119 HAVE BEEN PURPOSELY OMITTED.**

**SECTION 120. BOARD OF APPEALS.**

(a) **Creation.** There shall be and is hereby created a Board of Appeals, hereinafter referred to as the 'Board', which shall consist of 5 members. The 5 members of the Board shall be appointed by the Mayor, and shall be constituted of the following persons:

1. One person who is a Professional Engineer registered in the State of Colorado.
2. One person who is an Architect licensed in the State of Colorado.
3. One person who is the holder of a City Building Contractor Class A, B, or C License.
4. Two citizen members who are not associated with the building industry.

(b) **Secretary.** There shall be a Secretary of the Board, furnished by the Department, and the Secretary shall be without voting power. The Secretary shall be the custodian of the records, shall conduct correspondence and be responsible for clerical work of the Board. The Secretary shall be present at all meetings, and shall present all relevant information regarding appeals to the Board. The Secretary shall notify all interested parties regarding matters to come before the Board prior to the meeting of such Board.

(c) **Fire Department Representative.** The Chief of the Fire Prevention
Bureau, or his authorized representative, shall be an ex-officio member to the Board, but shall have no voting power. Terms of office and remuneration shall not be applicable to this member.

(d) **Terms.** Each member of the Board shall serve a term of 2 calendar years, and may be removed only for cause upon written charges. The members of the Board serving on the effective date of this Ordinance, under a Building Code effective prior hereto, shall be and constitute the first Board hereunder, and each member thereof shall serve the balance of the term to which he was appointed. Any vacancy which occurs in the Board shall be filled by the Mayor for the unexpired term of any member whose term became vacant. No member of the Board shall serve more than 2 consecutive full terms or a total of more than 4 consecutive calendar years.

(e) **Meetings-Quorum.**

1. **Regular Meetings.** Regular meetings shall be held once each month. At the first regular meeting of each calendar year, one of the members of the Board shall be elected as Chairman and one Vice-Chairman. The Chairman of the Board shall require that all members of the Board be polled during voting at the meeting, and shall instruct the Secretary to record each vote of aye, nay, or abstain. Three members of the Board shall constitute a quorum.

2. **Special Meeting.** Special meetings may be held at the call of the Chairman and at such times as the Board shall determine. The Department may exercise the same prerogatives. Any special meeting held at the request of an appellant shall be paid for by the appellant in the amount of $125.00. Three members of the Board shall constitute a quorum at special meetings.

(f) **Powers and Duties of the Board.**

1. **Procedures and Regulations.** The Board shall be authorized to make rules of procedure and adopt regulations essential for the transaction of business consistent with this Building Code.

2. **Appeals.** To hear and decide appeals of any order, decision, or determination made by the Department in the enforcement of this building Code.

3. **Variances.** To hear and decide appeals for variances to Building Code requirements where there are practical difficulties or unnecessary hardships caused by conformance to the strict letter of this Building Code. The intent of this Building Code shall be observed to the end that public welfare is preserved, and substantial justice performed in the granting of any variance.

4. For the purpose of exercising the powers herein enumerated, the Chairman, or in his absence, the vice-chairman, may administer oaths, accept affirmations and compel the attendance of witnesses. A failure or refusal to appear in response to the subpoena issued by the Board shall constitute a violation of this Ordinance.

(g) **Decision of the Board.** The Board may, in exercising its powers and duties, reverse or affirm, wholly or in part, or may modify the order, requirements, decision, or determination made by the Department, and shall render its order, requirements, decision, or determination. A concurring vote of 3 members of the Board shall be necessary to reverse any order, requirement, decision, or determination of any administrative official, or to decide in favor of the appellant, or any matter upon which the Board is required to pass under this building Code.
(h) **Compensation.** Each member of the Board shall receive $25.00 per regular or special meeting attended.

**SECTION 121. APPEALS.**

(a) **Method of Application-Fee.** Prior to an action by the Board an application shall be filed in the office of the Department, on a form providing the necessary information required by the Board. An appeal shall not be considered unless filed with the Department at least 10 days prior to the meeting. Upon filing the application, a fee of $15.00 shall be paid the City. All checks shall be made payable to the Manager of Revenue, and shall be paid in the office of the Department.

(b) **Hardship or Error.** Any person, firm, or corporation aggrieved by a decision of the Department in the enforcement of this Building Code; or any person, firm, or corporation who feels that there are practical difficulties or unnecessary hardships involved in carrying out the strict letter of this Building Code; or where it is alleged there is error in any order, requirement, decision, or determination made by the Department, may, within 30 days after being notified of such decision or order, appeal the decision or order of the Department by filing an application with the Board.

(c) **Unsafe Condition.** Whenever the owner of an alleged unsafe building, structure, or utility, or other condition does not agree with the order from the Department in the enforcement of this Building Code as to the correction to be made, he shall have the right to appeal to the Board within 30 days from the date of said order. In his appeal, he shall state how he proposes to make the building, structure, utility, or other condition safe; and, if required by the Board, he shall submit detailed engineering analysis or recommendations, accompanied by plans and specifications prepared by a Colorado licensed architect or Colorado registered Professional Engineer, as prescribed in this Building Code. The Board may require substantiating data concerning the removal or other remedial steps to be taken to render the building, structure, utility, or other condition safe.

**SECTION 122. APPEALS FROM DECISIONS OF THE BOARD.**

(a) **Procedure.** Any person aggrieved, the City, or any officer, department, or division of the City may have a decision of the Board reviewed in the manner provided by the rules relating to civil proceedings. A review shall not be granted unless a petition therefore, duly verified, setting forth that such decision is illegal in whole or in part, and specifying the grounds of the illegality, is presented to the court of record within 30 days after the filing of the decision in the office of the Board. The Board shall not be required to return the original papers acted upon by it, but shall return copies thereof. The returned copies shall concisely set forth other facts pertinent and material to the decision appealed from, and shall be verified.

(b) **Effect of Appeal.** The issuance of a writ on a petition hereunder shall not stay proceedings upon the decision appealed from; but the court, on application after notice to the Board and on due cause shown, may grant a restraining order.

(c) **Transcript Costs.** Whenever a transcript is demanded by the person taking the appeal, or when a transcript is furnished by the Board pursuant to court order, the cost of preparing the transcript of proceedings shall be borne by the appellant, in the amount of at least $200.00.
CHAPTER 2
LICENSING, CERTIFICATION, BOARDS OF STANDARDS

SECTION 200. GENERAL. This Chapter provides for the licensing of all persons, the Certification of supervisory personnel, other types of Certifications, and Boards of Standards.

SECTION 201. AUTHORITY.
(a) Licenses. The Department is vested with the authority to establish licensing procedures, to qualify applicants for licenses and to issue, revoke, renew, and suspend licenses.
(b) Certificates. The Department is vested with the authority to establish certification procedures, prequalify applicants, and to issue, revoke, renew, and suspend certificates.

SECTION 202. LICENSES.
(a) Defined. A license is authority granted to the person, agency, or political entity to whom it is issued to perform the work authorized by the License. Licenses are not transferable.
(b) Licenses Required. Licenses shall be required for all types of work described in this Chapter.
   EXCEPTION: Public Utility Companies will not be required to obtain Licenses when engaged in the installation, operation and maintenance of their equipment used for the production, generation, or distribution of the utility, product or service through the facilities owned or operated by the utility company to the point of customer service.
(c) Application and Fee. Every applicant for a License shall fill out a form provided by the Department, and shall pay an application fee of $15.00 at the time of filing. This fee shall not be refundable and shall not apply to the License fee. The name of the Certified Supervisor shall appear on the License application. A final review and appropriate action shall be taken on the License application by the Department, and the applicant shall be notified accordingly. If the License is approved, the applicant shall procure this License within 90 days after notification. Thereafter, upon failure of the applicant to procure the License, a new application with fee shall be filed. If the application for License is disapproved by the Department, the applicant may appeal to the Board of Appeals in the manner provided for in this Building Code.
(d) Supervisor Required. Every licensee shall be required to have in their employ a Supervisor who holds a Supervisor Certificate of Qualification for that particular license. The license shall be valid only as long as the named Supervisor shall remain in the employ of the Licensee in an active, full time capacity. If the Supervisor should leave the employ of the Licensee, the Licensee shall notify the Department within 3 working days after the Supervisor terminates. Failure of the Licensee to notify the Department within 3 working days that the Supervisor is no longer in his employ shall be cause for suspension or revocation of the License. The Licensee shall be required to obtain a certified Supervisor within 15 days after the date the Supervisor leaves the employ of the Licensee. If a
Supervisor is not obtained within the 15 day period, the License shall be deemed suspended until the Supervisor is obtained and the Department notified accordingly.

1. **Individual.** If the Licensee is an individual, he also may qualify as the Supervisor for that license, after examination.

2. **Not Required.** The following Licenses shall not require a certified Supervisor:
   A. Building Contractor Class E.
   B. Sign Contractor Class B.
   C. Lawn Sprinkler Contractor.

SECTION 203. CLASSIFICATION OF LICENSES.

(a) **General.** There shall be various classes of Licenses and the holder thereof shall be authorized to perform the following:

1. **Building Contractor Class A.** To erect, add to, alter, or repair any building or structure. The demolition of a building or structure is permitted when the Licensee establishes that he will erect a new building or addition on the same site. All work shall be performed under the supervision of the holder of a Class A Building Supervisor Certificate.

2. **Building Contractor Class B.** To erect, add to, alter or repair any building or structure except that buildings of Type I or II construction shall not exceed the height and area which is permitted for a Type III building. The demolition of any I Occupancy or one story building or structure is permitted when the Licensee establishes that he will erect a new building or addition on the same site. All work shall be performed under the supervision of the holder of a Class A or B Building Supervisor Certificate.

3. **Building Contractor Class C.** To erect, add to, alter or repair any Group I or J Occupancy building. He may work on any other type building or structure provided the character of the work is not structural. The demolition of any one story Group I and J occupancy building or structure is permitted when the Licensee establishes that he will erect a new building or addition on the same site. All work shall be performed under the supervision of the holder of a Class A, B, or C Building Supervisor Certificate.

4. **Building Contractor Class D.** To perform work listed under any one of the crafts listed below. All work enumerated in this Section shall be performed under the supervision of the holder of a Class A, B, C or the particular Class D Building Supervisor Certificate.
   - **D-1 Lathing, Plastering and Dry Wall.** Installation of all lathing, plastering and dry wall, including the installation of non-bearing partitions and stucco.
   - **D-2 Roof Covering and Waterproofing.** Installation of roof coverings including valleys, gutters and downspouts, waterproofing and dampproofing.
   - **D-3 Masonry.** Laying and forming all types of masonry.
   - **D-4 Sand Blasting and Cleaning.** Sand blasting, cleaning, or texturing of the exterior of buildings or structures.
   - **D-5 Well Drilling, Excavating, Concrete Foundations and Caissons.** Well drilling, all types of excavating work, and installation of concrete foundations and caissons.
   - **D-6 Wood Framing.** The fabrication and erection of wood
framing for all types of buildings.

**D-7 Swimming Pools.** Installation of swimming pools, except utilities.

**D-8 Structural Metals.** The fabrication and erection of structural metal for all types of buildings or structures, excluding the complete construction of a Type IV building.

**D-9 Pre-Cast Concrete Building Units.** The erection of pre-cast concrete structural units for all types of buildings and structures.

**D-10 Dry Wall.** Installation of all dry wall including the installation of non-bearing partitions.

5. **Building Contractor Class E.** To perform the work involving the installation, altering or repair of any or all of the following:
   - Accoustical treatment.
   - Gutters and Downspouts.
   - Fences.
   - Glass and Glazing.
   - Prefabricated Metal Patios, Carports, and Awnings.
   - Scaffold Erection.
   - Siding.
   - Building Insulation.
   - Tile and Marble.

   A certified Supervisor shall not be required for this License.

6. **Construction Management Firm.** To administer and coordinate those trades and contracts directly engaged in the construction of buildings, structures and utilities. The holder of this License shall conform to all the provisions of this Building Code and Chapter except that he shall not be permitted to obtain Permits in accordance with Chapter 3. This License shall require a Construction Certificate holder who shall be certified in the Class of Construction being performed and be in the employ of the Construction Management Firm. See Table 2-B.

7. **Demolition Contractor Class A.** To demolish any building, structure, utility, or portion thereof. All work shall be performed under the supervision of the holder of a Class A Demolition Supervisor Certificate.

8. **Demolition Contractor Class B.** To demolish any building not more than 2 stories in height. All work shall be performed under the supervision of the holder of a Class A or B Demolition Supervisor Certificate.

9. **Moving Contractor.** Moving of all types of buildings or structures. All work shall be performed under the supervision of the holder of a Moving Supervisor Certificate.

10. **Electrical Contractor.** To install, add to, alter or repair all electrical wiring, apparatus and appliances, including fire detection, fire alarm and burglar alarm systems. All work shall be performed under the supervision of the holder of an Electrical supervisor Certificate.

11. **Plumbing Contractor Class A.** To install, add to, alter or repair sanitary plumbing, potable water supply piping and appliances connected thereto; storm sewer; gas piping, water heaters, piping for the transmission of chemicals and gases, gas ranges, domestic gas
incinerators, and gas dryers, fire standpipes, fire sprinklers not to exceed 10 heads, pool piping, process piping. All work shall be performed under the supervision of the holder of a Plumbing Supervisor Certificate.

12. **Plumbing Contractor Class B.** To install, add to, alter or repair sanitary plumbing, potable water supply piping and appliances connected thereto; storm sewer; water heaters not exceeding 100 MBtu input, gas ranges, domestic gas incinerators and gas dryers, pool piping. All work listed in this category is for Group I and J Occupancies only. All work shall be performed under the supervision of the holder of a Plumbing Supervisor Certificate.

13. **Steam and Hot Water Contractor.** To install, add to, alter or repair steam and hot water heating systems, process piping and related appurtenances; piping used for the transmission of chemicals, gases, air and other products; all items regulated by Chapter 58 of this Building Code; low static gas-fired unit heaters; industrial ovens; burners, controls, piping, and controls utilizing gas, liquid or solid fuel; water heaters; pipe insulation and low voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway. All work shall be performed under the supervision of the holder of a Steam and Hot Water Supervisor Certificate.

14. **Hot Water Contractor.** To install, add to, alter or repair hot water heating systems and their appurtenances; water heaters; gas piping and controls; pipe insulation and low voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway. All work permitted by this License shall be restricted to a Group I and J Occupancy only. All work shall be performed under the supervision of the holder of a Steam and Hot Water or Hot Water Supervisor Certificate.

15. **Heating and Ventilating Contractor Class A.** To install, add to, alter or repair warm air heating, venting, ventilation, evaporative cooling, exhaust systems and their appurtenances; ductwork; dust collection systems; domestic and commercial range hoods; water heaters not exceeding 100 Mbtu input; gas piping, burners, controls, and venting; trash and laundry chutes; exterior sheet metal; duct insulation; low voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway; maximum of 10 tons of refrigeration when it is utilized for comfort cooling and the refrigerating system is self-contained. This refrigeration shall not include systems with precharged lines or separate air-cooled condenser or chilled water systems. All work shall be performed under the supervision of the holder of a Class A Heating and Ventilating Supervisor Certificate.

16. **Heating and Ventilating Contractor Class B.** To install, add to, alter or repair warm air heating systems and their appurtenances; duct work; ventilation; evaporative cooling; duct insulation; exterior sheet metal; gas piping; burners, venting and controls; water heaters not exceeding 100 Mbtu input; low voltage wiring which does not exceed 48 volts is not enclosed in a conduit or raceway. All work listed in this category is for Group I and J Occupancies only. All work shall be performed under the supervision of the holder of a Class A or B Heating and Ventilating Supervisor Certificate.
17. **Gas Service Contractor.** To install, add to, alter or repair the following equipment which utilizes gas or liquid fuel:
   A. Commercial Cooking Equipment
   B. After-Burners
   C. Ranges
   D. Dryers
   E. Conversion Burners
   F. Venting of Domestic Water Heaters, Dryers and Incinerators
   G. Water Heaters not exceeding 100 Mbtu input.
   H. Low voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway.
   All work shall be performed under the supervision of the holder of a Gas Supervisor Certificate or Class a or B Heating and Ventilating Supervisor Certificate.

18. **Refrigeration Contractor Class A.** To install, add to, alter or repair refrigeration systems and appurtenant cooling towers; pipe insulation and voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway. A permit or license is not required for the installation of window type air conditioners. All work shall be performed under the supervision of the holder of a Class A Refrigeration Supervisor Certificate.

19. **Refrigeration Contractor Class B.** To install, add to, alter or repair refrigeration systems consisting of self-contained refrigeration systems of 5 tons or less; the installation of precharged systems utilizing Group I Refrigerants and gas fired absorption chillers. All work permitted by this license shall be restricted to Group I Occupancy only. All work shall be performed under the supervision of the holder of Class A or B Refrigeration Supervisor Certificate.

20. **Sign Contractor Class A.** To fabricate, install, erect, or maintain all types of signs. All work shall be performed under the supervision of the holder of a Sign Supervisor Certificate.

21. **Sign Contractor Class B.** To install, erect or maintain the following types of non-illuminated signs:
   1. Cloth signs painted directly on a wall.
   2. Wall signs not exceeding 200 square feet in area.
   3. Ground signs not exceeding 150 square feet in area.
   4. Arcade signs not exceeding 25 square feet in area per side.
   A certified supervisor shall not be required for this license.

22. **Elevator Contractor.** To install, add to, alter or repair elevators, escalators, moving sidewalks, moving ramps, dumbwaiters, stage lifts, manlifts and amusement devices which employ ropes, cables, pulleys or platforms. In addition, this license shall include electrical work from the controls to the equipment. All work shall be performed under the supervision of the holder of an Elevator Supervisor Certificate.

23. **Fire Protection Contractor Class A.** To install and repair fire extinguishing systems of all types. All work shall be performed under the supervision of the holder of a Class A Fire Protection Supervisor Certificate.

24. **Fire Protection Contractor Class B.** To install and repair automatic fire sprinkler and standpipe systems of all types. All work shall be performed under the supervision of the holder of a Class A
or B Fire Protection Supervisor Certificate.

25. **Fire Protection Contractor Class C.** To install and repair approved non-water, factory engineered extinguishing systems. All work shall be performed under the supervision of the holder of a Class A or C Fire Protection Supervisor Certificate.

26. **Lawn Sprinkler Contractor.** To install, add to, alter or repair underground lawn sprinkler systems except for the connection to the water service line. A certified supervisor shall not be required for this License.

27. **Electrical Signal Contractor.** To install, add to, alter, or repair electrical wiring and equipment for fire alarm, fire detection, emergency voice communication systems, burglar alarm, and electrical signalling and control wiring. Voltages shall not exceed 48 volts, or system shall be Class 2 power, limited, as defined by the National Electrical Code. Complete conduit or raceway systems shall not be installed by the holder of this License. All work shall be performed under the supervision of the holder of an Electrical Signal Supervisor or Electrical Supervisor Certificate.

28. **Domestic Appliance Contractor.** To install, repair and replace Domestic Appliances as defined in Chapter 41 of this Building Code. All work shall be performed under the supervision of the holder of a Domestic Appliance Supervisor or Plumbing Supervisor Certificate.

29. **Boilermaker Contractor.** To install, assemble, or repair steam and hot water boilers, all pressure and non-pressure vessels, precipitators, breeching, metal stacks, plates and casings. All work shall be performed under the supervision of the holder of a Boilermaker Supervisor Certificate.

30. **Water Service Contractor.** To install the initial water service from the main tap through the stop box and meter pit and continuing to and through the wall of the building and capped at that point. This License shall not permit the installation of the water meter. All work shall be performed by or under the supervision of the holder of a Water Service Supervisor Certificate or a Plumbing Supervisor.

**SECTION 204. LICENSE FEES.**

(a) **Annual Fees Required.** The annual license fee applicable to those enumerated shall be paid to the Department in accordance with Table 2-A.

(b) **License Fee Refund.** License fees shall not be refundable.

**SECTION 205. LICENSE RENEWAL.** All licenses shall be renewed annually. Any work performed 30 days after expiration of a license shall constitute a violation of this Building Code.

**SECTION 206. REISSUANCE OF A LICENSE.** The Department shall have the authority to reissue a license without the filing of a new application provided the reissuance is accomplished within 1 year after the license has expired. If the license is not reissued within 1 year, a new application and fee shall be required.

**SECTION 207. LICENSEE RESPONSIBILITY.**

(a) **General.** All licensees shall be responsible for performing the work under the provisions of this Building Code, including, but not limited to the following items:
1. To report in writing to the Department within 3 working days, any accident occurring in any construction, demolition, or undertaking which has resulted in lost time, injury, or death to any person or damage to any building, structure or utility.
2. To provide minimum safety measures and equipment to protect workmen and the public.
3. To present the license card when requested by the Department.
4. To employ a qualified supervisor certified in accordance with the requirements of this Building Code.
5. To employ qualified journeymen certified in accordance with the requirements of this Building Code.
6. To obtain a permit when required.
7. To faithfully construct, without substantial departure from drawings and specifications filed and approved by the department and permit issued for same, unless changes are approved by the Department.
8. To complete all work authorized by the permit issued under the authority of this Building Code, unless acceptable cause is indicated to the Department.
9. To obtain inspection services where required by this Building Code.
10. To pay any fee assessed under authority of this Building Code.
11. To obey any order or notice issued under the authority of this Building Code.
12. To provide all vehicles used in the operation of his business with identification of the business in a manner prescribed by the Department.
13. To provide toilet facilities prior to construction or demolition.

SECTION 208. LICENSE CHANGES.

(a) Change of Name. A change of name or address of a licensee shall be reported to the Department within 15 days after making the change. A new license shall not be required for the change.

(b) New Licenses Required. The creation of a new legal entity, even though one or more of the members, officers or directors have a license, shall require that a new license be obtained within 15 days after the change is made.

(c) Dissolution. The dissolution of a corporation or partnership which has been licensed terminates the license, and no person may operate under that license.

SECTION 209. SUSPENSION OR REVOCATION OF LICENSE.

(a) Authority. The Department may suspend or revoke a license when the licensee commits one or more of the following acts or omissions:
1. Fails to comply with any of the licensee responsibilities as outlined in this Building Code.
2. Knowingly conspires with a person to permit a license to be used by another person.
3. Acts as agent, partner, associate, or acts in any capacity with persons to evade the provisions of this Building Code.
4. Violates any of the provisions of this Building Code.

(b) Procedure. When any of the acts or omissions enumerated herein are committed by a license holder and the Department deems that the license shall be suspended or revoked, the action shall be as follows:
1. The Department shall notify the licensee in writing by certified mail or personal service at least 7 days prior to suspension or revocation.
2. Upon receipt of the notice, the licensee may request a hearing. This request shall be in writing to the Department within 7 days after receipt of the notice.
3. If a hearing is requested by the licensee, the Department shall set a time, date, and place, and so notify the licensee. Suspension or revocation of the license shall be deferred until after the hearing or appeal.
4. When a hearing is conducted, the licensee and other interested parties may be in attendance. Upon completion of the hearing, the Department shall take all evidence admitted under advisement, and shall notify the licensee of the findings and ruling. The findings and ruling shall be rendered in writing by certified mail or personal service.
5. If the decision rendered by the Department is adverse to the licensee, the licensee may appeal to the Board of Appeals as set forth in Chapter 1 of this Building Code within 30 days after notice of ruling.

(c) **Emergency Suspension.** If the Department finds that cause does exist for suspension or revocation of a license, it may enter an order for the immediate suspension of the license, pending further investigation. The licensee may, upon notice of the suspension, request an immediate hearing before the Department. The hearing shall be conducted in the manner prescribed by other Sections of this Chapter.

(d) **Delegation of Authority.** In the event of a hearing, the Director may appoint a qualified member of the Department to sit in his stead as Hearing Commissioner to conduct the hearing. Final decision shall be rendered by the Director.

**SECTION 210. CERTIFICATES.**

(a) **Definition.** A Certificate of Qualification is authority to perform certain skills, and is issued by the Department on the successful completion of an examination. This certificate is not transferrable. Where the term Certificate is used, this shall mean Certificate of Qualification.

(b) **Temporary Certificate.** The Department may issue a temporary certificate when the applicant has previously exhibited his skills to the satisfaction of the Department and the applicant’s qualifications are acceptable. The Department shall determine the period of validity of the temporary certificate.

(c) **Certificate Application.** Every applicant for a certificate shall be required to complete a form provided by the Department and to pay an application fee of $15.00 at the time of the filing. The fee shall not be refundable and shall not apply to the certificate fee. The payment of the fee shall entitle the applicant to one examination only; and if the applicant is re-examined for any reason whatsoever, a new application and fee shall be required. If an applicant does not appear for examination and indicates a valid reason for not appearing, one excused absence shall be permitted without a new application and fee.

(d) **Successful Applicants.** After an applicant has successfully passed the examination given by the Department and fails to procure this
certificate within 90 days after notification, this certificate shall be declared to be null and void and a new application and fee shall be filed.

(e) **Failure to Pass Examination.** When an applicant has failed to pass the examination, he shall be notified in writing by the Department.

(f) **Right to Appeal.** All decisions of the Department may be appealed as prescribed in Chapter 1.

(g) **Supervisors.**
1. Every supervisor required for a particular license shall be examined by the Department, and if qualified shall be issued a Supervisor Certificate of Qualification. The certificate holder shall be entitled to perform and supervise the work in the particular skill for which he is qualified and certified. This certificate is an individual certificate and shall not be construed to be a license.
2. The certificate holder shall maintain an active part in the supervision of the workmen under his direction.

**SECTION 211. CLASSIFICATION OF SUPERVISOR CERTIFICATE OF QUALIFICATION.**

All licenses issued by the Department shall require a Supervisor Certificate for the particular work to be performed, in accordance with Table 2-B. The Supervisor Certificate shall permit the holder thereof to be a Supervisor under the licenses enumerated herein.

**SECTION 212. CLASSIFICATION OF JOURNEYMAN AND OPERATOR CERTIFICATE OF QUALIFICATION.**

(a) **General.** Unless otherwise provided for in this Section or in the Building Code, all journeymen and operators required to be certified shall perform that work permitted under the provisions of licenses for a particular type of work. The work permitted by the certification shall be performed in the employ of the licensee as hereinafter set forth.

(b) **Journeyman Certificate of Qualification.** A Journeyman Certificate of Qualification shall be required in the following trades and shall entitle the individual to work in the trade for which he is certified and classified. This Certificate shall permit the individual to work only under a certified supervisor.

1. **Journeyman Electrical Certificate.** Permits the installation of electrical wiring apparatus and appliances, including fire detection, fire alarms and burglar alarm systems. The holder of this Certificate may perform this work only in the employ of an Electrical Contractor.

2. **Journeyman Plumbing Certificate.** Permits the installation of all sanitary plumbing, potable water supply piping and appliances connected thereto; storm sewer; gas piping; water heaters; piping for the transmission of chemicals and gases; gas ranges; domestic gas incinerators; lawn sprinkler systems; firestand pipe; fire sprinklers not to exceed 10 heads; pool piping; process piping. The holder of this certificate may perform this work only in the employ of a Plumbing Contractor Class A or B.

3. **Journeyman Steamfitter Certificate.** Permits of the installation of steam and hot water heating systems; process and industrial piping and related appurtenances; piping used for the transmission of chemicals, gases, air, milk, and other products transmitted through piping; all items regulated by Chapter 58 of the Building Code; low static gas-fired unit heaters; industrial ovens; burners, piping and
controls utilizing gas, low voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway; commercial cooking equipment; commercial incinerators; after-burners. The holder of this certificate may perform this work only in the employ of a Steam and Hot Water Contractor or a Hot Water Contractor.

4. **Journeyman Water Service Certificate.** Permits the installation of the initial water service from the main tap through the stop box and meter pit and continuing to and through the wall of the building and capped at that point. This certificate shall not permit the installation of the water meter. The holder of this Certificate may perform this work only in the employ of a Water Service Contractor or a Plumbing Contractor Class A or B.

5. **Journeyman Gas Service Certificate.** Permits the installation of the following equipment utilizing gas or liquid fuel:
   A. Commercial Cooling Equipment.
   B. After-Burners.
   C. Ranges.
   D. Dryers.
   E. Conversion Burners.
   F. Venting of Domestic Water Heaters, Dryers and Incinerators.
   G. Water Heaters not exceeding 100 MBtu input.
   H. Low Voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway. The low voltage wiring permitted by this Certificate shall apply to gas or liquid fuel-fired appliances only. The holder of this Certificate may perform this work when in the employ of a Gas Service Contractor or a Heating and Ventilating Contractor Class A or B.

6. **Journeyman Heating and Ventilating Certificate.** Permits the installation of warm air heating, ductwork, ventilation and evaporative cooling; exterior sheet metal; water heaters not exceeding 100 Mbtu input; gas piping, burners, venting and controls; exhaust systems and appurtenances thereof; low-voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway. The holder of this Certificate may perform this work only in the employ of a Heating and Ventilating Contractor A or B.

7. **Journeyman Refrigeration Certificate.** Permits the installation of refrigeration systems and appurtenant cooling towers; pipe insulation; low voltage wiring which does not exceed 48 volts and is not enclosed in a conduit or raceway. The holder of this Certificate may perform this work only in the employ of a Refrigeration Contractor Class A or B.

8. **Journeyman Domestic Appliance Certificate.** Permits the installation of Domestic Appliances as defined in Chapter 41 of this Building Code. The holder of this Certificate may perform this work only in the employ of a Domestic Appliance Contractor or a Plumbing Contractor Class A or B.

9. **Journeyman Boilermaker Certificate.** Permits the installation and erection of steam and hot water boilers; pressure and non-pressure vessels; precipitators; incinerators; breeching; chimneys; plate and casings. The holder of this Certificate may perform this work only in the employ of a Boilermaker Contractor.

10. **Journeyman Residential Electrical Certificate.** Permits the in-
Installation of electrical wiring, electrical apparatus and appliances in Group I and J occupancies only. The holder of this Certificate may perform this work only in the employ of an Electrical Contractor.

11. **Journeyman Electrical Signal Certificate.** Permits the installation of electrical wiring and equipment for fire alarm, fire detection, emergency voice communication system, burglar alarm, and electrical signalling and control wiring. Voltages shall not exceed 48 volts, or the system shall be Class 2 power, limited, as defined in the National Electrical Code. Complete conduit or raceway systems shall not be installed by the holder of this Certificate. The holder of this Certificate shall perform this work only in the employ of an Electrical Signal Contractor or Electrical Contractor.

12. **Journeyman Drainlayer Certificate.** Installation of sanitary and storm sewer and sewer connections. This work shall commence at the pipe located 5 feet outside the building and thence to the main sewer and shall include digging and backfilling of ditches. The holder of this Certificate may perform this work only in the employ of a Plumbing Contractor Class A or B.

(c) **Stationary Engineer and Operator Certificates.** It shall be unlawful to operate any of the following equipment without the personal attendance, of a properly Certified Stationary Engineer or a properly Certified Operator.

1. Any steam boiler and appurtenances thereto; steam pumps; steam turbines; and steam engines where the steam pressure is in excess of 15 psi working pressure and where the equipment produces a total of 10 boiler horsepower or more at Denver altitude.

2. Water heating systems when the water temperature exceeds 250 degrees F. in the system.

3. Composite grouping of refrigeration machines where machines are 25 tons in capacity and parallel to a common refrigerant piping system. The total charge in the entire system shall determine the capacity of the system.

4. Refrigeration systems utilizing Group 2 or 3 refrigerants as defined in Chapter 49 in this Building Code and which contain a charge of 200 lbs. or more.

5. Refrigeration systems having manual or semi-automatic control with charges of 1500 lbs. or more of Group 1 refrigerants as outlined in Chapter 49.

6. Refrigeration systems with fully automatic controls with charges of 1500 pounds or more of Group 1 refrigerants.

(d) **Stationary Engineer.** Permits the holder to take charge of and operate all steam boilers and appurtenances thereto; steam pumps; steam turbines; steam engines and mechanical refrigeration systems.

(e) **Boiler Operator Certificate, Class A.** Permits the holder to take charge of and operate all steam boilers and appurtenances; steam pumps; steam turbines; and steam engines.

(f) **Boiler Operator Certificate, Class B.** Permits the holder to take charge of, and operate all steam boilers and appurtenances; steam pumps; steam turbines; and steam engines containing a steam pressure between 15 and 100 psi and where the equipment produces a total of between 10 and 100 horsepower at Denver altitude.

(g) **Refrigeration Operator Certificate.** Permits the holder to take
charge of, operate, and make needful adjustments and maintenance repairs for refrigeration systems of all sizes and types.

(h) **Semi-Automatic Defined.** As used in this Section, semi-automatic shall mean plants or systems which are provided with automatic safety controls by manual load proportioning controls requiring other than seasonal adjustments.

(i) **Hoist Operator Certificate.** It shall be unlawful to operate any construction hoist power by steam, electricity, or other power when such hoist serves buildings or structures under construction or demolition exceeding 25 feet in height unless said hoist is operated by a properly certified hoist operator. This Section shall not be construed to include elevators regulated an defined in Chapter 55 of this Building Code.

**EXCEPTION:** Single drum material hoists not carrying personnel need not require a Hoist Operator Certificate Holder.

(j) **Motion Picture Machine Operator Certificate.** It shall be unlawful to operate or maintain motion picture projection equipment (16 mm or over), spot and flood lights used in theatrical productions, and other electrical and lighting equipment associated with motion picture, stage, and theatrical productions, without the attendance of a properly certified Motion Picture Machine Operator.

**SECTION 213. APPRENTICES AND TRAINEES.**

(a) **General.** This Section shall govern the requirements for apprentices and trainees and shall be limited to the crafts listed in this Chapter where a Journeyman Certificate holder is required.

(b) **Requirements.** Apprentices and trainees shall not be required to possess a Certificate, but shall be permitted to work as prescribed in other Sections of this Chapter.

(c) **Definition.**

1. An apprentice shall mean any person who has entered into an apprentice agreement which provides for participation in a program of training through employment and education in related and supplementary subjects.

2. A Trainee shall mean any person working at the trade under the direct Supervision of a Certified Journeyman or Supervisor.

(d) **Work.** An apprentice or trainee may perform any work which is distinctive to a specific craft, but only under the direction and supervision of a Certified Supervisor or Journeyman of that craft. Persons working on tasks not distinctive to any specific craft shall not be classed as an apprentice.

(e) **Employment of Apprentices.** Contractors may employ apprentices or trainees for the licensed crafts or trades. The ratio of apprentices and trainees to Journeyman employed shall not exceed one apprentice or trainee to one Journeyman.

(f) **Employer.** All apprentices or trainees shall be in the employ of the Licensed crafts where Journeymen Certificate holders are required.

**SECTION 214. CERTIFICATE FEES.**

(a) **Annual Fees.** Annual Certificates of Qualification fees shall be paid the Department in accordance with the provisions of this Section.

- Supervisor Certificate ................. $25.00
- Journeyman Certificate ............... $10.00
Engineer Certificate ................... $10.00
Operator Certificate ................... $10.00

EXCEPTION: The certificate fee for employees of the City shall be waived when performing work for the City or when employed by the Department.

(b) Certificate Fee Refund. Certificate fees shall not be refundable.

SECTION 215. CERTIFICATE RENEWAL. Certificates shall be renewed annually. Any work performed 30 days after expiration of the Certificate and prior to obtaining a renewal of the certificate shall be a violation of this Building Code.

SECTION 216. REISSUANCE.

(a) General. The Department shall have the authority to renew a Certificate provided the renewal is accomplished within the limits set forth herein:

1. The Certificate may be reissued without a new application provided such reissuance shall be accomplished within one year after the Certificate has expired. If such certificate is not reissued within said one year period, a new application shall be required.
2. If the Certificate holder reapplies within 3 years of the date of expiration, re-examination shall not be required.
3. If the Certificate holder applies more than 3 years but less than 5 years after expiration, re-examination shall be required, unless he can substantiate that a Department issued Certificate has been in force within the past 5 years.
4. If neither the Department nor the individual can substantiate Certification within the past 5 years, the individual shall reapply in the manner provided for new applicants.

SECTION 217. CERTIFICATE HOLDER RESPONSIBILITY.

(a) General. All certificate holders shall be responsible for the work they assume in accordance with the requirements of this Building Code, without limitation, and to the following items:

1. To have in possession at all times, a Certificate of Qualification.
2. To present a certificate when requested by any member of the Department.
3. To faithfully construct, without departure from or disregard of approved drawings and specifications.
4. To obey any order issued under authority of this Building Code.
5. To pay any fee assessed under the authority of this Building Code.
6. To observe the safety requirements of this Building Code.

SECTION 218. SUSPENSION OR REVOCATION OF CERTIFICATE.

(a) Authority. The Department may suspend or revoke a Certificate issued under the provisions of this Building Code for any one or more of the following acts of omission:

1. Incompetence.
2. Misuse of the certificate.
3. Violation of any of the provisions of this Building Code.
4. Failure to comply with any of the certificate holder responsibilities outlined in Section 217.

(b) Procedures. When any acts or omissions enumerated are committed
by a certificate holder and the Department deems that the certificate shall be suspended or revoked, the action shall be as follows:

1. **Notification.** The Department shall notify the certificate holder, in writing, by certified mail or by personal service, at least 7 days prior to suspension or revocation.

2. **Request Hearing.** Upon receipt of the notice, the certificate holder may request a hearing. This request shall be in writing to the Department within 7 days after receipt of the notice.

3. **Time of Hearing.** If a hearing is requested by the certificate holder, the Department shall set a time, date, and place, and so notify the certificate holder. Suspension or revocation of the certificate shall be deferred until after the hearing or appeal.

4. **Attendance.** When a hearing is conducted, the certificate holder and other interested parties may be in attendance. Upon completion of the hearing, the Department shall take all evidence admitted under advisement, and shall notify the certificate holder of the finding and ruling, in writing, by certified mail or personal service.

5. **Adverse Decision.** If the decision rendered by the Department is adverse to the certificate holder, the certificate holder may appeal this decision to the Board of Appeals, within 30 days after notice of ruling. The finding and ruling shall be rendered in writing and the certificate holder shall be notified by certified mail or personal service.

(c) **Emergency Suspension or Revocation.** If the Department finds that cause does exist for suspension or revocation of a certificate, it may enter an order for immediate suspension or revocation of the certificate, pending further investigation. The certificate holder may, upon notice of the suspension or revocation, request an immediate hearing before the Department. The hearing shall be conducted in the manner prescribed herein.

(d) **Delegation of Authority.** In the event of a hearing, the Director may appoint a qualified member of the Department to sit in his stead as the Hearing Commissioner to conduct the hearing. Final decision shall be rendered by the Director.

**SECTION 219. BOARDS OF STANDARDS.**

(a) **Creation of Boards of Standards.** There is hereby created and established Boards of Standards which shall have the duties, powers, and functions prescribed by this Section.

(b) **Members.** The members of the Boards shall be appointed by the Mayor to serve a period of 2 calendar years and may be reappointed for an additional two years; but no member shall serve more than 4 consecutive years.

(c) **Procedures and Bylaws.** The Boards of Standards are authorized to make rules of procedure and adopt bylaws necessary for the transaction of business consistent with this Building Code. Each Board shall elect its own Chairman at the first meeting of each calendar year and that person shall be Chairman for the entire year. A simple majority shall constitute a quorum. Each member shall receive $25.00 for attendance per meeting.

(d) **Examination Standards.** The Boards of Standards shall develop standards for the examination of applicants for certificates and shall submit
the standards to the Department for approval. The standards shall be consistent with the purpose of this Building Code, which is the protection of the public health, safety, and welfare of the people of the City to the extent that those persons recommended to be certified under this Building Code are qualified in terms of their skills, knowledge, practical experience and knowledge of pertinent law to perform the work for which they may be certified.

1. The examination Section of the Department shall examine applicants in the following areas:
   A. Applicable portions of the Building Code.
   B. Technical knowledge.
   C. Skills.

2. The Boards shall furnish the Examination Section of the Department with suggested test material which reflects the examination standards established.

3. The Department shall establish minimum standards for education and experience of applicants.

(e) Annual Review. The standards shall be reviewed annually, or more frequently if necessary, to maintain the standards current with changes in the Building Code and building practices.

(f) Members. The qualifications for members of the respective Boards shall be as follows:

1. Building Board.
   Construction Class A Certificate Holder.
   Construction Class B Certificate Holder.
   Construction Class C Certificate Holder.
   Professional Engineer registered in the State of Colorado.
   Architect licensed in the State of Colorado.
   Sign Class A Certificate Holder.
   Demolition Class A Certificate Holder.

   This Board shall develop standards for the examination of applicants for the following certificates:
   Construction Class A, B, C, D, and Moving.
   Demolition Class A and B.
   Sign Class A.

   Heating and ventilating Class A Certificate Holder.
   Gas Service Certificate Holder.
   Professional Engineer registered in the State of Colorado.
   Journeyman Heating and Ventilating Certificate Holder.

   This Board shall develop standards for the examination of applicants for the following certificates:
   Heating and Ventilating Class A and B.
   Gas Service.
   Journeyman Gas Service.
   Journeyman Heating and Ventilating.

3. Mechanical Board.
   Steam and Hot Water Certificate Holder.
   Journeyman Steamfitter Certificate Holder.
   Stationary Engineer Class A Certificate Holder.
   Professional Engineer registered in the State of Colorado.
   Refrigeration Class A Certificate Holder.
Fire Protection Class A Certificate Holder.
Boilermaker Certificate Holder.
Journeyman Boilermaker Certificate Holder.
Journeyman Refrigeration Certificate Holder.

This Board shall develop standards for the examination of applicants for the following certificates:
Refrigeration Class A, B.
Stationary Engineer.
Boiler Operator Class A, B.
Refrigeration Operator.
Hoist Operator.
Steam and Hot Water.
Hot Water.
Fire Protection Class A, B, C.
Boilermaker.
Journeyman Steamfitter.
Journeyman Refrigeration.
Journeyman Boilermaker.

4. Electrical Board.
Electrical Certificate Holder.
Journeyman Electrical Certificate Holder.
Professional Engineer registered in State of Colorado.
Electrical Signal Certificate Holder.
Elevator Certificate Holder.
Motion Picture Machine Operator Certificate Holder.

This Board shall develop standards for the examination of applicants for the following certificates:
Electrical.
Journeyman Electrical.
Journeyman Residential Electrical.
Elevator.
Electrical Signal.
Journeyman Electrical Signal.
Motion Picture Machine Operator.

5. Plumbing Board
Plumbing Certificate Holder.
Journeyman Plumbing Certificate Holder.
Professional Engineer Registered in State of Colorado.
Domestic Appliance Certificate Holder.
Water Service Certificate Holder.
Board of Water Commissioners Representative.

This Board shall develop standards for the examination of applicants for the following certificates:
Plumbing.
Journeyman Plumbing.
Water Service.
Journeyman Water Service.
Domestic Appliance.
Journeyman Domestic Appliance.
Journeyman Drainlayer.

SECTION 220. TRANSITIONAL PROVISIONS. Except as otherwise
expressly provided herein, this Building Code shall not be construed to require the duplication of reissuance of any license or certificate within the same calendar year, the duplication of any examination, nor the duplication of any payment of any license or certificate fee for a particular grade of license or certificate within the same calendar year. All persons in the building and construction industries presently licensed under former codes and ordinances shall be deemed to be appropriately licensed hereunder. Any licensee under a former code or ordinance who fails to reapply for a license at the conclusion of the calendar year shall surrender his license and the same shall be deemed to be null and void.

SECTION 221. TABLES.

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CHAPTER 3
PERMITS - DRAWINGS - INSPECTIONS - CERTIFICATE OF OCCUPANCY

SECTION 300. PERMITS REQUIRED.
(a) General. No person, the City and County of Denver, School District No. 1 in the City and County of Denver, shall erect, construct, enlarge, remodel, alter, repair, move, improve, remove, convert, demolish or change type of occupancy of any building, structure or utility or perform any other work regulated by this Building Code, or cause the same to be performed, without first having obtained a permit from the Department, for the specific work to be performed.
(b) Prohibition. Permits shall not be transferable or refundable.
(c) Validity. The issuance of a permit or the approval of drawings and specifications shall not be construed to be a permit for, nor an approval of, any violation or deviation from the provisions of this Building Code or other ordinances, laws, rules, or regulations. The Department shall notify and take action it deems necessary to require that all work performed meets all requirements of this Building Code.
(d) Public Utility. A permit shall not be required of a Public Utility duly franchised or authorized as such in the City for the repair and maintenance of the equipment and facilities used in the distribution of their utility.

SECTION 301. ISSUANCE OF PERMITS.
(a) General. The Department shall, upon application, issue permits to perform work as shown on the submitted documents and as specified on the permit:
1. After all phases of the project conform to the requirements of this Building Code, Department of Public Works, Zoning Administration, Department of Health and Hospitals, and Fire Department; and,
2. When the applicant is a Person licensed under this Building Code to do work authorized by the permit; or,
3. When the applicant is a Natural person who owns an I or J occupancy building; or, owns and occupies a unit in an H-3 occupancy building; or who owns property and wishes to construct an I or J occupancy building for his own occupancy, all under the following conditions:
   A. All construction or demolition shall be performed under the personal supervision of the owner or occupant.
   B. Any person other than the owner who is employed and paid to perform any work shall hold an appropriate license to perform such work.
   C. The applicant for a permit to perform electrical, heating, cooling, or plumbing work shall hold an appropriate Certificate of Qualification or shall pass an examination appropriate to the work to be performed and shall personally perform all the work.

   EXCEPTION: A permit shall not be issued to the owner-occupant of an H-3 occupancy for structural or utility work. Only one permit to construct a Group I occupancy building
shall be issued to any person under Section 301 (a) 3 in any 12 month period.

(b) **Application.**

1. The application for a permit shall be on forms furnished by the Department and shall contain the information the Department deems necessary. The applicant should exercise care in completing information, especially addresses, as permits are nontransferable. No refunds will be made for improper addresses unless the change is approved by the address section of the Design Engineering division.

2. Prior to the issuance of a permit, each person licensed under this Building Code shall submit to the Department the Contractor license card or a copy of the card approved by the Department. Approved copies of the card may be obtained from the Department at a cost of $1.00 per copy. Duplicate copies of lost cards may also be obtained from the Department at a cost of $5.00 per copy.

3. The owner may apply for a permit under Section 301(a) 3.

4. Every application for a permit shall be signed by:
   A. The license holder, or
   B. An authorized representative of the license holder, or
   C. The owner applying for a permit under Section 301(a) 3.

(c) **Suspension-Cancellation-New Permit.**

1. A permit shall be cancelled by the Department when:
   A. The work is not commenced within 60 days from the date of issue, or
   B. The work is suspended or abandoned after commencement for a period of 60 days.
   C. No request for inspection has been made for a period of 60 days.

2. A demolition or moving permit shall be cancelled by the Department when:
   A. The work is not commenced within 30 days after the date of issue, or
   B. The work is suspended or abandoned for a period of 10 days after work is commenced.

3. A new permit may be issued to replace an expired permit, provided no changes have been made in the original drawings and specifications for the work, when:
   A. The holder of a cancelled permit demonstrates that the suspension or abandonment of work was occasioned by circumstances beyond his control and that it would be an injustice to require a new fee; or,
   B. Payment of a fee equal to 1/2 the current permit fee, provided the application is made within one year after cancellation.

(d) **Suspension or Cancellation of Permits.** The Department may suspend or cancel any permit, or may stop the work for any of the following reasons:

1. Whenever there is a violation of any provisions of this Building Code or any City ordinance which the Department is empowered to enforce.

2. Upon written notice by the Department or Division affected when the owner or permit holder has failed to comply with the requirements of the Department of Public Works, Zoning Administration, Department of Health and Hospitals, and the Fire Department.
3. Whenever the continuance of any work becomes dangerous to life or property.

(e) Notice. The suspension or cancellation notice for reasons stated in Section (d), shall be in writing and shall be served upon the holder of the permit, the owner, or the person in charge of the work. After the notice is served, it shall be unlawful to proceed with any work.

SECTION 302. PERMIT FEES.

(a) Fees Required. A fee for each permit shall be paid to the Department as set forth in Table No. 3-A.

(b) Valuation. See Chapter 4.

(c) Reinspection Fee. Permit fees provide for customary inspections only. When inspection cannot be completed due to circumstances generated by the permit holder, a fee of $10.00 shall be charged for each reinspection. This fee shall be paid to the Department by the holder of the permit.

(d) Late Fees. When work for which a permit is required by this Building Code is begun without obtaining a permit, the fees stated in Table 3-A shall be doubled. The payment of this double fee shall not relieve any person from fully complying with the requirements of this Building Code in the execution of the work nor from other penalties for performing work without a permit.

**EXCEPTION:** For items of work performed on an emergency basis, as determined by the Department, to maintain an existing service or utility when the maintenance is necessary to protect health, life, or safety, the penalties stated herein shall not apply if application for a permit is made within 3 normal working days after commencement of the emergency work.

(e) Fees Not Required. The City and County of Denver and School District No. 1.

(f) Additional Fees. A supplementary permit shall be obtained for any additional valuation not included in the original permit. The fee shall be the difference between the fee paid and the current fee which would have been required had the original permit included the entire valuation.

(g) Additional Permit Fees for Rejected Drawings. When drawings are rejected by the Department an additional fee equal to 10 percent of the permit fee, but not less than $25.00, shall be charged for each rejection.

(h) Modified Drawings. When an approved set of drawings is modified or substantially changed so as to require rechecking by the Department, an additional fee equal to 25 percent of the original permit fee, but not less than $25.00, shall be charged. If changes or modifications require additional field inspection of construction, an additional permit fee equal to 10 percent of the original permit fee, but not less than $10.00, shall be charged for each additional inspection.

SECTION 303. DRAWINGS AND SPECIFICATIONS.

(a) General. Drawings and specifications shall be required for review and approval by the Department prior to the issuance of a permit.

(b) New Construction, Additions, Alterations, Repairs. Application for a permit shall be accompanied by the following:

1. Three complete sets of drawings which shall include architectural,
structural, mechanical, electrical and general elevator arrangements.
2. Three plot plans, except for interior alterations and repairs.
3. One complete set of specifications.
4. One copy of the land survey. See Section 306.
5. When required by the Department, additional drawings shall be submitted for approval.

(c) Approval. Drawings and specifications complying with the provisions of this Building Code and approved by the Department shall bear the Department stamp of approval on the first page thereof. When corrections are required to be made, the Department may require that the drawings and specifications be revised and resubmitted for approval prior to the issuance of a permit.

(d) Distribution. 2 sets of approved drawings shall be returned to the applicant. One set shall be maintained at the job site. One set of approved drawings and specifications shall remain in the office of the Department.

(e) Disposal. Upon completion of the work, and when final inspections have been made by the Department, the Department’s copy of the approved drawings and specifications may be disposed of at any time after 2 years have elapsed from the date of issuance of the permit. If no permit is issued, plans and specifications may be disposed of after 90 days from the date of application for the permit, or when requested by the permit holder or applicant for a shorter time.

(f) Not Required. Drawings and specifications need not be submitted for minor buildings, structures, or utilities; minor alterations and minor repairs to existing buildings; structures or utilities when the Department is satisfied that the strength, safety, sanitation, and fire resistance are adequately described on the permit application.

(g) Utility Companies. With the approval of the Department, the design of buildings, structures or utilities for the franchised or authorized public utility companies may vary from these Building Code requirements.

SECTION 304. PREPARATION OF DRAWINGS AND SPECIFICATIONS. Any person may submit drawings and specifications in connection with an application for a permit, in accordance with the following limitations:

(a) Architect and Engineer Required. Drawings and specifications for the following buildings or structures shall bear the seal and signature of the architect and engineer responsible for the design phases of the building or structure:
   1. Buildings or structures 3 or more stories in height.
   2. Buildings or structures housing the following occupancies: Group A, B-1, B-2, B-3, C-1, C-2, D-1, D-2, F-1, F-2, H-1 and H-2 occupancies.

(b) Architect or Engineer Required. Drawings and specifications for any building or structure housing Groups B-4, E-1, E-2, E-3, E-4, E-5, G-1, G-2, G-3, and H-3 occupancies shall bear the seal and signature of either the architect or the engineer.

(c) Architect or Engineer Not Required. Drawings and specifications for the following buildings, structures, additions, alterations, or repairs need not bear the seal of an architect or engineer:
   1. Group I and J occupancies.
   2. H-2 and H-3 occupancies when the floor area of the building does not
exceed 5,000 square feet, and the building is not more than one story in height, and is without basement or cellar.

3. Garages, industrial buildings, warehouses, stores, mercantile buildings, or office buildings where the floor area of the building does not exceed 5,000 square feet and the building is not more than one story, without a basement, cellar or excavated sub-floor area.

4. Nonstructural alterations to any building or structure, provided the alterations do not affect the stability of the building or the health and safety of the occupants.

5. If after review of the drawings and specifications, the Department is unable to determine that the proposed building or structure is adequately designed, the Department may require that the drawings and specifications bear the seal of an architect and engineer who will be responsible for the design phases of the building or structure.

6. Architect and engineer defined, see Chapter 4.

SECTION 305. INFORMATION REQUIRED FOR PREPARATION OF DRAWINGS AND SPECIFICATIONS. Drawings and specifications shall be complete and of sufficient clarity to indicate the entire work proposed and to show in detail that the building, structure, or utility conforms to the provisions of this Building Code, relevant laws, ordinances, rules and regulations. Each set of drawings and specifications shall contain the following:

(a) Architectural Drawings, Specifications, and Analysis.
   1. The exact address, legal description, and location of the work to be performed.
   2. The name and address of the owner.
   3. Name and address of the person or firm responsible for the preparation of the drawings and specifications. The seal and signature of the architect or engineer responsible for the preparation of the drawings and specifications shall be affixed to each drawing.
   4. A plot plan showing the location of the proposed construction and the location of every adjacent existing building on the property, including roads, walks, utilities, and other site improvements, all property lines, streets, alleys, easements, and other public areas.
   5. The Occupancy Group which applies to the building, the type of construction, and the Fire Zone in which the building is located.
   6. Building drawings showing the number of floors, arrangement of each floor, elevations, sections, and details required to show construction and fire-resistive protection, door and finish schedules.
   7. Specifications shall clearly describe the type, quality, and finish of materials, and the method of assembly, erection, and installation of equipment to be installed.
   8. For an analysis of the floor areas permitted for a new building or an addition to an existing building, when the total floor area exceeds the basic area permitted, see Chapter 5.
   9. A complete elevator and dumbwaiter layout, if applicable.

(b) Structural drawings, Specifications, and Analysis.
   1. The name and address of the person or firm responsible for the preparation of the drawings and specifications. The seal and signature of the architect or engineer responsible for the preparation of the drawings and specifications shall be affixed to each drawing.
   2. Foundation, floor, and roof plans; elevations; sections and details
showing all structural requirements.
3. Foundation design criteria in accordance with a soils investigation report signed and sealed by an engineer responsible for the preparation of the report.
4. Design criteria indicating all lateral and vertical loads and allowable stresses in all structural materials.
5. Specifications which describe the type and quality of material employed, with proper reference to accepted Standards.

(c) **Mechanical Drawings, Specifications, and Analysis.**
1. The name and address of the person or firm responsible for the preparation of drawings and specifications. The seal and signature of the engineer or architect responsible for the preparation of the drawings and specifications shall be affixed to each drawing.
2. Single line drawings, including typical isometric, of plumbing, heating, air treatment systems, and gas piping layout shall be submitted.
3. Btu rating of gas units, method of combustion and ventilation air supply, type and horsepower of refrigeration, and gas meter locations.
4. Heating, cooling, ventilating, plumbing, fire protection details, and fire or smoke damper locations.

(d) **Electrical Drawings, Specifications, and Analysis.**
1. The name and address of the person or firm responsible for the preparation of drawings and specifications. The seal and signature of the engineer or architect responsible for the preparation of the drawings and specifications shall be affixed to each drawing.
2. Complete electrical drawings, including a single-line power distribution diagram showing sizes of service, feeder conductors, and over-current protection and panel ratings.
3. Electrical diagrams for fire protection systems as required in Chapters 38 and 53.
4. Four complete sets of drawings for fire alarm and fire detection systems, shall be submitted prior to installation. Each drawing shall bear the seal and signature of the engineer responsible for the design of the system.
5. Drawings of all new or replacement services in excess of 400 amperes. Drawings shall indicate all information, including calculated loads. Each drawing shall bear the seal and signature of the engineer responsible for the design of the system, when required by the Department.

(e) **Additional Information, When Requested.**
1. Reports from an independent testing agency which substantiate requirements of this Building Code regarding structural or fire-resistant requirements.
2. Engineering design calculations.
3. Other information deemed necessary to determine compliance with the requirements of this Building Code.

**SECTION 306. FIELD SURVEYS.**

(a) **General.** Prior to the issuance of a permit, a field survey shall be conducted by a land surveyor registered by the State of Colorado, establishing the following:
1. **Corner Stakes.** Location of property corners and placement of co
ner stakes or markers.

2. **Lines and Locations.** Lines and locations of all existing buildings on the property.

3. **Boundaries.** Building site boundaries.

4. **Certificate.** Items 1 through 3 shall be shown on a surveyor's certificate and shall be drawn to scale.

(b) **Access for Department.** The contractor or property owner shall provide unobstructed access for the Department to the required corner stakes or markers.

**SECTION 307. INSPECTIONS.**

(a) **General.** All work performed shall be subject to inspection by the Department, and certain work shall be continuously inspected by privately employed qualified inspectors. All inspections except those requiring a special or periodical inspection shall be requested at least 24 hours in advance.

(b) **Inspection Required.** The Department shall conduct the inspections of buildings, structures, or utilities and shall either approve that portion of the work then completed or notify the permit holder or his agent of any failure to comply with the requirements of this Building Code. Inspection shall constitute those as approved by the Department.

(c) **Annual and Semi-Annual Inspections.**

1. **Boilers, Incinerators, Crematories, and Pressure Vessel Annual Inspection.** Boilers, pressure vessels, crematories, and incinerators of all types except boilers used for heating potable water, located in any Group A through H-2 occupancy, shall be inspected by the Department at least once in each year. If, after inspection by the Department, the equipment is found to be in a safe condition, the Department shall issue a certificate stating that the equipment may be operated. The certificate shall be posted in a conspicuous place in the boiler room and shall be framed with glass or clear plastic cover.

2. **Vertical Transportation Semi-Annual Inspection.** The units enumerated herein shall be inspected by the Department and City Licensed Elevator Contractors as indicated in this Section: Passenger or passenger service elevators, combination passenger and freight elevators, freight and freight service elevators, escalators, dumbwaiters, sidewalk elevators, stage lifts, orchestra lifts, and manlifts.

   A. **Inspection.** The owner or operating agent shall, at his expense, cause to be checked, by a City licensed elevator contractor, in addition to the requirements of Chapter 55, the following:

   All hoistway door or gate interlocking devices to determine if the equipment can operate with the doors in an open position. All hoisting and counterweight ropes or cables shall be checked to determine if sufficient wear or breaks justify
replacement. In addition, the owner or operating agent shall cause the following work and tests to be conducted by the Elevator Contractor at the following intervals:

All hoisting ropes or cables of winding type machines shall be reshackled every year for overhead machines and every 2 years for winding machines, and every 5 years for traction machines. The overspeed governor actuating the safety device shall be checked for calibration every 3 years. Where a conflict exists between this Section and other Sections of this Building Code, this Section shall supersede.

B. **Tag.** The owner or operating agent shall cause the equipment to be tagged so as to indicate the contractor's name and date when the test and work were performed.

C. **Certificate.** If, after inspection by the Department, the equipment is found to be in a safe condition, the Department shall issue a Certificate stating that the equipment is ready for use and indicating the maximum load permitted. Certificates shall be maintained, in the building for which they are issued, by the owner, agent or lessee in a manner easily accessible for checking by the Department or other interested persons. See Chapter 56.

D. **Annual and Semi-Annual Inspection Fees.** The semi-annual inspection fee for vertical transportation units shall be as specified in Table 3-C.

(d) **Special Inspection - Inspector.**

1. The Department may require the owner or his agent to employ a qualified inspector during construction for the following types of work:
   A. **Concrete.** Structural reinforced concrete work including forms and placement of reinforcement; and on precast, prestressed and post tensioned concrete.
   B. **Masonry.** Plain masonry when the design is based upon an ultimate design strength of masonry in excess of 1,000 pounds per square inch.
   C. **Structural Steel.** At all times during the erection of structural steel when field bolting, riveting, or structural welding is being performed.
   D. **Special Cases.** Special construction or work involving unusual hazards; or when the Department does not have the capability to perform the required inspection(s).

2. **Special Inspector.** The special inspector shall be a qualified person approved by the Department and shall be an engineer registered in the State of Colorado, an architect licensed in the State of Colorado, or a person in the employ of or subject to direct supervision and control of the named engineer or architect.
   A. **Duties of Special Inspector.** The special inspector shall provide continuous inspection of the construction or work requiring his employment. He shall submit a written report of his inspections to the owner and to the Department.

(e) **Other Inspections.** The Department may make or require other inspections for any work to ascertain compliance with the provisions of
this Building Code and other laws enforced by the Department.

(f) **Inspection Record Card.** All construction work including new work, additions, alterations and repairs for all occupancies shall not be commenced until the permit holder or his agent has posted an inspection record card in a conspicuous place so as to allow the Department conveniently to make the required entries thereon regarding inspection of the work. This card shall include the information requested by the Department and shall be maintained in such location until the work has been completed and final inspections made. Upon completion of the work and after all necessary inspections have been made and properly signed by personnel of the Department, such record card shall be returned to the Department by the construction permit holder. Return of the completed card shall be mandatory prior to the issuance of a Certificate of Occupancy, where such Certificate is required.

(g) **Exposure of Work.** Whenever any work is covered or concealed by additional work without first having been inspected as required, the Department may order, by written notice, that such work be exposed for examination. The work of exposing and recovering shall not entail expense to the City.

**SECTION 308. CERTIFICATE OF COMPLIANCE.** A certificate of Compliance shall be issued by the Department to the General Building Contractor when the inspection card issued by the Department is returned indicating that all final inspections by the Department’s inspectors have been made.

**SECTION 309. CERTIFICATE OF OCCUPANCY.**

(a) **Required.** New buildings or structures in Group A through H occupancies shall not be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the Department has issued a Certificate of Occupancy. See Section 309(e) for temporary Certificate of Occupancy.

(b) **Requirements Prior to Issuance.** A Certificate of Occupancy shall be issued to the owner after the issuance of a Certificate of Compliance as specified in Section 308, and after approvals by the Department of Public Works, Zoning Administration, Department of Health and Hospitals, and the Fire Department.

(c) **Issuance of Certificate.** When all the conditions of this Chapter have been fulfilled, the Department, in conjunction with the Zoning Administrator, shall issue a Certificate of Occupancy indicating:

1. The use and occupancy for which the Certificate is issued, including the occupant load.
2. Approval by the Department and the Zoning Administrator.

(d) **Duplicate Certificate of Occupancy.** Upon payment of $5.00 to the Department, a duplicate Certificate of Occupancy may be secured by the owner, architect, engineer, contractor, permit holder or tenant.

(e) **Temporary Certificate of Occupancy.** The Department may issue a Temporary Certificate of Occupancy to the owner, upon payment of a fee to the Zoning Administrator, provided:

1. The Department and Zoning Administrator find that no substantial hazard will result from the occupancy.
2. Approval by the Department of Public Works, Department of Health and Hospitals and the Fire Department has been obtained.
3. Unusual construction difficulties delayed the completion of the building.

This Temporary Certificate shall be valid for a period not to exceed 6 months. After the expiration of the Temporary Certificate of Occupancy, the building or structure shall require a Certificate of Occupancy in accordance with other provisions of this Chapter.

(f) **Change of Occupancy.** Changes in the character or occupancy of Group A through I occupancies shall not be made except as specified in Chapters 5 and 31 of this Building Code.

(g) **Cancellation of Certificate of Occupancy.** A Certificate of Occupancy may be cancelled when:
   1. The owner has failed to comply with the requirements of the Department of Public Works.
   2. The continued occupancy of the structure is dangerous to the public health, safety, or welfare.

(h) **Violation.** It shall be a violation of this Building Code to occupy a building or structure prior to obtaining a Certificate of Occupancy when required.

SECTION 310. ADDRESS.

(a) **On Job Site.** The construction permit holder shall post, at the front of the premises in a conspicuous place, a sign indicating the following:
   1. The address number and street or avenue, court, parkway or other, as assigned by the office of the City Engineer.
   2. The name of the firm, address, business phone number, and emergency phone number of the permit holder.
   3. The Building Permit number.

(b) **Permanent Address.** The owner or occupant of every building or structure shall display the permanent address of each building in a permanent visible location on the building.

SECTION 311. TEMPORARY BUILDING PERMIT. A permit for a temporary building may be issued by the Department if the applicant can substantiate that an emergency and a definite need for the temporary building exists. The Permit shall not exceed 6 months duration. However, after the expiration date of the permit, if the applicant can demonstrate that there have been no complaints or hazards as a result of this temporary occupancy, the Department may issue a renewal of the permit for an additional 6 months. The request for a permit shall be in writing, detailing the reason for the request. The basis for approval shall be on the need, extent of time, and the type of unit to be installed.

**EXCEPTION.** Temporary buildings for use by licensed contractors at the construction or demolition sites, shall not require a permit.

SECTION 312. FOUNDATION PERMITS.

(a) **General.** A foundation permit for Group A through H occupancies may be issued to a contractor who holds a license qualifying him as a general contractor for the entire project, prior to the issuance of the Construction Permit for the building, provided:
   1. The total valuation of the project, excluding utilities, exceeds $200,000.
   2. Drawings of the proposed superstructure containing sufficient detail relating to the design of the foundation or substructure are submit-
ted to the Department. Complete calculations shall be submitted to validate the design of footings, caissons and all other substructure elements.

3. Approvals required by the appropriate City agencies are obtained prior to issuance of the permit.

(b) **Fee.** The fee charged at the time of issuance of the foundation permit shall be based on the total valuation of the construction for both the substructure and the superstructure, plus an additional 25 percent. See Table 3-A.

(c) **Deviations.** Any deviation from the approved foundation permit drawings shall be cause for the cancellation of the permit. However, if changes are substantiated by engineering calculations and revised drawings, the deviations may be approved by the Department.

(d) **Responsibility.** The contractor shall assume full responsibility for the installation of all utilities in the substructure. Any changes in design or construction to meet the requirements of this Building Code for the combined substructure and superstructure shall be the sole responsibility of the contractor. A permit issued under this Section shall not be construed as approval for any portion of the structure not covered by the foundation permit.

(e) **Not Applicable.** Phased Construction.

**SECTION 313. PHASED CONSTRUCTION PERMITS.**

(a) **General.** The Department may issue permits for the construction of a portion or phase of a building, structure, or utility prior to the submission of the complete drawings and specifications, provided:

1. The minimum total valuation of the building, structure, or utility is more than $1,000,000.
2. The approval of appropriate City agencies has been obtained prior to application for the initial permit.
3. The valuation of that portion of the work, including utilities, is stated on each application.
4. Drawings shall show on each sheet the note: ‘Phased construction’ with a brief description of the phase covered by the permit.

(b) **Fees.** Permit fees shall be assessed in twice the amount of those specified in Table 3-A. A permit issued under this Section shall not be construed as approval for any portion of the structure not covered by the permit.

**SECTION 314. TABLES AND FEES.**

(a) **Permit Fees.** A fee, as specified in Table 3-A shall be assessed for all permits except as otherwise provided for in this Chapter.

(b) **Other Fees.** Annual and semi annual fees shall be as specified in Tables 3-B and 3-C.
### TABLE NO. 3-A
**FEES FOR REQUIRED PERMITS**

**PERMITS NOT OTHERWISE SPECIFIED**

<table>
<thead>
<tr>
<th>VALUATION OF WORK</th>
<th>FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 1.00 - $ 500.00</td>
<td>$ 8.00</td>
</tr>
<tr>
<td>501.00 - 2,000.00</td>
<td>10.00</td>
</tr>
<tr>
<td>2,001.00 - 100,000.00</td>
<td>10.00 plus $5.00 for each additional $1,000 or fraction thereof over $2,000.</td>
</tr>
<tr>
<td>100,001.00 - 500,000.00</td>
<td>500.00 plus $4.00 for each additional $1,000 or fraction thereof over $100,000.</td>
</tr>
<tr>
<td>500,000.00 - and Over</td>
<td>2,100.00 plus $3.00 for each additional $1,000 or fraction thereof over $500,000.</td>
</tr>
</tbody>
</table>

**ELECTRICAL PERMITS**

**GROUP A THROUGH H-2 OCCUPANCIES**

<table>
<thead>
<tr>
<th>VALUATION OF WORK</th>
<th>FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 1.00 - $ 300.00</td>
<td>$ 10.00</td>
</tr>
<tr>
<td>301.00 - 2,000.00</td>
<td>15.00</td>
</tr>
<tr>
<td>2,001.00 - 50,000.00</td>
<td>6.00 per each $1,000 valuation or fraction thereof</td>
</tr>
<tr>
<td>50,001.00 - 500,000.00</td>
<td>50.00 plus $5.00 per each $1,000 valuation or fraction thereof of total valuation</td>
</tr>
<tr>
<td>500,000.00 - and Over</td>
<td>550.00 plus $4.00 per each $1,000 valuation or fraction thereof of total valuation</td>
</tr>
</tbody>
</table>

**GROUP I AND H-3 OCCUPANCIES**

<table>
<thead>
<tr>
<th>FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not more than 1000 sq. ft.</td>
</tr>
<tr>
<td>More than 1000 sq. ft. and not more than 1500 sq. ft.</td>
</tr>
<tr>
<td>More than 1500 sq. ft. and not more than 2000 sq. ft.</td>
</tr>
<tr>
<td>Per 100 sq. ft., in excess of 2,000 sq. ft.</td>
</tr>
<tr>
<td>Reinspections</td>
</tr>
</tbody>
</table>

**WRECKING PERMITS**

(Includes all stories, basements or cellars)

<table>
<thead>
<tr>
<th>FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2,000 sq. ft</td>
</tr>
<tr>
<td>2001 sq. ft. or over</td>
</tr>
</tbody>
</table>

**ELEVATOR REPAIR PERMITS**

Major repairs as determined by the Department shall carry a fee in accordance with the valuation schedule herein. Ordinary or minor maintenance as determined by the Department, shall not require a Permit.

**BUILDING MOVING PERMITS**

<table>
<thead>
<tr>
<th>FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per each address</td>
</tr>
</tbody>
</table>

1 This fee schedule shall apply to new construction and extensive remodeling. Extensive remodeling shall mean work exceeding 50 percent of the value of the existing utility. The fee schedule for all other installations shall conform to the Table for Group A through H-2 Occupancies.
### TABLE NO. 3-B
PERIODICAL INSPECTION FEES

<table>
<thead>
<tr>
<th>HORSEPOWER</th>
<th>FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 50</td>
<td>$10.00</td>
</tr>
<tr>
<td>51 to 100</td>
<td>15.00</td>
</tr>
<tr>
<td>101 to 250</td>
<td>20.00</td>
</tr>
<tr>
<td>251 to 500</td>
<td>25.00</td>
</tr>
<tr>
<td>501 to 1000</td>
<td>30.00</td>
</tr>
<tr>
<td>1001 and over</td>
<td>35.00</td>
</tr>
</tbody>
</table>

HEATING BOILERS
Cast-Iron 15 psi or less in Pressure

<table>
<thead>
<tr>
<th>Sq. Ft. of Radiation</th>
<th>FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1400</td>
<td>$10.00</td>
</tr>
<tr>
<td>1401 to 5000</td>
<td>15.00</td>
</tr>
<tr>
<td>5001 to 10000</td>
<td>20.00</td>
</tr>
<tr>
<td>10000 to 25000</td>
<td>25.00</td>
</tr>
<tr>
<td>25001 and over</td>
<td>30.00</td>
</tr>
</tbody>
</table>

UNFIRED PRESSURE VESSELS
$10.00

INCINERATORS
$10.00

All inspections other than those required by this Chapter shall be assessed at $10.00 for each additional inspection.

Saturday, Sunday, and Holiday Inspection Fees shall be double the fees indicated in Table 3-B.

---

### TABLE NO. 3-C
PERIODICAL INSPECTION FEES

<table>
<thead>
<tr>
<th>TYPE OF INSPECTION</th>
<th>FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevators</td>
<td>$10.00 (each unit)</td>
</tr>
<tr>
<td>For each additional landing over 3</td>
<td>1.00</td>
</tr>
<tr>
<td>Escalators *</td>
<td>10.00 (each unit)</td>
</tr>
<tr>
<td>Dumbwaiters</td>
<td>10.00 (each unit)</td>
</tr>
<tr>
<td>Stage Lifts</td>
<td>10.00 (each unit)</td>
</tr>
<tr>
<td>Orchestra Lifts</td>
<td>10.00 (each unit)</td>
</tr>
<tr>
<td>Man Lifts</td>
<td>10.00 (each unit)</td>
</tr>
</tbody>
</table>

* This shall mean each unit, floor to floor, in either direction.

Saturday, Sunday, and Holiday Inspection Fees shall be double the fees indicated in Table 3-C.

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3-13
CHAPTER 4
DEFINITIONS AND ABBREVIATIONS

SECTION 401. INTRODUCTION. For the purposes of this Building Code, certain words, phrases and terms shall be given the defined meaning. Words, phrases and terms neither defined herein, nor in this Building Code, shall be given their usual and customary meanings. The text of this Building Code shall control captions, titles, maps, figures, and diagrams. The word “shall” is mandatory and not permissive; the word “may” is permissive and not mandatory. Words used in the singular shall include the plural, and words used in the plural shall include the singular. Words used in the present tense shall include the future tense, and words used in the future tense shall include the present tense. Words used in the masculine gender shall include the feminine, and words used in the feminine gender shall include the masculine. Many other terms and abbreviations used only with specialized application are defined in the Chapter in which they are used.

SECTION 402. DEFINITIONS.
ABANDON. The desertion of a building, structure or utility. Abandon shall also apply when the building, structure, or utility is left to the effects of vandalism, dilapidation, and deterioration, thereby creating a fire hazard, unsafe condition, or a public nuisance.
ACCESSORY USE, MINOR. A secondary occupancy or use closely associated with the principal use. See Chapter 5.
ADEQUATE. Determined to be acceptable to the Department.
ADDITION. Construction which increases the external dimensions of a structure.
AGGREGATE. See Chapter 26.
AIR CONDITIONING. See Chapter 52.
 AISLE. A free, unobstructed passageway in a building for public ingress and egress to and from seats or other similar use areas leading to a lobby, foyer, corridor, or exit. See Fire Code.
ALLEY. An established passageway for vehicles and pedestrians affording a secondary means of access to properties abutting on a street or highway.
ALTERATION. Any change, re-arrangement, addition, or modification in construction or occupancy.
APARTMENT. A living unit in an apartment building.
APARTMENT BUILDING. Any building, or portion thereof, occupied as the residence of 3 or more families living independently of each other, with separate eating, sleeping, and toilet facilities.
APPLIANCE. See Chapters 41, 51, and 53.
APPRENTICE. See Chapter 2.
APPROVED. Methods, materials, equipment, and types of construction accepted officially by the Department as determined from the results of investigation and tests by recognized testing laboratory, national authorities, technical and scientific organizations, and by the Standards established in this Building Code. Approved (Approval) shall also mean to be officially acceptable or satisfactorily meeting the basic requirements of this Building Code and Department.
APPROVED AGENCY. An established and recognized agency regularly
engaged in conducting tests or furnishing inspection services when the
agency has been approved by Department.

**APPROVED FABRICATOR.** An established and qualified person, firm,
or corporation approved by the Department.

**ARCHITECT.** An Architect licensed by the State of Colorado.

**AREA.** See Floor area.

**ASPHALT.** See Chapter 32.

**ASSEMBLY BUILDING.** A building used in whole, or in part, for the as-
sembly of persons for purposes of deliberation, education, instruction,
workshop, entertainment, recreation, amusement, dancing, drinking, din-
ing, awaiting transportation, and other similar uses.

**AREAWAY.** An excavated space outside the wall of a building used for ac-
cess, lighting, or ventilation.

**ARCADE.** A covered passageway between buildings.

**ASSEMBLY, FIRE.** See Chapter 43.

**ATRIUM.** A space entirely within a building, covered with a roof, and form-
ing a vertical opening through more than 2 stories.

**ATTIC STORY.** A story located wholly or partly within a roof structure and
used for occupancy or storage.

**AWNING.** See Chapter 45.

**BALCONY.** That portion of the seating space of an assembly room in which
the lowest part is raised 4 feet or more above the level of the main floor. A
balcony is also a projection from a building, designed to be occupied or
used.

**BALCONY, EXTERIOR EXIT.** See Chapter 33.

**BALCONY, INTERIOR.** See Mezzanine.

**BALCONY, PRIVATE.** A balcony provided for the exclusive use of one te-
nant.

**BALCONY, PUBLIC.** A balcony used by more than one tenant, or as an ex-
terior exit balcony.

**BASEMENT.** That portion of a building between floor and ceiling which is
partly below and partly above grade, located so that the vertical distance
from grade to the floor below is less than the vertical distance from grade
to the ceiling. See Story.

**BOARD.** The Board of Appeals.

**BOILER.** See Chapter 58.

**BOILER OR FURNACE ROOM.** A boiler or furnace room is any room
where central heating equipment is located.

**BREEZEWAY.** See Arcade.

**BRICK.** See Chapter 24.

**BUILDING.** Any structure used for supporting or sheltering any use or oc-
cupancy.

**BUILDING, EXISTING.** A building constructed prior to the adoption of
this Building Code, or on land annexed to the City.

**BUILDING, TEMPORARY.** A building not intended for permanent use.

See Chapter 3.

**BURNER.** See Chapter 51.

**CANOPY.** See Chapter 45.

**CARPORT.** A covered shelter for automobiles or similar motor vehicle.

**CAST STONE.** A precast building stone manufactured from portland ce-
ment concrete.

**CELLAR.** That portion of a building between floor and ceiling which is
wholly or partly below grade and located so that the vertical distance from
grade to the floor below is equal to or greater than the vertical distance
from grade to the ceiling.

CEMENT. See Chapters 26 and 47.

CENTRAL STATION SYSTEM. See Chapter 38.

CITY. The City and County of Denver.

CLINIC. A building or portion thereof which contains offices for the diag-
nosis and treatment of out-patients for health services. This definition
does not include buildings which provide facilities for overnight accomodation
of patients.

COLUMN. See Chapters 23, 25, 26, and 27.

COMBUSTIBLE MATERIAL. Material which will ignite and burn when
subjected to fire.

CONCRETE. See Chapter 26.

CONSTRUCTION. All labor and materials used in the erection, demol-
ition, or removal of a building, structure, utility, appliance or device.

CORRIDOR. See Chapter 33.

CORRIDOR, PRIVATE. See Chapter 33.

CORRIDOR, PUBLIC. See Chapter 33.

COURT. A space open to the sky and bounded on 3 or more sides by walls of
a building. An inner court is a court entirely within the exterior walls of a
building. See Chapter 33.

CRAWL SPACE. A space located under the first floor of a building which
provides a clear height of less than 5 feet.

DEMOLITION. The destruction and removal of a building, structure, or
utility.

DEPARTMENT. The Building Inspection Division of the Department of
Public Works.

DETERIORATION. Buildings, structures, utilities, equipment, and
materials in which corrosion, decay, wear and tear through use or abuse,
obsolescence, effects of the elements, fire damage, disaster, flood, earth-
quake, lack of maintenance, vandalism, or any other cause, including
fatigue due to overstressing, disintegration of component parts, and the
separation of materials and structural parts occurs.

DIRECTOR. The Officer charged with the administration and enforcement
of this Building Code, or his authorized representatives.

DOMESTIC APPLIANCE. See Chapter 41.

DOOR, FIRE. See Chapter 43.

DOOR, SELF-CLOSING. A door which closes automatically after use.

DOOR, LEAF. A single door section. When an opening is closed by 2 or
more doors, each individual door shall be considered a leaf.

DEAD LOAD. See Chapter 23.

DORMITORY. A building, or portion thereof occupied as a residence by an
organized group of unrelated persons sharing common living facilities.

DWELLING. A building occupied as the residence of one or 2 families living
independently of each other, with separate eating, sleeping, and toilet
facilities.

DWELLING, MULTIPLE. See Chapter 13.

ENGINEER. An Engineer Registered by the State of Colorado.

EXHIBITION HALL. See Chapter 18.

EXISTING BUILDING. See Building, Existing.

EXITS. See Chapter 33.
EXTINGUISHING AGENT. See Chapter 38.
FAMILY. An individual, two or more persons related by blood or marriage, or a group of not more than five persons, excluding servants, who need not be related by blood or marriage, living together in a dwelling.
FIRE ALARM SYSTEM. See Chapter 38.
FIRE ASSEMBLY. See Chapter 43.
FIREBRICK. See Chapter 48.
FIRE CODE. The Fire Code of the City and County of Denver administered by the Fire Department.
FIRE DAMPER. See Chapter 52.
FIRE DEPARTMENT. The Fire Department of the City and County of Denver.
FIRE DETECTION SYSTEM. See Chapter 38.
FIRE DISTRICT ZONING. See Chapter 16.
FIRE DOORS. See Chapter 43.
FIREPLACE. See Chapter 48.
FIRE PROTECTION SYSTEM. See Chapter 38.
FIRE RESISTIVE CONSTRUCTION. See Chapters 5 and 43.
FIRE SPRINKLER SYSTEM. See Chapter 38.
FIRE STANDPIPE SYSTEM. See Chapter 38.
FLAMMABLE LIQUID. See Fire Code.
FLAME-SPREAD. The propagation of flame over a surface.
FLAME-SPREAD RATING. See Chapter 42.
FLOOR AREA. The area included within the surrounding exterior walls of a building. The floor area of a building without surrounding walls is the area of the horizontal projection of the roof or floor above.
FOOTING. That portion of the foundation of a building, structure or utility which distributes and transmits loads directly to the bearing surface.
FUELS. See Chapter 51.
FURNACE. See Chapter 52.
FURNACE ROOM. See Boiler Room.
GARAGE. A building, or portion thereof, in which vehicles are housed.
GARAGE, OPEN PARKING. See Chapter 12.
GARAGE, PRIVATE. A building, or portion thereof with an area of not more than 1000 square feet, in which motor vehicles used by tenants of the building are stored.
GARAGE, PUBLIC. Any garage other than a private garage.
GARAGE, REPAIR. A building, or portion thereof used for the repair of internal combustion engines; repair of motor vehicle transmissions, differentials, frames or bodies; where any part is removed for repairs which would render the vehicle inoperative; repairs requiring welding or brazing; stripping of inoperative motor vehicles; painting, or any other work not permitted in a storage garage.
GARAGE, STORAGE. A building other than a private, repair, or open parking garage used exclusively for the housing of motor vehicles.
GAS. See Chapter 51.
GRADE. The lowest point of elevation of the finished surface of the ground, paving, or sidewalk within the area between the building and the property line; or when the property line is more than 5 feet from the building, between the building and a line 5 feet from the building.
GROUT. See Chapter 24.
GUEST. Any person hiring or occupying a room for living or sleeping purposes.

GUEST ROOM. A room used by a guest for sleeping purposes.

GYPSUM, GYPSUM LATH AND PLASTER. See Chapter 47.

HABITABLE SPACE. Any room used for sleeping, living, cooking, and dining purposes, excluding closets, pantries, bath and toilet rooms, janitors closets, connecting corridors, laundries, unfinished attics, foyers, storage spaces, utility rooms, and other similar spaces.

HEIGHT OF BUILDING. The vertical distance above grade to the highest point of the coping of a flat roof or to the highest point of a pitched roof. The height of a stepped or terraced building is the maximum height of any portion of the building.

HELIPORT. An area of land, water, or a structural surface used for the landing, take-off, and servicing of helicopters.

HELISTOP. A structural surface used for the landing and take-off of helicopters, with no refueling or repairs.

HOMES FOR THE AGED. See Senior Homes.

HOMES, NURSING. See Nursing Homes.

HOSPITAL. A building, or portion thereof, used for the treatment and housing of ill or injured persons.

HOSPITAL, MENTAL. A building, or portion thereof, used for the treatment and housing of mentally ill persons.

HOTEL. A building, or portion thereof, used for the living accommodation of guests on a short term rental basis, and which does not provide individual kitchen facilities.

INCINERATOR. See Chapter 48.

INCOMBUSTIBLE. See Noncombustible.

LANDING. A continuation of the floor of a building giving access to stairs, ramps, or an escalator, and any level space between runs.

LINTEL. A structural member placed over an opening or recess in a wall for the purpose of supporting construction above.

LISTED, LISTING. Materials or equipment shown in a list published by an approved testing agency qualified and equipped for experimental testing, maintaining a periodic inspection of current productions, and whose listing states that the material or equipment complies with nationally recognized safety standards, and the Standards of this Building Code.

MARQUEE. A rigid, roof-like structure attached to the exterior walls of a building.

MASONRY. See Chapter 24.

MACHINE ROOM. A room used for the housing of elevator, refrigeration or air handling equipment.

MEZZANINE. An intermediate floor placed in any story or room. When the total area of the mezzanine exceeds one-third of the total floor area in that room, it shall be considered to be an additional story. The clear height below a mezzanine floor construction shall be at least 7 feet.

MORTAR. See Chapters 24, 47, and 48.

MOTEL. A hotel as defined in this Building Code.

NONCOMBUSTIBLE. Material which will not ignite and burn when subjected to fire. Any material conforming to ASTM E-136 shall be considered as noncombustible. Gypsum board shall be considered noncombustible.

N.E.C. The abbreviation of the National Electric Code, Pamphlet 70, NFPA.
NURSING HOME. A facility which is operated in connection with a hospital or in which nursing care and medical services are prescribed by or performed under the general direction of persons licensed to practice medicine or surgery by the State of Colorado; for the accommodation of convalescents or other persons who are not actually ill and not in need of hospital care and related services. The term Nursing Home is restricted to provide those facilities, the purpose of which is those contained in skilled nursing care and related medical services for a period of not less than 24 hours per day.

OCCUPANCY. The purpose for which a building, or portion thereof, is used or intended to be used.

OCCUPANCY, MIXED. The use of a building for more than one occupancy.

OCCUPANT LOAD. See Chapter 33.

OCCUPIED ROOF. The roof of a building or structure used for purposes other than maintenance, repair, or servicing of the building or equipment.

OWNER. A person, firm, corporation, or agent having a legal or equitable interest in a property.

PANIC HARDWARE. See Chapter 33 and 43.

PARTITION. A vertical construction used to divide a building, or portion thereof, into rooms or spaces.

PARTITION, PERMANENT. A partition meeting the requirements of this Building Code for fire-resistance or noncombustibility as determined by the type of construction.

PARTITION, TEMPORARY. A partition which does not meet the requirements of this Building Code for fire-resistance or noncombustibility as determined by the type of construction.

PENTHOUSE. An enclosed structure built on or above the roof of a building, and used for the housing of machinery or equipment, and not used for habitation.

PERMIT. An official document issued by the Department authorizing performance of a specified activity.

PERSON. A natural person, his heirs, executors, administrators, or assigns; also a firm, corporation, or partnership, its successors or assigns; or an agent of any of the aforesaid.

PERSONAL CARE BOARDING HOME. A facility which provides meals and personal care for ambulatory tenants. Personal care shall include the following services: housekeeping, maid service, laundry, social supervision, and other services of a personal nature.

PIER. See Chapter 24.

PIT. See Chapter 52.

PLATFORM. An elevated portion of an assembly room which does not meet the requirements for an enclosed platform, stage, or balcony.

PLATFORM, ENCLOSED. A partially enclosed portion of an assembly room, the ceiling of which is not more than 5 feet above the highest point of the proscenium opening, and which is used for the presentation of plays or other entertainment wherein scenery, drops, decorations, or other effects may be used.

PLASTIC. See Chapter 60.

PLUMBING. See Chapter 50.

PORCH. A roofed structure providing shelter at the entrance of a building or an open or enclosed room at the outside of a building.
PREFABRICATED ASSEMBLY. See Chapter 34.
PROSCENIUM. A vertical plane or separation between an assembly area and a stage or enclosed platform.
PUBLIC WAY. See Chapters 33 and 45.
REFRIGERANT - REFRIGERATION SYSTEMS. See Chapter 49.
REPAIR. The reconstruction or renewal of any portion of an existing building, structure, or utility.
REHABILITATION CENTER. A center for the rehabilitation of handicapped persons.
RETAIL ESTABLISHMENT. Any occupancy open to the public for the purpose of buying or selling goods or services.
ROOF, OCCUPIED. See Occupied Roofs.
ROOF, OPEN FRAME. A roof with all supporting members exposed on the underside and without a ceiling.
ROOF STRUCTURE. A structure above or on the roof of a building including: cooling towers, tanks, heating and cooling equipment, spires and towers or any other projection above the roof, not used for habitation.
ROOF. See Chapter 32.
SCHOOL, PUBLIC OR PRIVATE. An institution which provides instruction or education at elementary, secondary and high school learning levels.
SCHOOL, VOCATIONAL. An institution which provides instruction or education for a trade, art, voice, music, modeling, or similar endeavors.
SENIOR HOMES (HOMES FOR THE AGED). A building for the housing of the elderly which does not provide hospital, medical, personal care, or detention services.
SERVICE STATION. A building or lot, the primary purpose of which is the sale of motor vehicle fuel. The term may include the replacement of minor parts and minor repairs, but does not include parking of motor vehicles within a building, or repair garage use.
SHAFT. An enclosed vertical opening through a building.
SIGN STRUCTURE. See Chapter 56.
SKYLIGHT. See Chapters 54 and 60.
STAGE. A partially enclosed portion of an assembly building or room used for the presentation of plays or other entertainment wherein the scenery, drops, decorations or other effects may be used, where the distance between the top of the proscenium opening and the ceiling above is more than 5 feet, and the stage is equipped with tie and fly galleries.
STAIRS. See Chapter 33.
STAIRWAY. 2 or more risers.
STAIRWAY, EXIT. See Chapter 33.
STAIRWAY, PRIVATE. See Chapter 33.
STORY. That portion of a building included between the upper surface of any floor and the floor next above, except that the topmost story is that portion of a building included between the upper surface of the topmost floor and the ceiling above. If the finished floor level directly above a basement, cellar, or unused under-floor space is more than 6 feet above grade for more than 50 percent of the total perimeter of the building, or is more than 12 feet above grade at any point, the basement, cellar, or unused under-floor space shall be considered as a story. Any basement or cellar containing habitable space is considered a story.
STREET. A thoroughfare dedicated or deeded to the public for public use. A
street may also be a thoroughfare not dedicated or deeded to the public, but on private property and used by the public.

**TENANT.** A person or persons occupying a building, or portion thereof, and separated from other tenants by walls, floors, and ceilings.

**TIER.** One of 2 or more rows arranged one above the other.

**TREAD.** The horizontal portion of a step, including nosing.

**USE.** The purpose for which a building is occupied.

**USEABLE SPACE.** Space that may be used. This definition does not apply when a useable or potential useable space is sealed off so that access to the area is not provided.

**UNSAFE BUILDING, STRUCTURE, OR UTILITY.** See Chapter 1.

**UTILITIES.** For the purposes of this Building Code, utilities shall be defined, without limitation, to include the following:

- Refrigeration systems and their appurtenances;
- Electrical systems and all appurtenances, such as motors, etc.;
- Heating and ventilating systems and appurtenances;
- Elevators, dumb waiters, escalators, and similar conveyances;
- Fire protection systems and apparatus;
- Air conditioning or air treatment systems, including ductwork;
- Exhaust or ventilating systems, including ductwork;
- Plumbing and sanitary systems and all appurtenances;
- Signal and annunciator systems;
- Gas, oil, and solid fuel fired appliances, piping, controls, burners, and their appurtenances;
- Evaporative cooling, antennas, wells, and equipment;
- Water heaters; gas lights; swimming pool piping; gasoline pumps; L.P.G., liquid fuel, and gasoline tanks and piping.

**PUBLIC UTILITY.** An authorized or franchised firm which is given the right to perform services necessary to fulfill obligations specified in the authorization or franchise.

**VALUE OR VALUATION.** The determination of value-valuation is made by the Department based on the market value as established by the City Assessor. Value-valuation is also defined, for Permit purposes, as being the cost to the owner, i.e., labor, profit, overhead, materials, and equipment.

**VENNEER.** See Chapter 30.

**VENT.** See Chapter 37.

**VENTILATION.** See Chapter 52.

**VERTICAL OPENING.** An opening extending vertically through one or more floors of a building.

**VERTICAL TRANSPORTATION.** See Chapter 55.

**WALL.** A vertical structural member which encloses, divides, supports, or protects a building or room.

- **Bearing.** A wall which supports any load other than its own weight.
- **Cavity.** See Chapter 24.
- **Composite.** See Chapter 24.
- **Faced.** See Chapter 24.
- **Foundation.** A wall extending from the footing to the lowest floor and serving as the support for other parts of the building.
- **Hollow.** See Chapter 24.
- **Interior.** A wall entirely within the exterior walls of a building.
- **Non-Bearing.** A wall which supports no load other than its own weight.
- **Panel.** See Chapter 24.
- **Parapet.** That part of a wall entirely above a roof line surface.
- **Party.** A wall used or adapted for joint service between two buildings.
Retaining. A wall designed to resist the lateral displacement of earth or other forces.
Solid. See Chapter 24.
Spandrel. See Chapter 24.
Veneer. See Chapter 24 and 30.
WEATHER EXPOSED SURFACE. Any building surface exposed to the elements.
WINDOW, BAY. A rectangular, curved or polygonal window.
WRECKING. See Demolition.
YARD. An open unoccupied space, other than a court, situated on the same lot with a building.
CHAPTER 5
CLASSIFICATION OF ALL BUILDINGS BY USE OR OCCUPANCY: GENERAL REQUIREMENTS FOR ALL OCCUPANCIES

SECTION 501. OCCUPANCY CLASSIFIED.

(a) **General.** Every building shall be classified according to its use or the character of its occupancy as a building of Group A through J, as defined in Table 5-A and in Chapters 6 through 15, respectively.

(b) **Other Occupancy.** Any occupancy not mentioned specifically, or about which there is any question, shall be classified by the Department and included in that Group which it most nearly resembles, based upon the existing or proposed use and fire hazard.

SECTION 502. CHANGE IN OCCUPANCY.

(a) **General.** Changes shall not be made in the character of an occupancy or use of any building which would place the building in a different Division of the same Group of occupancy or in a different Group of occupancy unless the building shall be made to comply with the requirements of this Building Code for that Division or Group of occupancy.

**EXCEPTION:** Historic structures as designated by the Denver Landmark Preservation Commission shall be inspected and reviewed by the Department and shall be made to comply only with those requirements of this Building Code which are deemed necessary for public safety. See Chapter 31.

(b) **Change.** The character of the use or occupancy of existing buildings may be changed, subject to the approval of the Department; and the building may be occupied for purposes in other Groups of occupancy without conforming to all the requirements for those groups; provided the new or proposed use or occupancy is less hazardous, based upon use and fire hazard, than the existing use. There shall be no change made in the use of a building which changes the occupancy classification without the issuance of a new Certificate of Occupancy as required in Chapter 3 of this Building Code.

SECTION 503. MIXED OCCUPANCY.

(a) **General.** When a building is used for more than one occupancy purpose, each part of the building comprising a distinct 'Occupancy', as described in Chapters 5 through 15, shall be separated from any other occupancy as specified in Section 503(c). When a building houses more than one occupancy, each portion of the building shall conform to the requirements for the occupancy housed therein. The area of the building shall be such that the sum of the ratio of the actual area divided by the allowable area for each separate occupancy shall not exceed one. When minor accessory uses do not occupy more than 10 percent of the area of any floor of a building, nor more than the basic area permitted by Table No. 5-C for the minor use, the major use of the building shall determine the occupancy classification, provided the uses are separated as specified in Table 5-B.

(b) **Type of Separations.** Occupancy separations shall be vertical, horizontal, or both; or as may be required to afford a complete separation bet-
ween the various occupancies in the building. Occupancy separations
shall be classed as 4-Hour, 3-Hour, 2-Hour, and One-Hour Fire-Resistive.

(c) **Requirements for Separations.** Occupancy separation shall be pro-
vided between the various Groups and Divisions of occupancies as
specified in Table 5-B.

1. A Four-Hour Fire-Resistive occupancy separation shall be at least 4-
hour fire-resistive construction. Openings in walls forming the sep-
eration shall be protected by a fire assembly which provides a 3-hour
fire-resistive rating. The total width of all openings in any story
shall not exceed 10 percent of the length of the walls in that story,
and no single opening shall exceed 25 square feet. Horizontal open-
ings shall not be permitted.

2. A Three-Hour Fire-Resistive occupancy separation shall be at least
3-hour fire-resistive construction. Openings in walls forming the sep-
eration shall be protected by a fire assembly which provides a 3-
hour fire-resistive rating. The total width of all openings in any sto-
ry shall not exceed 25 percent of the length of the walls in that story,
and no single opening shall exceed 120 square feet. Openings in
floors shall be protected by vertical enclosures extending con-
tinuously above and below the openings to the adjacent floors or to
the point of termination of the penetrating enclosure. Vertical
enclosures shall be at least 2-hour fire resistive construction, and
openings therein shall be protected by a fire assembly which pro-
vides a 1-1/2-hour fire-resistive rating.

3. A Two-Hour Fire-Resistive occupancy separation shall be at least 2-
hour fire-resistive construction. Openings in walls forming the sep-
eration shall be protected by a fire assembly which provides a 1-1/2-
hour fire-resistive rating.

4. A One-Hour Fire-Resistive occupancy separation shall be of at least
one-hour fire-resistive construction. Openings in walls forming the
separation shall be protected by a fire assembly which provides a
one-hour fire-resistive rating.

**SECTION 504. LOCATION WITHIN THE CITY AND LOCATION ON
PROPERTY.**

(a) **General.** Buildings shall adjoin or have access to a public space, yard, or
street on at least one side. Required yards shall be permanently main-
tained. See Zoning Regulations and Chapter 16. For the purpose of this
Section, the center line of an adjoining street or alley shall be considered
an adjacent property line.

(b) **Access.** For access, see Chapters 6 through 15.

(c) **Exterior Walls.** Exterior walls shall be provided with fire-resistance
and opening protection as specified in this Chapter, Chapters 6 through
15, Chapter 17, and in accordance with the additional requirements
specified in Chapters 16 and 43. The set-back distance shall be
measured perpendicular to the property line. The provisions of this Sec-
tion shall not apply to walls perpendicular to the property line.

(d) **Method For Wall and Opening Protection.** For purposes of deter-
mining the required wall and opening protection, buildings on the same
property and court walls of buildings over one-story in height shall be
assumed to have a property line between them.

(e) **New Building on Property with Existing Building.** When a new
building is erected on the same property with an existing building and is considered a separate structure, the distance to the property line shall be the distance to the assumed property line from the existing building for each occupancy as specified in Table 5-A and Chapters 17 through 22. If the distance requirements are not met, 2 or more buildings on the same property may be considered as portions of one building if the aggregate area of both buildings is within the limits specified in Section 505 for a single building. If the distance requirements are not met, and the buildings house different occupancies or are of different types of construction, the allowable area shall be that permitted for the most restrictive occupancy or type of construction.

SECTION 505. ALLOWABLE FLOOR AREAS.

(a) One-Story Buildings. The area of a one-story building shall not exceed the limits specified in Table 5-C nor the limits specified in Chapter 16, except as provided for in Section 506. For buildings located in fire zone 3, the basic area may be increased by 33 1/3 percent.

(b) Areas of Buildings Over One Story. The total area of all floors of buildings over one story in height shall not exceed 200 percent of the area permitted for one story buildings. No single floor area shall exceed that permitted for one story buildings. Basements and cellars need not be included in the total allowable area.

(c) Separation Walls. Each portion of a building separated by one or more separation walls may be considered a separate building, provided the separation walls meet the following requirements:

1. Separation walls shall conform to the 4-hour occupancy separation in Types I, II, or III buildings, and 2-hour occupancy separation in Types IV and V buildings.

2. Separation walls shall extend from the foundation to the highest point of the building, shall terminate at the underside of the roof sheathing or decking, and shall extend to the exterior walls. Openings or penetrations shall not be permitted except as provided in Section 503.

3. When a separation wall separates portions of a building having different heights, openings at a point 30 inches or more above the lower roof level shall be permitted, provided the openings are protected by assemblies having a 3/4-hour fire protective rating.

SECTION 506. MAXIMUM HEIGHT OF BUILDINGS AND FLOOR AREA INCREASES.

(a) General. The maximum area, height, and number of stories of every building shall not exceed the limits set forth in Tables 5-C and 5-D, except as provided for in this Section, and as specified in Section 503 for mixed occupancy buildings.

(b) Allowable Area Increases. The allowable floor area requirements specified in Section 505 may be increased by one or more of the following:

1. Separation on 2 Sides. Where public space, streets, or yards more than 20 feet in width extend along and adjoin 2 sides of the building, floor areas may be increased at a rate of 1 1/4 percent for each foot.
by which the minimum width exceeds 20 feet, but the increase shall not exceed 50 percent.

2. Separation on 3 Sides. Where public space, streets, or yards more than 20 feet in width extend along and adjoin 3 sides of the building, the floor area may be increased at a rate of 2 1/2 percent for each foot by which the minimum width exceeds 20 feet, but the increase shall not exceed 100 percent.

3. Separation on All Sides. Where public space, streets, or yards more than 20 feet in width extend on all sides of a building and adjoin the entire perimeter, floor areas may be increased at a rate of 5 percent for each foot by which the minimum width exceeds 20 feet, but the increase shall not exceed 100 percent.

EXCEPTIONS:
A. Aircraft repair hangars may have the floor area increased 300 percent.
B. One-story aircraft storage hangars may have the floor area increased 500 percent.

(c) Unlimited Area. The area of a one story building of Group G occupancy, of Type II, Type III one-hour, or Type IV construction, shall not be limited if the building is entirely surrounded by public space, street, or yards at least 40 feet in width.

(d) Automatic Fire Sprinkler System Increases. The area of any one-story building of Group E, Division 5; Group F; and Group G occupancies shall not be limited when the building is provided with an approved automatic fire sprinkler system throughout, and is entirely surrounded by public space, streets, or yards at least 20 feet in width. The allowable area requirements specified in Section 505 may be tripled in one-story buildings and doubled in buildings of more than one story if the building is provided with an automatic fire sprinkler system throughout. The increase in area for fire sprinkler systems may be combined with the area increases permitted in Section 506(b).

(e) Towers, Spires, and Steeples. The height of towers, spires, and steeples erected as a part of a building and not used for habitation or storage shall be limited only by structural design if constructed completely of noncombustible material, or may extend not more than 20 feet above the height limit in Table No. 5-D if constructed of combustible materials.

SECTION 507. FIRE RESISTIVE SUBSTITUTIONS. When one-hour fire-resistive construction throughout is required by this Building Code, an automatic fire-sprinkler system may be substituted, if not required by other portions of this Building Code.

SECTION 508. ARCADES. Arcades connecting buildings and used exclusively as passageways need not be considered as adjacent buildings for the provisions of this Chapter, provided the walls of the arcade adjoining the building are of the same construction required for the exterior walls of the building, with no communicating openings between the buildings and arcade except self-closing Class C fire doors; and provided the arcades are of at least one-hour fire-resistive construction or constructed entirely of noncombustible materials or heavy timber construction with 2 inch nominal sheathing.

EXCEPTION: In Group C occupancies, automatic fire doors may be installed in lieu of the self-closing doors required herein.
SECTION 509. TOILET FACILITIES.

(a) **General.** Every building shall be provided with toilet room facilities for use by the public and employees as specified in Table No. 5-E and in this Section. Separate toilet room facilities shall be provided for males and females unless otherwise excepted in this Section. Toilet room facilities shall be completely enclosed or screened to insure privacy; shall be identified for each sex, and shall be available for use during normal hours of occupancy of the building.

(b) **Ratio.** In buildings occupied by both sexes, the ratio of male to female facilities shall be established on the basis of 50 percent male and 50 percent female occupants, except when the building, or portions thereof, are designed and intended for an unbalanced division of the sexes. In this case, the number of fixtures for each sex shall be installed on the basis of the actual or intended ratio of male and female occupants of the building or portion thereof.

(c) **Construction.**
   1. **Floors and Walls.** In occupancies other than family dwelling units, floors and walls of toilet facilities shall be constructed of hard, smooth, non-absorbent surfaces.
   2. **Compartments.** Compartments for water closets shall be at least 30 inches wide, and shall provide at least 24 inches clearance in front of the water closet. Compartments for handicapped persons, when required, shall be at least 36 inches wide; with a door or access at least 32 inches wide; shall provide at least 32 inches clearance, unobstructed by door swing, in front of the water closet; and shall be equipped with grab bars at least 24 inches long on each side of the compartment.
   3. **Bathing and Shower Facilities.** Enclosures for bathtubs and showers, when provided, shall be constructed of shatter-resistant materials. Hinged doors shall open outward. See Chapter 54 for glazing requirements.
   4. **Lavatories.** 18 inches of wash sink or 18 inches of a circular basin, when provided with water outlets at each space, shall be considered equivalent to one lavatory. Lavatories for handicapped persons, when required, shall provide a clear space 26 inches wide, and 12 inches deep, excluding the projection of the bowl and waste piping.
   5. **Toilet Room Accessories.** At least one type of hand-drying facility shall be provided in each toilet room facility where lavatories are provided. When mirrors and hand-drying facilities are provided, and toilet room facilities for the handicapped are required, at least one mirror and one hand-drying facility shall be installed not more than 40 inches above the floor to the bottom of the fixture.
   6. **Access.** Access to any portion of the building shall not be through a toilet room facility. Access to toilet rooms shall not be through food preparation areas, except for toilet room facilities provided exclusively for the use of employees in the food preparation area.

(d) **Special Requirements.**
   1. **Handicapped Persons.** In all occupancy Groups A through G and H-1, at least one water closet and one lavatory shall be provided for the use of handicapped persons, and shall be constructed as specified in this Chapter.
A. When separate toilet facilities are required by this Chapter, toilet facilities for handicapped persons shall be provided for each sex.
B. Toilet facilities for handicapped persons shall be located on the ground level in buildings not equipped with elevators.
C. The access door and access space created by screen or baffle walls in toilet rooms providing facilities for handicapped persons shall be at least 32 inches wide. In addition, in Group H and I occupancies, the door into the toilet room shall be provided with a minimum dimension of 32 inches in width and 6 foot 8 inches in height.

2. Coin-Operated Toilets. When toilet rooms for public use are provided with coin-operated or other external locking devices, these toilet facilities shall be provided in addition to the toilet room facilities required by this Chapter.

3. Temporary Toilet facilities. Enclosed temporary toilet facilities for working personnel shall be provided when existing permanent toilet facilities are not available or assigned for use in a convenient location near the work area. Fixtures may be conventional water closets and urinals installed in accordance with the requirements of Chapter 50, or may be water closets and urinals of the chemical storage type. Water closets shall be provided with seats and covers.

4. Group A and B Occupancies. No special requirements.

5. Group C Occupancy. When gymnasiums, swimming pools, or indoor recreational space is provided for students above the sixth grade level, showers shall be provided for 20 percent of the number of students of each sex anticipated or scheduled to use the facilities during any given time period.

   A. One bathtub or shower shall be provided for each ten inmates or patients, or fraction thereof, for each sex.
   B. Toilet facilities for the public and for staff personnel shall be provided separate from and in addition to those required for inmates or patients.
   C. In Group D-2 occupancies, one enclosed toilet room and one lavatory shall be provided for each room or ward serving not more than 2 patients each, an interconnecting enclosed toilet room with a lavatory in each patient room may be provided. In rooms serving a single patient, an enclosed toilet room and a lavatory shall be provided.

7. Group E Occupancy. In areas where skin contamination due to the use of poisonous, infectious, or irritating materials exists, one lavatory for each 5 persons and one shower for each 15 persons shall be provided.

   A. The number of occupants for a drive-in restaurant shall be considered to be the number of parking stalls provided.
   B. Employee toilet facilities in a restaurant shall be provided separate from and in addition to those required for the public or for customers. Hand-washing facilities for kitchen employees shall be provided in the kitchen.
C. Retail and wholesale establishments with an occupant load of 20 or fewer persons may provide one water closet and one lavatory in an enclosed room which may accommodate both sexes.

9. **Group G Occupancy.** Toilet room facilities shall not be required for automobile parking garages.

10. **Group H Occupancy.** In Division 1 occupancies, at least one water closet, one lavatory, and one bathtub or shower shall be provided for each room or suite of rooms used for overnight accommodation of the public. Toilet facilities for use by the public and staff personnel shall be provided separate from and in addition to those required herein.

11. **Group I Occupancy.** In addition to toilet room facilities specified, each dwelling unit shall be provided with a kitchen sink with garbage disposer.

12. **Group J Occupancy.** In Division 2 occupancies, separate toilet room facilities, including showers, shall be provided and located adjacent to swimming pools used by the public.

**SECTION 510. TABLES.**
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<tr>
<th>GROUP</th>
<th>DIVISION</th>
<th>DESCRIPTION OF OCCUPANCY</th>
<th>CHAPTER REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>An assembly building with a stage and an occupant load of 1,000 or more.</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>An assembly building with a stage and an occupant load of less than 1,000.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>An assembly building without a stage and an occupant load of 300 or more.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>An assembly building without a stage and an occupant load of less than 300, and which is not classified as a Group F occupancy.</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Stadiums, grandstands, bleachers, reviewing stands, and amusement park structures not included within Group A or Group B, Divisions 1, 2, or 3 occupancies.</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>A building used for educational purposes by twenty or more persons at the twelfth grade level or below, such as nurseries, kindergartens, preschools, dance schools, day care centers, schools for manual arts, elementary schools, junior high schools, high schools, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>A building used for educational purposes by fewer than twenty persons at the twelfth grade level or below, such as nurseries, kindergartens, preschools, dance schools, day care centers, schools for manual arts, elementary schools, junior high schools, high schools, etc.</td>
<td>8</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>Buildings used for mental hospitals, mental sanitariums, jails, prisons, houses of correction, or buildings where personal liberties of the inmates are restrained.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Buildings used for hospitals, sanitariums, homes for the retarded, homes for the handicapped, nursing homes, orphanages, rehabilitation centers, and similar uses, and which accommodate five or more patients or residents.</td>
<td>9</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>A building storing or handling hazardous and highly flammable or explosive materials such as National Fire Code Class 1 liquids, explosives, or compressed gases.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>A building storing or handling combustible or flammable materials such as National Fire Code Class 2 liquids, materials such as diesel fuel, gasoline, fuel oil, printers ink, animal fat, and flammable dry cleaning fluids. Automobile service stations and Division 4 occupancies are excluded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>A building storing or handling materials for processing or manufacturing, where combustible residue is produced or generated.</td>
<td>10</td>
</tr>
<tr>
<td>GROUP</td>
<td>DIVISION</td>
<td>DESCRIPTION OF OCCUPANCY</td>
<td>CHAPTER REFERENCE</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Repair facilities where gasoline, diesel fuel, gas and similar fueled equipment is housed.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Aircraft repair, hangers and aircraft storage hangers.</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>Drinking and dining establishments, recreational buildings, and other assembly buildings without fixed theater type seating, and with an occupant load of less than 150 persons.</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Stores for wholesale or retail sales, office buildings, medical or dental office buildings and clinics, veterinary clinics and hospitals, police and fire stations, universities, colleges, and adult education facilities in which each classroom has an occupant load of less than fifty persons.</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>1</td>
<td>Manufacturing plants, factories, or workshops utilizing noncombustible, non-explosive or not highly combustible materials.</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>A building storing non-explosive materials, noncombustible or not highly combustible materials.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Automobile parking garages.</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>1</td>
<td>Hotels and motels.</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Apartments, garden apartments, dormitories, convents, monasteries, rooming and boarding houses, foster homes, senior citizen homes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Townhouses, cluster homes, row dwellings and connected dwellings housing more than two families.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td>One and two family dwelling units.</td>
<td>14</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>Private garages, carports, covered patios, storage sheds, agricultural buildings, laundry buildings, and minor recreational buildings not exceeding 1000 square feet in area and an occupant load of ten.</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Separate structures such as swimming pools, retaining walls, and fences.</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: See Chapters 6 through 15 for specific requirements.
### TABLE NO. 5-B

**REQUIRED SEPARATIONS IN BUILDINGS OF MIXED OCCUPANCY (IN HOURS)**

| GROUP | A | B | B | B | B | C | D | E | E | E | E | E | E | F | F | G | G | G | G | H | H | H | H | I | J | J |
|       | 1 | 2 | 3 | 4 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 1 | 2 |
| A     | N | N | N | N | N | N | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| B-1   | N | N | N | N | N | N | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| B-2   | N | N | N | N | N | N | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| B-3   | N | N | N | N | N | N | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| B-4   | N | N | N | N | N | N | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| C-1   | N | N | 1 | 1 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| C-2   | N | 1 | 1 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| D-1   | N | N | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| D-2   | N | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | N |
| E-1   | N | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 3 | 1 | N |
| E-2   | N | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | N |
| E-3   | N | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | N |
| E-4   | N | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | N |
| E-5   | N | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | N |
| F-1   | N | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | N |
| F-2   | N | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | N |
| G-1   | N | N | 1 | 1 | 1 | 1 | 1 | N |
| G-2   | N | 1 | 1 | 1 | 1 | 1 | 1 | N |
| G-3   | N | 2 | 2 | 2 | 2 | 1 | N |
| H-1   | N | 1 | 1 | 1 | N |
| H-2   | N | 1 | 1 | 1 | N |
| H-3   | N | 1 | 1 | N |
| I     | N | 1 | 1 | N |
| J-1   | N | 1 | 1 | N |
| J-2   | N | N | N |

**Minimum Separation**

In a building or portion of a single occupancy classification, when enclosed spaces are provided for separate tenants, the spaces shall be separated by 1 hour construction, metal ducts exempted, or incombustible construction complete with draft stops.

Refer to Occupancy Chapters 6 through 15 for specific requirements.

N = No separation required.

* Provided that materials as approved for one-hour fire-resistive construction on the garage side and tight-fitting solid wood door at least one and three-eighths (1 3/8) inches in thickness, shall be permitted.
**TABLE NO. 5-E**

**MINIMUM PLUMBING FACILITIES**

<table>
<thead>
<tr>
<th>Type of Building or Occupancy</th>
<th>Water Closets</th>
<th>Urinals</th>
<th>Lavatories</th>
<th>Bathtubs or Showers</th>
<th>Drinking Fountains</th>
<th>Service Sinks or Floor Sinks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Fixtures/Persons</td>
<td>Fixtures/Persons</td>
<td>Fixtures/Persons</td>
<td>Fixtures/Persons</td>
</tr>
<tr>
<td>A &amp; B s, c</td>
<td>2 — 1-200</td>
<td>2 — 1-100</td>
<td>2 — 1-200</td>
<td>1 — 1-200</td>
<td>1 per 100&lt;sup&gt;a&lt;/sup&gt;</td>
<td>One additional fixture for each 200 persons.</td>
</tr>
<tr>
<td></td>
<td>3 — 201-400</td>
<td>3 — 101-200</td>
<td>3 — 201-400</td>
<td>2 — 201-400</td>
<td>1 per 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 — 401-600</td>
<td>4 — 201-400</td>
<td>4 — 401-600</td>
<td>3 — 401-750</td>
<td>1 per 8</td>
<td>For female, add one bathtub per 30</td>
</tr>
<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males &amp; 1 for each 300 females.</td>
<td>Over 600, add 1 fixture for each additional 300 males.</td>
<td>Over 750, add 1 fixture for each additional 500 persons.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1—30</td>
<td>1 — 25</td>
<td>1 — 25</td>
<td>1 — 40</td>
<td>1 — 50</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>1 per 10</td>
<td>1 per 8</td>
<td>1 per 25</td>
<td>1 per 12</td>
<td>1 per 10&lt;sup&gt;e&lt;/sup&gt;</td>
<td>One additional fixture for each 200</td>
</tr>
<tr>
<td></td>
<td>Additional occupant:</td>
<td>1 per 25</td>
<td>Over 150, 1 per 50</td>
<td>Over 12, 1 per 15 females</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 per 25</td>
<td>1 per 20</td>
<td>1 per 20 males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Fixtures</td>
<td>Persons</td>
<td>Up to 100, 1 per 100</td>
<td>Over 100, 1 per 15</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1 — 9</td>
<td>d</td>
<td>Up to 100, 1 per 100</td>
<td>Over 100, 1 per 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 — 10 — 24</td>
<td></td>
<td>Up to 100, 1 per 100</td>
<td>Over 100, 1 per 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 — 25 — 49</td>
<td></td>
<td>Over 100, 1 per 15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 — 50 — 74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 — 75-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 add’l for each 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*THE FIGURES SHOWN ARE BASED UPON ONE FIXTURE BEING THE MINIMUM REQUIRED FOR THE NUMBER OF PERSONS INDICATED OR ANY FRACTION THEREOF.*  
NOTE: See Chapter 33 for occupant loads.

* For restaurants, use requirements for F-1 occupancy.
* For dormitories, use requirements for D occupancy.
* Where alcoholic or malt beverages are served, the requirements for toilets and lavatories shall be doubled.
* Whenever urinals are provided, one water closet less than the number specified may be provided for each urinal installed, except the number of water closets in such cases shall not be reduced to less than two-thirds of the minimum specified.
* Where food is consumed, water stations may be substituted for drinking fountains.
### TABLE NO. 5-E

**MINIMUM PLUMBING FACILITIES**

<table>
<thead>
<tr>
<th>Type of Building or Occupancy</th>
<th>Water Closets</th>
<th>Urinals</th>
<th>Lavatories</th>
<th>Bathtubs or Showers</th>
<th>Drinking Fountains</th>
<th>Service Sinks or Floor Sinks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Fixtures/Persons</td>
<td>Fixtures/Persons</td>
<td>Fixtures/Persons</td>
<td>Fixtures/Persons</td>
</tr>
<tr>
<td>F-1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Fixtures</td>
<td>Persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1-50</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>51-100</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>101-200</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>201-500</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-2</td>
<td>Fixtures</td>
<td>Persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1-15</td>
<td>1-15</td>
<td>1—1-15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>16-35</td>
<td></td>
<td>2—16-35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>36-55</td>
<td></td>
<td>3—36-60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>56-80</td>
<td></td>
<td>4—61-90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>81-110</td>
<td></td>
<td>5—91-125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>111-150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 add'l for each 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Requirements for Type E Occupancy</th>
<th>1 for each dwelling or apartment unit.</th>
<th>1 for each dwelling or apartment unit.</th>
<th>1 for each dwelling or apartment unit.</th>
</tr>
</thead>
</table>

THE FIGURES SHOWN ARE BASED UPON ONE FIXTURE BEING THE MINIMUM REQUIRED FOR THE NUMBER OF PERSONS INDICATED OR ANY FRACTION THEREOF.

- <sup>a</sup> For restaurants, use requirements for F-1 occupancy.
- <sup>b</sup> For dormitories, use requirements for D occupancy.
- <sup>c</sup> Where alcoholic or malt beverages are served, the requirements for toilets and lavatories shall be doubled.
- <sup>d</sup> Whenever urinals are provided, one water closet less than the number specified may be provided for each urinal installed, except the number of water closets in such cases shall not be reduced to less than two-thirds of the minimum specified.
- <sup>e</sup> Where food is consumed, water stations may be substituted for drinking fountains.

NOTE: See Chapter 33 for occupant loads.
TABLE NO. §C
BASIC ALLOWABLE FLOOR AREA (IN SQ. FT.) FOR BUILDINGS ONE STORY IN HEIGHT IN FIRE ZONES No. 1 AND No. 2. FOR BUILDINGS LOCATED IN FIRE ZONE No. 3, THE BASIC AREA MAY BE INCREASED 33 1/3 PERCENT.

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>TYPES OF CONSTRUCTION</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-Hour or H.T.</td>
<td>N</td>
<td>1-Hour</td>
<td>N</td>
</tr>
<tr>
<td>A Unlimited</td>
<td>22,500</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>B-1 Unlimited</td>
<td>22,500</td>
<td>10,200</td>
<td>NP</td>
<td>10,200</td>
<td>NP</td>
<td>7,800</td>
</tr>
<tr>
<td>B-2 Unlimited</td>
<td>22,500</td>
<td>10,200</td>
<td>NP</td>
<td>10,200</td>
<td>NP</td>
<td>7,800</td>
</tr>
<tr>
<td>B-3 Unlimited</td>
<td>22,500</td>
<td>10,200</td>
<td>6,900</td>
<td>10,200</td>
<td>6,900</td>
<td>7,800</td>
</tr>
<tr>
<td>B-4 Unlimited</td>
<td>22,500</td>
<td>10,200</td>
<td>6,900</td>
<td>10,200</td>
<td>6,900</td>
<td>7,800</td>
</tr>
<tr>
<td>C-1 Unlimited</td>
<td>33,000</td>
<td>15,300</td>
<td>10,200</td>
<td>15,300</td>
<td>10,200</td>
<td>11,700</td>
</tr>
<tr>
<td>C-2 Unlimited</td>
<td>15,000</td>
<td>15,300</td>
<td>3,000</td>
<td>6,000</td>
<td>3,000</td>
<td>4,800</td>
</tr>
<tr>
<td>D-1 Unlimited</td>
<td>12,000</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>D-2 Unlimited</td>
<td>12,000</td>
<td>5,100</td>
<td>SR</td>
<td>5,100</td>
<td>SR</td>
<td>3,900</td>
</tr>
<tr>
<td>E-1</td>
<td>20,000</td>
<td>9,000</td>
<td>4,200</td>
<td>2,700</td>
<td>4,200</td>
<td>2,700</td>
</tr>
<tr>
<td>E-2</td>
<td>35,000</td>
<td>9,000</td>
<td>4,200</td>
<td>2,700</td>
<td>4,200</td>
<td>2,700</td>
</tr>
<tr>
<td>E-3 Unlimited</td>
<td>18,000</td>
<td>8,400</td>
<td>5,700</td>
<td>8,400</td>
<td>5,700</td>
<td>6,600</td>
</tr>
<tr>
<td>E-4 Unlimited</td>
<td>18,000</td>
<td>8,400</td>
<td>5,700</td>
<td>8,400</td>
<td>5,700</td>
<td>6,600</td>
</tr>
<tr>
<td>E-5 Unlimited</td>
<td>33,000</td>
<td>25,000</td>
<td>15,000</td>
<td>25,000</td>
<td>15,000</td>
<td>6,600</td>
</tr>
<tr>
<td>F-1 Unlimited</td>
<td>18,000</td>
<td>13,500</td>
<td>9,000</td>
<td>13,500</td>
<td>9,000</td>
<td>10,500</td>
</tr>
<tr>
<td>F-2 Unlimited</td>
<td>30,000</td>
<td>13,500</td>
<td>9,000</td>
<td>13,500</td>
<td>9,000</td>
<td>10,500</td>
</tr>
<tr>
<td>G-1 Unlimited</td>
<td>45,000</td>
<td>13,500</td>
<td>9,000</td>
<td>13,500</td>
<td>9,000</td>
<td>10,500</td>
</tr>
<tr>
<td>G-2 Unlimited</td>
<td>45,000</td>
<td>20,400</td>
<td>13,500</td>
<td>20,400</td>
<td>13,500</td>
<td>15,900</td>
</tr>
<tr>
<td>G-3 Unlimited</td>
<td>45,000</td>
<td>NP</td>
<td>NP</td>
<td>13,500</td>
<td>9,000</td>
<td>NP</td>
</tr>
<tr>
<td>H-1 Unlimited</td>
<td>24,000</td>
<td>10,200</td>
<td>6,900</td>
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<td>See Chapter 15</td>
<td>See Chapter 15</td>
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</table>

SR = Special requirements - Refer to Occupancy Chapter for special provisions.
NP = Not Permitted
N = Non Fire-resistive construction

NOTE: See Section 505 and 506 for additional information on allowable floor area and floor area increases.
### TABLE NO. 5-D

**MAXIMUM HEIGHT OF BUILDINGS**

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>TYPES OF CONSTRUCTION</th>
<th>I</th>
<th>II</th>
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#### MAXIMUM HEIGHT IN FEET

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</tr>
</tbody>
</table>

NP = Not Permitted
NA = Not Applicable
N = Non Fire-resistive Construction

**NOTES:** Refer to Chapters 6 through 22 for other requirements.

For other restrictions regarding the height of buildings, see Articles 640, 645, and 646 of the Revised Municipal Code.
CHAPTER 6
REQUIREMENTS FOR GROUP A OCCUPANCIES

SECTION 601. GROUP A OCCUPANCIES DEFINED. Group A occupancy shall be an assembly building with a stage and an occupant load of 1000 or more.

SECTION 602. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.
(a) General. Buildings or portions of buildings classified in Group A because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.
(b) Special Provisions.
1. Stages and enclosed platforms shall be constructed in accordance with the requirements of Chapter 39.
2. The slope of the main floor of the assembly room shall not exceed one foot in eight.
3. See Chapters 17, 25, and 32 for attic space partitions and draft stops.
(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 603. LOCATION.
(a) In City. Buildings shall not be limited in location within fire zones.
(b) On Property. Buildings shall front directly upon or have access to a public street at least 20 feet in width. The access to a public street shall be a 20 foot minimum width right-of-way maintained solely as access to the public street. The main entrance to the building shall be located on the public street or the access. See Chapter 17 and Zoning Regulations for property setbacks.
(c) Exterior Walls and Opening Protection. See Chapters 17 and 18 for fire resistive protection of exterior walls and openings, as determined by location on the property. See Chapter 5 for regulating adjacent buildings on the same property.

SECTION 604. EXIT FACILITIES. See Chapter 33.

SECTION 605. LIGHT, VENTILATION, TOILET ROOM FACILITIES.
(a) Light. All portions of the building used by human occupants shall be provided with either natural or artificial light. Lighting in all portions of the building used by human occupants shall be on a circuit separate from the stage lighting, and shall be controlled from the box office.
(b) Ventilation. See Chapter 52.
(c) Toilet Room Facilities. See Chapter 5.

SECTION 606. ENCLOSURE OF VERTICAL OPENINGS.
(a) Exits. See Chapter 33.
(b) Shafts. See Chapter 17.

SECTION 607. FIRE PROTECTION SYSTEMS. See Chapter 38.
SECTION 608. SPECIAL REQUIREMENTS.

(a) Chimneys and Heating Apparatus. See Chapters 37, 51, and 52.
(b) Motion Picture Machine Booths. See Chapter 40.
(c) Heating or Equipment Rooms. See Chapters 17 and 33.
CHAPTER 7

REQUIREMENTS FOR GROUP B OCCUPANCIES

SECTION 701. GROUP B OCCUPANCIES DEFINED. Group B occupancy shall be:

Division 1: An assembly building with a stage and an occupant load of less than 1000.

Division 2: An assembly building without a stage and an occupant load of 300 or more.

Division 3: An assembly building without a stage and an occupant load of less than 300, and which is not classified as a Group F occupancy.

Division 4: Stadiums, grandstands, bleachers, reviewing stands, and amusement park structures not included within Group A or Group B Divisions 1, 2, and 3 occupancies. See Chapter 33 for specific requirements for grandstands, bleachers, and reviewing stands.

SECTION 702. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in Group B because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

EXCEPTION: Division 4 structures of open frame type shall not be limited in height or area.

(b) Special Provisions.


2. The slope of the main floor of the assembly room shall not exceed one in eight.

EXCEPTION: Gymnasiums which have not more than two balconies, each with an occupant load of less than 300, and which are not located over usable spaces, need not have one-hour fire-resistive protection.

3. Division 3 occupancies located in a basement or above the first story shall not be located in the basement.

4. Group B assembly rooms having an occupant load of 1000 or more shall not be located in the basement.

5. Division 3 occupancies with an occupant load of 50 or more which are located over usable space shall be separated from the usable space by at least one-hour fire-resistive construction.

6. See Chapters 17, 25, and 32 for attic space partitions and draft stops.

7. Structures housing Division 4 occupancies, other than those of open frame type, when more than one story in height or 400 square feet in area, shall be at least one-hour fire-resistive construction.

8. When the space under a Division 4 occupancy is used for any purpose, it shall be separated from all parts of the Division 4 occupancy, including exits, by walls, floors, and ceilings of noncombustible materials.

EXCEPTIONS:

A. Exits under temporary grandstands need not be separated.
B. The underside of continuous steel deck grandstands, when erected outdoors, need not be fireproofed when the enclosed spaces are used for public toilets.

(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 703. LOCATION.

(a) In City. See Chapter 16 for restrictions based upon location in Fire Zones.

(b) On Property. Buildings shall front directly upon or have access to a public street at least 20 feet in width. The access to a public street shall be a 20 foot minimum width right-of-way maintained solely as access to the public street. The main entrance to the building shall be located on the public street or the access. See Chapter 17 and Zoning Regulations for property setbacks.

(c) Exterior Wall and Opening Protection. See Chapters 5 and 17 through 22 for fire-resistive protection of exterior walls and openings, as determined by location of property. See Chapter 5 for regulating adjacent building on the same property.

SECTION 704. EXIT FACILITIES. See Chapter 33.

SECTION 705. LIGHT, VENTILATION, TOILET ROOM FACILITIES.

(a) Light. All portions of the building used by human occupants shall be provided with either natural or artificial light.

(b) Ventilation. See Chapter 52.

(c) Toilet Room Facilities. See Chapter 5.

SECTION 706. ENCLOSURE OF VERTICAL OPENINGS.

(a) Exits. See Chapter 33.

(b) Shafts. See Chapter 17.

SECTION 707. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 708. SPECIAL REQUIREMENTS.

(a) Chimneys and Heating Apparatus. See Chapters 37, 51, and 52.

(b) Motion Picture Machine Booths. See Chapter 40.

(c) Heating or Equipment Rooms. See Chapters 17 and 33.

SECTION 709. EXCEPTIONS AND DEVIATIONS. Gymnasiums and similar occupancies may have running tracks constructed of wood or unprotected steel, or of other surfaces approved by the Department. In gymnasiums and in multi-purpose schoolrooms having an area not greater than 3200 square feet, one-inch nominal tight tongue-and-groove wood or 3/4 inch plywood wall covering may be used as a finish on the inner side of the required fire-resistive walls.
CHAPTER 8
REQUIREMENTS FOR GROUP C OCCUPANCIES

SECTION 801. GROUP C OCCUPANCIES DEFINED.

Division 1. A building used for educational purposes by twenty or more persons at the twelfth grade level or below, such as nurseries, kindergartens, preschools, dance schools, day care centers, schools for manual arts, elementary schools, junior high schools, and high schools.

Division 2. A building used for educational purposes by fewer than twenty persons at the twelfth grade level or below, such as nurseries, kindergartens, preschools, dance schools, day care centers, schools for manual arts, elementary schools, junior high schools, and high schools.

SECTION 802. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in a Group C occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

(b) Special Provisions.

1. Rooms having an occupancy load of more than 100 and rooms used for preschool, kindergarten, and first or second-grade shall be located at ground level, except in buildings of Type I construction.

2. Except in one-story buildings in which rooms used for instruction have at least one exit door directly to the outside, buildings shall be at least one-hour fire-resistant construction throughout.

A fire-resistive ceiling shall not be required in a one-story building having an open frame roof.

3. Balconies and bleachers over useable space, and janitor closets, shall be protected with at least one-hour fire-resistant construction.

4. See Chapter 42 for the flame-proofing of curtains, drapes, and drops.

5. See Chapter 39 for stages and platforms.

6. See Chapters 17, 25, and 32 for attic space partitions and draft stops.

(c) Existing Buildings Converted to a C-2 Occupancy. Existing buildings may be remodeled for a C-2 occupancy provided the following conditions are met:

1. Students shall not be permitted on other than the ground floor.

2. The ground floor shall provide a minimum of two exits. There shall be no dead-end corridors.

3. All openings to corridors and stairways shall be protected by a fire assembly which provides at least a 3/4 hour fire-resistant rating.

4. Gas fired appliances. See Chapters 17, 37, 51, 52, and 58.

5. Existing partitions, walls, and ceilings may be approved if the existing surface is of a fire-resistant material consisting of lath and plaster or gypsum board of at least 1/2 inch thickness.

6. The basement or second floor shall be separated from the ground floor by a minimum of one-hour fire-separation.

(d) Occupancy loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.
SECTION 803. LOCATION.

(a) **In City.** See Chapter 16 for restrictions based on location in Fire Zones.
(b) **On Property.** Buildings shall front directly upon or have access to a public street at least 20 feet in width. The access to a public street shall be 20 foot minimum width right-of-way maintained solely as access to the public street. At least one required exit shall be located on the public street or access way. See Chapter 17 and Zoning Regulations.
(c) **Exterior Wall and Opening Protection.** See chapters 5 and 17 through 22 for fire-resistive protection of exterior walls and openings, as determined by location on property. See Chapter 5 for regulating adjacent buildings on the same property.

**EXCEPTION:** Exterior walls or portions of walls of Group C occupancies having an occupant load of less than 100 persons, when within 10 feet of adjacent property lines, may be of one-hour fire-resistive construction.

SECTION 804. EXIT FACILITIES. See chapter 33.

SECTION 805. LIGHT, VENTILATION, TOILET ROOM FACILITIES.

(a) **Light.** All portions of the building used by human occupants shall be provided with either natural or artificial light.
(b) **Ventilation.** see Chapter 52.
(c) **Toilet Room Facilities.** See chapter 5.

SECTION 806. ENCLOSURE OF VERTICAL OPENINGS.

(a) **Exits.** See Chapter 33.
(b) **Shafts.** See Chapter 17.

SECTION 807. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 808. SPECIAL REQUIREMENTS.

(a) **Chimneys and Heating Apparatus.** See Chapters 37, 51, and 52.
(b) **Motion Picture Machine Booths.** See Chapter 40.
(c) **Heating or Equipment Rooms.** See chapters 17 and 33.

SECTION 809. EXCEPTIONS AND DEVIATIONS. Gymnasiums and similar occupancies may have running tracks constructed of wood or unprotected steel, or of other surfaces approved by the Department. In gymnasiums and in multipurpose schoolrooms having an area not greater than 3200 square feet, one-inch nominal tight tongue-and-grooved wood or 3/4 inch plywood wall covering may be used as a finish on the inner side of the required fire-resistive walls.
CHAPTER 9 REQUIREMENTS FOR GROUP D OCCUPANCIES

SECTION 901. GROUP D OCCUPANCIES DEFINED.

Division 1: Buildings used for mental hospitals, mental sanitariums, jails, prisons, houses of correction, or buildings where personal liberties of inmates are restrained.

Division 2: Buildings used for hospitals, sanitariums, homes for the retarded, homes for the handicapped, nursing homes, orphanages, rehabilitation centers, and similar uses, and which accommodate five or more patients or residents.

SECTION 902. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in Group D occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

(b) Special Provisions.

1. Division 1 occupancies shall be of Type I or II construction throughout. Occupancies in which the personal liberties of inmates or patients are restrained within the building shall have floors of noncombustible construction.

2. Division 2 occupancies more than one story in height shall be of Type I or II construction; further, all buildings shall be of one-hour fire-resistant construction throughout. Nonbearing partitions between rooms and minor interior partitions shall be constructed of noncombustible materials or covered with a minimum of 1/2 inch plaster or gypsum board.

3. Existing buildings may be remodeled for D-2 occupancy for an occupant load of ten or less patients provided the ceilings and walls are finished with noncombustible materials throughout. All openings to corridors and stairways shall be protected by a fire assembly having a 3/4 hour fire-resistant rating. A minimum of two exits shall be provided on the ground floor. Use by patients of other than the ground floor is prohibited.

4. See Chapters 17, 25, and 32 for attic space partitions and draft stops.

(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 903. LOCATION.

(a) In City. See Chapter 16 for restrictions based on location in Fire Zones.

(b) On Property. Buildings shall adjoin a yard, public space, or street on at least one side. See Chapter 17 and Zoning Regulations for property setbacks.

(c) Exterior Wall and Opening Protection. See Chapters 5 and 17 through 22 for fire-resistant protection of exterior walls and openings, as determined by location on property. See Chapter 5 for regulating adjacent buildings on the same property.

SECTION 904. EXIT FACILITIES. See Chapter 33.
SECTION 905. LIGHT, VENTILATION, TOILET ROOM
  FACILITIES.
  (a) Light. All portions of the building used by human occupants shall be
  provided with either natural or artificial light.
  (b) Ventilation. See Chapter 52.
  (c) Toilet Room Facilities. See Chapter 5.

SECTION 906. ENCLOSURE OF VERTICAL OPENING.
  (a) Exits. See Chapter 33.
  (b) Shafts. See Chapter 17.

SECTION 907. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 908. SPECIAL REQUIREMENTS.
  (a) Chimneys and Heating Apparatus. See Chapters 37, 51, and 52.
  (b) Motion Picture Machine Booths. See Chapter 40.
  (c) Heating or Equipment Rooms. See Chapters 17 and 58.
  (d) Auxiliary Power Plants. Auxiliary power plants used for lighting and
  power purposes may be located in boiler or heating equipment rooms if
  the fuel used is natural gas or diesel fuel. If the fuel used is gasoline, the
  equipment shall be located on the exterior of the building, enclosed with
  walls of at least 8 inch thickness of masonry.

SECTION 909. REQUIREMENTS FOR ANESTHESIA ROOMS AND
  ANESTHETIZING LOCATIONS.
  (a) Conductive Flooring. Conductive flooring shall be provided in
      anesthetizing locations to provide accumulation of electrostatic charges.
      A resistance not exceeding five to ten megohms between the objects or
      persons shall be considered sufficient to prevent dangerous voltages.
      The floor limit of one million ohms resistance shall be sufficient to meet
      this requirement.
  (b) Heating and Cooling. Heating and cooling systems and equipment
      shall conform to the requirements of Chapters 37, 49, 51, 52, and 58.

SECTION 910. STANDARDS. Unless provided for in other portions of
  this Building Code, the following Standards shall apply:

  ORGANIZATION   TITLE OF PUBLICATION
  NFPAPamphlet No. 56, June 1965, for the Use of
  Flameable Anesthetics.

  LEGEND
  ORGANIZATION
  NFPANational Fire Protection Association
  60 Batterymarch Street
  Boston, Mass. 02110
CHAPTER 10
REQUIREMENTS FOR GROUP E OCCUPANCIES

SECTION 1001. GROUP E OCCUPANCIES DEFINED.

Division 1: A building storing or handling hazardous and highly flammable or explosive materials such as National Fire Code Class 1 liquids, explosives, or compressed gases.

Division 2: A building storing or handling combustible or flammable materials such as National Fire Code Class 2 liquids, materials such as diesel fuel, gasoline, fuel oil, printers ink, animal fat, and flammable dry cleaning fluids. Automobile service stations and Division 4 occupancies are excluded.

Division 3: A building storing or handling materials for processing or manufacturing, where combustible residue is produced or generated.

Division 4: Repair facilities where gasoline, diesel fuel, gas and similar fueled equipment is housed.

Division: Aircraft repair hangars and aircraft storage hangars.

SECTION 1002. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in Group E occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

(b) Special Provisions.

1. Division 5 occupancies shall have exterior walls of at least one-hour fire-resistive construction, or shall be surrounded by public space, streets, or yards at least 60 feet in width.

2. See Chapter 5 for area increases for aircraft repair hangars.

3. In public garages and repair facilities when flammable or explosive liquids are stored or used, floors shall be of noncombustible, nonabsorbent materials.

4. See Chapters 17, 25, and 32 for attic space partitions and draft stops.

(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 1003. LOCATION.

(a) In City. See Chapter 16 for restrictions based upon location in Fire Zones.

(b) On Property. The building shall adjoin a yard, public space, or street on at least one side. See Chapter 17 and Zoning Regulations for property setbacks.

(c) Exterior Wall and Opening Protection. See Chapters 5 and 17 through 22 for fire-resistive protection of exterior walls and openings, as determined by location on property. See Chapter 5 for regulating adjacent buildings on the same property.

SECTION 1004. EXIT FACILITIES. See Chapter 33.
SECTION 1005. LIGHT, VENTILATION, TOILET ROOM FACILITIES.

(a) Light. All portions of the building used by human occupant shall be provided with either natural or artificial light.

(b) Ventilation. See Chapter 52.

(c) Toilet Room Facilities. See Chapter 5.

SECTION 1006. ENCLOSURE of VERTICAL OPENINGS.

(a) Exits. See Chapter 33.

(b) Shafts. See Chapter 17.

(c) Automobile Ramp Doors. Doors which are part of an automobile ramp enclosure may be kept open normally, but shall be provided with an automatic fire-assembly arranged to be self-closing when released.

SECTION 1007. FIRE PROTECTION SYSTEM. See Chapter 38.

SECTION 1008. SPECIAL REQUIREMENTS.

(a) Chimneys and Heating Apparatus. See Chapters 37, 51, 52 and 58.

(b) Heating or Equipment Rooms. See Chapters 17 and 58.

(c) Explosion Venting. Buildings, because of the explosion characteristics of the materials being processed or stored, shall be designed in accordance with the Standards.

(d) Fire Protection System. See Chapter 38.

SECTION 1009. SERVICE STATIONS WITHIN BUILDINGS. Service stations within buildings are not permitted.

SECTION 1010. ADDITIONAL REGULATIONS FOR DRY CLEANING PLANTS. Dry cleaning plants shall be of Type I construction and shall not exceed one story in height. See Fire Code.

SECTION 1011. ADDITIONAL REQUIREMENTS FOR SPRAY PAINTING, DIPPING ROOMS, AND BOOTH.

(a) Location. See Chapter 16.

(b) General. In establishments where flammable liquids or solvents are used or applied by means of spraying or dipping, a separate room or booth shall be provided. Spraying or dipping shall be permitted only in this room or booth. These rooms or booths shall not be permitted below grade. For storage, see Fire Code.

(c) Enclosure. Spray painting and dipping rooms shall be of at least one-hour fire-resistive construction. Spray booths not exceeding 100 sq. ft. in area and 8 feet in height shall be constructed of metal or one-hour fire-resistive construction.

(d) Electrical equipment. See Chapter 53.

(e) Heating Equipment. Heating equipment located in a paint spray room or booth shall not constitute a source of ignition.

(f) Exits. In addition to the requirements of Chapter 33, each room in which spray booths or spraying equipment is installed shall be provided with two means of exit.

(g) Ventilation. See Chapter 52.

(h) Fire Protection Systems. See Chapter 38.
SECTION 1012. STANDARDS. Unless provided for in other portions of this building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA</td>
<td>Pamphlet No. 30, 1966 - Storage and Handling of Flammable Liquids.</td>
</tr>
<tr>
<td></td>
<td>Pamphlet No. 32, 1964 - Dry Cleaning Plants.</td>
</tr>
<tr>
<td></td>
<td>Pamphlet No. 33, 1966 - Spray Finishing.</td>
</tr>
<tr>
<td></td>
<td>Pamphlet No. 61C, 1962 - Flour and Feed Mills.</td>
</tr>
<tr>
<td></td>
<td>Pamphlet No. 63, 1964 - Dust Explosions in Industrial Plants.</td>
</tr>
<tr>
<td>ASTM</td>
<td>Pamphlet D-92, 1966 - Test for Flash and Fire Points by Cleveland Open Cup.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td></td>
<td>1916 Race Street</td>
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<tr>
<td></td>
<td>Philadelphia, Pa. 19103</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Assn.</td>
</tr>
<tr>
<td></td>
<td>60 Batterymarch Street</td>
</tr>
<tr>
<td></td>
<td>Boston, Mass. 02110</td>
</tr>
</tbody>
</table>
CHAPTER 11
REQUIREMENTS FOR GROUP F OCCUPANCIES

SECTION 1101. GROUP F OCCUPANCIES DEFINED.
Division 1: Drinking and dining establishments, recreational buildings, and other assembly buildings without fixed theatre type seating, and with an occupant load of less than 150 persons.
Division 2: Stores for wholesale or retail sales, office buildings, medical or dental office buildings and clinics, veterinary clinics and hospitals, police and fire stations, universities, colleges, and adult education facilities in which each classroom has an occupant load of less than 50 persons.

SECTION 1102. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.
(a) General. Buildings or portions of buildings classified in Group F occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.
(b) Special Provisions. See Chapters 17, 25, and 32 for attic partitions and draft stops.
(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 1103. LOCATIONS.
(a) In City. See Chapter 16 for restrictions based upon location in Fire Zones.
(b) On Property. Buildings shall adjoin a yard, public space, or street on at least one side. See Zoning Regulations for property setbacks.
(c) Exterior Wall and Opening Protection. See Chapters 5 and 17 through 22 for fire-resistive protection of exterior walls and openings, as determined by location on the property. See Chapter 5 for regulating adjacent buildings on the same property.

SECTION 1104. EXIT FACILITIES. See Chapter 33.

SECTION 1105. LIGHT, VENTILATION, TOILET ROOM FACILITIES.
(a) Light. All portions of the building used by human occupants shall be provided with either natural or artificial light.
(b) Ventilation. See Chapter 52.
(c) Toilet Room Facilities. See Chapter 5.

SECTION 1106. ENCLOSURE OF VERTICAL OPENINGS.
(a) Exits. See Chapter 33.
(b) Shafts. See Chapter 17.

SECTION 1107. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 1108. SPECIAL REQUIREMENTS.
(a) Chimneys and Heating Apparatus. See Chapters 37, 51, 52, and 58.
(b) Heating or Equipment Rooms. See Chapters 17 and 33.
SECTION 1109. ADDITIONAL REQUIREMENTS FOR DRY CLEANING PLANTS USING NONFLAMMABLE LIQUIDS.

(a) General. This Section shall apply to dry cleaning plants using nonflammable, toxic liquids.

(b) Construction and Occupancy. These plants shall be constructed without basement, cellar, or floor below grade. Dwelling occupancy shall not be permitted in conjunction with this occupancy.

(c) Floor Construction. The entire floor area shall be of non-absorbent, noncombustible construction.

(d) Servicing Area. The dry cleaning equipment shall be constructed to permit servicing from the rear of the equipment. An area shall be provided at the rear of the equipment to permit access and servicing. See Chapter 52 for ventilation of this area.

(e) Heating Equipment and Access. Heating equipment and water heaters shall be enclosed in accordance with the requirements of Chapter 17. Entry to the heating equipment or water heater room shall be provided only from the exterior of the building. Combustion air shall be provided from the outside in accordance with Chapter 51. The use of duct, wall, or unit heaters is prohibited.

SECTION 1110. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCA</td>
<td>Chemical Data Sheet - Perchloroethylene 1948.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCA</td>
<td>Manufacturing Chemists Association, Inc.</td>
</tr>
</tbody>
</table>
CHAPTER 12
REQUIREMENTS FOR GROUP G OCCUPANCIES

SECTION 1201. GROUP G OCCUPANCIES DEFINED.
Division 1: Manufacturing plants, factories, or workshops utilizing noncombustible, non-explosive or not highly combustible materials.
Division 2: A building storing non-explosive materials, noncombustible or not highly combustible materials.
Division 3: Automobile parking garages.

SECTION 1202. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.
(a) General. Buildings or portions of buildings classified in Group G occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.
(b) Special Provisions. See Chapters 17, 25, and 32 for attic space partitions and draft stops.
(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 1203. LOCATION.
(a) In City. See Chapter 16 for restrictions based upon location in Fire Zones.
(b) On Property. Buildings shall adjoin a yard, public space, or street on at least one side. See Zoning Regulations for property setbacks.
(c) Exterior Wall and Opening Protection. See Chapters 5 and 17 through 22 for fire-resistive protection of exterior walls and openings, as determined by location on property. See Chapter 5 for regulating adjacent buildings on the same property.

SECTION 1204. EXIT FACILITIES. See Chapter 33.

SECTION 1205. LIGHT, ventilation, TOILET ROOM FACILITIES.
(a) Light. All portions of the building used by human occupants shall be provided with natural or artificial light.
(b) Ventilation. See Chapter 52.
(c) Toilet Room Facilities. See Chapter 5.

SECTION 1206. ENCLOSURE OF VERTICAL OPENINGS.
(a) Exits. See Chapter 33.
(b) Shafts. See Chapter 17.

SECTION 1207. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 1208. SPECIAL REQUIREMENTS.
(a) Chimneys and Heating Apparatus. See Chapters 37, 51, 52, and 58.
(b) Heating or Equipment Rooms. See Chapter 17.
SECTION 1209. AUTOMOBILE PARKING GARAGES.

(a) General. Structures housing Group G, Division 3 occupancies shall conform to the following:

1. Automobile parking garages shall be constructed of noncombustible materials.
2. Automobile parking garages may be open or enclosed construction.
3. Curbs for traffic control shall be provided.
4. For purposes of this Chapter, a tier, level, or parking surface are synonymous.
5. Roof-top parking shall be permitted.
6. Hand-type fire extinguishers shall be as required by the Fire Department, and shall be located as directed.
7. Mechanical ventilation shall not be required for an automobile parking garage when 2 or more sides are at least 50 percent open.
8. Vehicle exit ramps may be utilized for pedestrian exit requirements, provided the pedestrian walkway space is clearly defined by a curb or raised walk; that the number of automobiles parked per tier is one hundred or less; and the number of tiers is three or less. See Chapter 33.
9. Where ramps are used for the transfer of automobiles from one floor to another, these ramps shall be within 2 feet of the ground floor level at a point at least 20 feet from the exit from the building. See Chapter 17.

(b) Open Parking Garages.

1. Definition. For the purpose of this Section, an open parking garage is a structure of Type I, II, or IV Construction more than one tier in height which is at least 50 percent open on 2 or more sides, and is used exclusively for the parking or storage of passenger motor vehicles.

2. Construction. Construction shall be of noncombustible materials. Open parking garages shall meet the design requirements of Chapter 23. Curbs and guardrails shall be provided at each opening.

3. Area and Height. Area and height of open parking garages in Fire Zones No. 1, No. 2, and No. 3 shall conform to Table No. 12-A, except for increases permitted by Subsection 1209(b)4.

4. Area and Height Increase. The area of a parking garage open on three sides may be increased 25 percent and one tier in height. The area of parking garages open on 4 sides may be increased 50 percent and one tier in height.

5. Location on Property. When located adjacent to interior property lines, exterior walls shall conform to the fire resistance requirements set forth in Table No. 12-B. Walls shall be without opening.

6. Stairs and Exits. Stairs and exits shall meet the requirements of Chapter 33 when persons other than parking attendants are permitted. When parking attendants only are permitted, at least 2 stairs, 3 feet wide shall be provided. Lifts may be installed for use of employees only, provided they are completely enclosed with noncombustible materials.

8. **Occupancy Separations.** Occupancy separations shall be installed as required in Chapter 5 between open parking garages and other occupancies.

9. **Enclosure of Vertical Openings.** Enclosure shall not be required for vertical openings except as specified in subsection 1209(b)(6) for stairs, exits, and lifts.

10. **Ventilation.** See Chapter 52.

11. **Prohibitions.** The following uses are prohibited:
   A. Automobile repair work.
   B. Sale of gasoline or oil.
   C. Parking of buses, trucks, and similar vehicles.
   D. Partial or complete closing of required openings in exterior walls by any means.

**SECTION 1210. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
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<tr>
<td>MCA</td>
<td>Manufacturing Chemists Association, Inc.</td>
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**SECTION 1211. TABLES.**

**TABLE NO. 12-A**

OPEN PARKING GARAGES

AREA AND HEIGHT

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<tr>
<th>TYPE</th>
<th>AREA (Square Feet)</th>
<th>HEIGHT</th>
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<tr>
<td>Type I</td>
<td>Unlimited</td>
<td>Unlimited</td>
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<tr>
<td>Type II</td>
<td>125,000 per tier</td>
<td>75 feet maximum</td>
</tr>
<tr>
<td>Type IV-one hour</td>
<td>50,000 per tier</td>
<td>75 feet maximum</td>
</tr>
<tr>
<td>Type IV-unprotected</td>
<td>30,000 per tier</td>
<td>75 feet maximum</td>
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**TABLE NO. 12-B**

OPEN PARKING GARAGES

FIRE RESISTANCE OF EXTERIOR WALLS

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<tr>
<th>Distance from Property Line To Building</th>
<th>Fire Zone No. 1</th>
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<th>Fire Zone No. 3</th>
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<tr>
<td>0’ - 10’</td>
<td>2-hour</td>
<td>2-hour</td>
<td>1-hour</td>
</tr>
<tr>
<td>10’ - 20’</td>
<td>1-hour</td>
<td>1-hour</td>
<td>None</td>
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</tbody>
</table>
CHAPTER 13
REQUIREMENTS FOR GROUP H OCCUPANCIES

SECTION 1301. GROUP H OCCUPANCIES DEFINED.

Division 1: Hotels and motels.
Division 2: Apartments, garden apartments, dormitories, convents, monasteries, rooming and boarding houses, foster homes, senior citizen homes.
Division 3: Townhouses, cluster homes, row dwellings, and connected dwellings housing more than 2 families.

SECTION 1302. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in Group H occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

(b) Special Requirements.

1. Group H-1 and H-2 occupancies more than one story in height shall be at least one-hour fire-resistive construction.

2. Group H-3 occupancies shall meet the following conditions:
   A. Shall consist of 3 or more attached dwelling units, not more than 2 stories in height, with each unit having independent access to the exterior of the building in the ground story.
   B. Shall be provided with separate sewerage, water supply, heating, electric and plumbing systems together with all other housing utilities and equipment.
   C. Each dwelling unit shall be separated by a two-hour fire-resistive wall extending from the foundation to the highest point of the building, to the underside of the roof sheathing or decking, and to the exterior walls. Voids or openings shall not be permitted. Common utilities including plumbing, electrical, heating, air conditioning, telephone and etc., shall not be permitted in the two-hour fire-resistive separation wall.
   D. Electrical, heating, and plumbing installations shall conform to all the requirements of Group I occupancies. Where a conflict exists between this Section and other Sections of this Building Code, this Section shall supersede.
   E. For purposes of this Section, if living quarters are located in a basement, the basement shall be considered a story.
   F. The second story or basement of any Group H-3 occupancy shall not be utilized to house another family.

3. Dwelling units within an apartment house not over one story in height may have non-bearing walls of unprotected construction, provided the units are separated from each other and from corridors by construction having a fire-resistive rating of at least one-hour. Openings to corridors shall be equipped with doors conforming to Chapter 33.

(c) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.
SECTION 1303. LOCATION.

(a) **In City.** See Chapter 16 for restrictions based on location in Fire Zones.

(b) **On Property.** Buildings shall adjoin a yard, public space, or street on at least one side. See Zoning Regulations for property setbacks.

(c) **Exterior Wall and Opening Protection.** See Chapters 5 and 17 through 22 for fire-resistive protection of exterior walls and openings, as determined by location on property. See Chapter 5 for regulating adjacent buildings on the same property.

SECTION 1304. EXIT FACILITIES. See Chapter 33.

SECTION 1305. LIGHT, CEILING HEIGHTS, VENTILATION, TOILET ROOM FACILITIES.

(a) **Light.** All portions of the building used by human occupants shall be provided with either natural or artificial light. Required windows shall open on a court, yard, or street, either directly or through a porch at least 7 feet high and not more than 7 feet deep, with at least 2 sides 50 percent open. The width of courts or yards shall be at least 3 feet when not more than 2 stories high, and shall be increased in width at the rate of 6 inches for each additional story. The court shall have a width at least 50 percent greater than otherwise required when the court is entirely surrounded by the building.

(b) **Ceiling Heights.** Every habitable room shall have a minimum ceiling height of 7 feet over at least 50 percent of its area, and no portion of the remaining ceiling shall be less than 5 feet in height.

(c) **Ventilation.** See Chapter 52.

(d) **Toilet Room Facilities.** See Chapter 5.

SECTION 1306. ENCLOSURE OF VERTICAL OPENINGS.

(a) **Exits.** See Chapter 33.

(b) **Shafts.** See Chapter 17.

SECTION 1307. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 1308. SPECIAL REQUIREMENTS.

(a) **Chimneys and Heating Apparatus.** See Chapters 37, 51, 52, and 58.

(b) **Heating or Equipment Rooms.** See Chapter 17.
CHAPTER 14
REQUIREMENTS FOR GROUP I OCCUPANCIES

SECTION 1401. GROUP I OCCUPANCIES DEFINED. Group I occupancy shall be one and 2 family dwelling units.

SECTION 1402. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in Group I occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

(b) Special Provisions. A minimum of one-hour fire-resistive construction shall be provided between the dwelling unit and an attached garage. See Table 5-B.

(c) Exceptions and Deviations. A carport open on two or more sides need not have a fire separation between the carport and the dwelling shall not be openable.

(d) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 1403. LOCATION.

(a) In City. See Chapter 16 for restrictions based on location in Fire Zones.

(b) On Property. Buildings shall adjoin a yard, public space, or street on at least one side. See Zoning Regulations for property setbacks.

(c) Exterior Wall and Opening Protection. See Chapters 5 and 17 through 22 for fire resistive protection of exterior walls and openings, as determined by location on property.

SECTION 1404. EXIT FACILITIES. See Chapter 33.

SECTION 1405. LIGHT, CEILING HEIGHTS, VENTILATION, TOILET ROOM FACILITIES.

(a) Light. All portions of the building used by human occupants shall be provided with either natural or artificial light. Required windows shall open on a court, yard, or street, either directly or through a porch at least 7 feet high and not more than 7 feet deep, with at least one side 50 percent open.

(b) Ceiling Heights. Every habitable room shall have a minimum ceiling height of 7 feet over at least 50 percent of its area, and no portion of the remaining ceiling shall be less than 5 feet in height.

(c) Ventilation. See Chapter 32.

(d) Toilet Room Facilities. See Chapter 5.

SECTION 1406. FIRE PROTECTION SYSTEMS. See Chapter 38.

SECTION 1407. SPECIAL REQUIREMENTS.

(a) Chimneys and Heating Apparatus. See Chapter 37, 51, and 52.

(b) Heating or Equipment Rooms. See Chapters 17 and 33.
CHAPTER 15

REQUIREMENTS FOR GROUP J OCCUPANCIES

SECTION 1501. GROUP J OCCUPANCIES DEFINED.

Division 1: Private garages, carports, covered patios, storage sheds, agricultural buildings, laundry buildings, and minor recreational buildings used as accessory to any other occupancy not exceeding 1000 sq. ft. in area.

Division 2: Separate structures such as swimming pools, retaining walls over 3 feet high, and fences over 4 feet high.

SECTION 1502. CONSTRUCTION, HEIGHT, ALLOWABLE AREA.

(a) General. Buildings or portions of buildings classified in Group J occupancy because of the use or character of the occupancy shall conform to the types of construction, area, and height requirements specified in Chapter 5.

(b) Occupancy Loads and Separations. See Chapter 33 for occupant loads. See Chapter 5 for occupancy separation requirements.

SECTION 1503. LOCATION.

(a) In City. See Chapter 16 for restrictions based on location in Fire Zones.

(b) On Property. See Zoning Regulations for property setbacks.

(c) Exterior Wall and Opening Protection. See Chapters 5, and 17 through 22 for fire resistive protection of exterior walls and openings, as determined by location on property.

SECTION 1504. VENTILATION. Under no circumstances shall a private garage have any opening directly into a room used for sleeping purposes.

SECTION 1505. TOILET ROOM FACILITIES. See Chapter 5.

SECTION 1506. SPECIAL REQUIREMENTS.

(a) Chimneys and Heating Apparatus. See Chapters 37, 51, and 52.

(b) Heating or Equipment Rooms. See Chapters 17 and 33.

SECTION 1507. FENCES AND RETAINING WALLS.

(a) General.

1. This Section shall apply to all fences or walls in excess of 4 feet in height; all retaining walls in excess of 3 feet in height; combination fences and retaining walls in excess of 4 feet in height and all fences, walls and retaining walls to be installed on corners or other locations, regardless of height as provided for in this Section.

2. When the Department shall determine that the installation, removal or repair of a fence shall be for the general welfare and safety of the public, notwithstanding the provisions of this Section, the Department may order such action to be taken as is deemed to be necessary.

(b) Design. All fences, walls and retaining walls shall be designed in accordance with the following:

1. Retaining walls shall be so designed, and drainage provided, so as to resist all lateral pressure to which they may be subjected.
2. Fences shall be designed to resist any wind load to which they may be subjected.

(c) **Prohibitions.** The prohibitions, as indicated herein, shall apply to all fences, walls or retaining walls, regardless of height.

1. The use of barbed wire or any other sharp pointed material as a fencing material or on top of fences or retaining walls is hereby prohibited except when and where specifically approved by the Department.

2. The use of electrically charged fences, as such, or on top of fences or retaining walls, is hereby prohibited except when and where specifically approved by the Department.

(d) **Review and Approval.** Fences, walls or retaining walls to be installed on corner or other locations which may create traffic hazards or be in violation of other applicable Ordinances, shall be subject to review by the appropriate City Agency and no such fence, wall or retaining wall shall be installed or maintained in derogation of the disapproval of any City Agency.

(e) **Repair or Removal.** When a fence, wall or retaining wall is declared by the Department to be dilapidated or hazardous, the Department may order the fence, wall or retaining wall to be removed or repaired.
CHAPTER 16
RESTRICTIONS IN FIRE ZONES

SECTION 1601. GENERAL.

(a) Fire Zones Defined. For the purpose of this Building Code, the City and County of Denver in its entirety shall be composed of Fire Zones 1, 2 and 3 described as follows:

1. Fire Zone 1 shall include all the area lying within the following boundaries:

   Beginning at the intersection of East Colfax Avenue and Sherman Street, thence north on Sherman Street to 20th Avenue, thence west on 20th Avenue to 20th Street, thence northwest on 20th Street to the alley between Larimer Street and Market Street, thence southwest on the alley between Larimer Street and Market Street to Cherry Creek, thence southeast on Cherry Creek to West Colfax Avenue, thence east on Colfax Avenue to the point of beginning.

2. Fire Zone 2 shall include all the area lying within the following boundaries, except that which is included in Fire Zone 1:

   Beginning at the intersection of East 14th Avenue and Grant Street, thence north on Grant Street to 21st Street, thence northwest on 21st Street to Blake Street, thence southwest on Blake Street to Cherry Creek, thence southeast on Cherry Creek to West 14th Avenue, thence east on 14th Avenue to the point of beginning.

3. Fire Zone 3 shall include all the area of the City and County of Denver except that which is included in Fire Zones 1 and 2.

(b) Fire Zone Boundaries Defined. Where a street, alley, or right-of-way is referred to in this Chapter, it shall mean the center line of the street, alley, or right-of-way.

(c) Building Located in More Than One Fire Zone. A building or structure located partly in one fire zone and partly in another shall be considered to be in the more restrictive fire zone, if 1/3 or more of its total floor area is located in that zone.

(d) Moved Buildings. Any building or structure moved within or into any fire zone shall be made to comply with all the requirements for new buildings in that fire zone.

(e) Temporary Buildings and Structures. Regardless of type of construction, temporary buildings and structures otherwise conforming to the requirements of this Building Code may be erected in any Fire Zone. A special permit from the Department for a limited period of time not exceeding one year from the date of the permit shall be required for a temporary building or structure. Upon expiration of the time limit stated on the permit, a temporary building or structure shall be completely removed from the site.

   EXCEPTION: Temporary buildings or trailers on construction sites during construction operation.
SECTION 1602. RESTRICTIONS IN FIRE ZONE 1.

(a) General. Buildings or structures erected, constructed or moved within or into Fire Zone 1 shall be only Type I, II, III-H.T., III one-hour, or IV one-hour construction, and shall otherwise meet the requirements of this Building Code.

EXCEPTIONS:
1. Open parking garages. See Chapter 12.
2. Type IV-N buildings not exceeding one story in height or 2500 square feet in area housing a Group F, G, or J occupancy, except where otherwise restricted. See Chapter 5.
3. Type V one-hour buildings not exceeding one story in height and 400 square feet in area.

(b) Occupancies Prohibited. No Group E, Division 2 occupancy having a floor area exceeding 1500 square feet shall be permitted in Fire Zone 1. No Group E, Division 1 or 5 Occupancies shall be permitted in Fire Zone 1.

EXCEPTIONS:
1. Dry cleaning plants which do not use highly flammable liquids.
2. Service stations.

SECTION 1603. RESTRICTIONS IN FIRE ZONE 2.

(a) General. Any building or structure complying with the requirements of this Building Code may be erected, constructed or moved within or into Fire Zone 2.

(b) Occupancies Prohibited. No Group E, division 2 Occupancy having a floor area exceeding 1500 square feet shall be permitted in Fire Zone 2. No Group E, Division 1 or 5 Occupancies shall be permitted in Fire Zone 2.

EXCEPTIONS:
1. Dry cleaning plants which do not use highly flammable liquids.
2. Service stations.

SECTION 1604. RESTRICTIONS IN FIRE ZONE 3.

(a) General. Any building or structure complying with the requirements of this Building Code may be erected, constructed or moved within or into Fire Zone 3.
CITY and COUNTY of DENVER
Fire Zones 1 and 2

NOTE: Balance of map not indicated herein shall indicate that all areas outside Fire Zones No. 1 and No. 2 shall be Fire Zone No. 3.
CHAPTER 17
CLASSIFICATION OF BUILDINGS BY TYPES OF CONSTRUCTION AND GENERAL REQUIREMENTS

SECTION 1701. GENERAL. Every building shall be classified by the Department into one of the types of construction specified in Table 17-A and described in Chapters 18 through 22. Any building which does not entirely conform to a type of construction specified in Table 17-A shall be classified by the Department into a type having an equal degree of fire-resistance. Buildings shall not be required to conform to the details of a Type of Construction higher than that type which meets the minimum requirements based on Occupancy (Chapters 5 through 15) or Restriction in Fire Zones (Chapter 16) although certain features of the building may conform to a higher Type of Construction. Where specific materials, types of construction and fire-resistive protection are required, these requirements shall be the minimum requirements. Any material, type of construction and fire-resistive protection which will afford equal or greater public safety or resistance to fire, as specified in this Code, may be used. Portions of buildings separated by area separation walls, as provided for in Chapter 5, may be considered as buildings for classification of Type of Construction. Where there is no area separation, the area of the entire building shall not exceed that specified in Chapter 5.

SECTION 1702. STRUCTURAL FRAME. The structural frame shall be the columns, girders, beams, trusses and spandrels having direct connection to the columns, and all other members essential to the stability of the building as a whole. The members of floor, roof, and wall panels which have no connection to the columns shall be secondary members and not part of the structural frame.

SECTION 1703. FLOORS OVER BASEMENTS, CELLARS AND CRAWL SPACES. In unprotected types III, IV, and V buildings, floor assemblies of metal or wood located over basements, cellars and crawl spaces shall be protected on the underside as required for one-hour fire-resistive construction. All structural members supporting these floors shall be of one-hour fire-resistive construction. Doors shall be self-closing 3/4 hour-rated or 1-3/4 inches solid wood core.

EXCEPTIONS:
2. Basements, cellars and crawl spaces provided with an approved fire sprinkler system.
3. Crawl spaces that are not used for storage.

SECTION 1704. ROOF CONSTRUCTION. For roof construction, see Chapter 32. For penthouses and roof structures, see Chapter 36. For skylights, see Chapters 54 and 60. For plastics see Chapter 60.

SECTION 1705. EXCEPTIONS TO CONSTRUCTION REQUIREMENTS. The provisions of this Section are exceptions to construction requirements specified in Chapters 5 through 22.
(a) **Fixed Partitions.** Nonbearing partitions subdividing spaces occupied by one tenant only, not requiring occupancy separation, and not part of a public corridor may be constructed of:

1. Noncombustible materials.
2. Fire-retardant treated wood. See Chapter 43.
3. One-hour fire-resistive construction.
4. Wood panels up to three-fourths the height of the room, but not exceeding 7 feet in height. The space between the top of these panels and the ceiling may be closed with glass.
5. Plastics as permitted by Chapter 60.
6. One-half inch regular gypsum board on each side of wood or metal studs in Type III one-hour, and Type V one-hour buildings only.

(b) **Folding Partitions.** Folding partitions need not have a fire-resistive rating provided:

1. They do not block required exits or establish an exit corridor.
2. Their location is restricted by means of permanent tracks, guides, or other approved methods.
3. Flammability meets the flame-spread requirements specified in Chapter 42.

(c) **Walls Fronting on Streets or Yards.** Certain elements of walls fronting on streets or yards having a width of 40 feet or more may be constructed as follows:

1. Bulkheads above and below show windows, show window frames, aprons, and showcases may be of combustible materials provided the height of their construction does not exceed 20 feet above grade.
2. Wood veneer of boards not less than one-inch nominal thickness or exterior type panels not less than 3/8 inch thickness may be applied to walls provided the height of the veneer does not exceed 20 feet above grade. The veneer shall be applied either directly against or furred not more than 1-1/2 inches from a noncombustible surface.

(d) **Trim.** Trim, picture molds, chair rails, baseboards, handrails and show window backing may be of wood. Unprotected wood doors and windows may be used except where openings are required to be fire protected. Materials used for interior finish of walls and ceilings shall be as specified in Chapter 42.

(e) **Exterior Loading Platforms.** Exterior loading platforms shall be of noncombustible materials or wood at least 1-1/2 inches thick. Wood construction shall not extend through the exterior walls. All exterior loading platforms shall be provided with an enclosure to prevent the accumulation of debris beneath the platform.

(f) **Wood Sleepers.** Where wood sleepers are used for laying wood flooring more than 1-1/2 inches above noncombustible floors, the space between the floor and the flooring shall be filled with noncombustible material or firestopped so that no open spaces shall exceed 100 square feet in area. The space shall be filled solid under all permanent partitions.

**SECTION 1706. ENCLOSURE OF VERTICAL OPENINGS.**

(a) **General** Openings extending vertically through floors shall be enclosed by fire-resistive construction as specified in Table 17-A. Exit enclosures shall be as specified in Chapter 33.
EXCEPTIONS:

1. In other than Group D occupancies, an enclosure or perimeter fire sprinklers shall not be required for openings which are not connected with openings serving other floors. This exception shall apply to basements and cellars only when provided with an approved fire sprinkler system throughout.

2. Enclosures shall not be required for escalators protected with fire sprinklers as specified in Chapter 38.

3. In Type V buildings, chutes and dumbwaiter shafts with a cross-sectional area of not more than 9 square feet may be lined with approved noncombustible materials. All openings into any such vertical enclosures shall be protected by metal or metal-clad doors with either metal or metal-clad jambs, casings, or frames.

4. In other than Group D occupancies, enclosure of an atrium shall not be required provided all of the following requirements are met:
   A. All rooms open to the atrium shall be provided with fire sprinklers.
   B. All doors opening into the atrium shall be self-closing or automatic closing, and fire-rated as specified in Chapter 33.
   C. The atrium shall be provided with an engineered smoke removal system.
   D. Enclosed exit stairs shall be procided as specified in Chapter 33.
   E. Perimeter fire sprinklers shall be provided as specified in Chapter 38.

(b) Protection of Openings. Every opening into a vertical enclosure shall be protected by a self-closing fire assembly conforming to the requirements of Chapter 43. Openings through a one-hour rated enclosure wall shall be protected by a 3/4 hour rated fire assembly, and openings through a two-hour rated enclosure wall shall be protected by a 1-1/2 hour rated fire assembly.

EXCEPTIONS:

1. Openings to the exterior may be unprotected when permitted by Table 17-C.

2. Ducts penetrating vertical fire rated enclosure walls shall be protected by fire dampers.

(c) Termination of Trash and Laundry Chutes. In other than Group I occupancies, trash and laundry chutes shall terminate in rooms separated from the remainder of the building by a one-hour fire-resistant occupancy separation. Openings into chutes shall not be located in exit stairways. See Chapter 48 for trash chute and incinerator requirements.

(d) Elevator Shafts. Elevator shafts shall be vented as specified in Chapter 55.

SECTION 1707. OPENINGS IN EXTERIOR WALLS.

(a) General. Exterior walls shall be provided for buildings located where openings are not permitted, and when protection of openings is required.

(b) Openings Not Permitted. Openings shall not be permitted in exterior walls located less than the following set-back distances from an adjacent property line or the center line of a street or alley:
1. Five feet for buildings housing Groups A through H occupancies.
2. Three feet for buildings housing Groups I through J occupancies, except carports and patios.

(c) **Protection of Openings Required.** All openings in exterior walls shall be protected by a fire assembly having a 3/4 hour fire-resistive rating where the walls are located less than the set-back distances from an adjacent property line or the center line of a street or alley as specified in Table 17-C. Where openings in exterior walls are required to be protected, the sum of the areas of the openings shall not exceed 50 percent of the total area of the wall in each story.

**EXCEPTION:** Carports and patios in Groups I and J occupancies.

(d) **Buildings on Same Property and Buildings Containing Courts.** For the purpose of determining the required opening protection in exterior walls of buildings on the same property and in court walls of buildings over one story in height, a property line shall be assumed between opposite walls.

**SECTION 1708. WEATHER PROTECTION.**

(a) **Weather Resistant Barriers.** All weather exposed wall surfaces shall have a weather resistant barrier. The barrier shall be waterproof building paper, asphalt saturated felt or an approved equal. Application shall be weatherboard lapped at least 2 inches at horizontal joints and at least 6 inches at vertical joints. The weather resistant barrier may be omitted in the following cases:
   1. Where exterior covering is of approved weatherproof materials.
   2. In back plastered construction.
   3. When there is no human occupancy.
   4. Over water repellent sheathing.
   5. Under approved paper backed metal lath.
   6. In solid masonry construction.

(b) **Flashing and Counterflashing.** Exterior openings exposed to the weather shall be made weatherproof. All parapets shall be provided with a weatherproof coping. All flashing, counterflashing and coping of metal shall be at least No. 26 U.S. gage corrosion resistant metal.

(c) **Weather Exposed Areas.** Balconies, landings, exterior stairways and similar surfaces exposed to the weather and sealed underneath shall be made weatherproof.

**SECTION 1709. MEMBERS SUPPORTING MASONRY OR CONCRETE WALLS.** Metal members supporting masonry or concrete walls in buildings over one story in height shall be protected with at least one-hour fire-resistive protection. Fire protection may be omitted from shelf angles, plates and the bottom flange of lintels where these members are not part of the structural frame. Wood members shall not be used to support masonry or concrete walls except as permitted by Chapter 25.

**SECTION 1710. PARAPETS.**

(a) **General.** Parapets shall be provided on all exterior walls of buildings except as follows:
   1. Walls not required to be of fire-resistive construction.
   2. Walls which terminate at roofs of at least two-hour fire-resistive
construction, or at roofs constructed entirely of noncombustible material.
3. Walls when unprotected openings are permitted.
4. Walls of buildings twenty feet or less in height.
5. Walls of buildings where the roof slope is 4:12 or greater.
(b) **Construction.** Parapets shall have the same degree of fire-resistance required for the wall upon which they are constructed. The height of the parapet shall be at least 30 inches above the point where the roof surface and the wall intersect.

**SECTION 1711. PROJECTIONS FROM BUILDINGS.**

(a) **General.** Cornices, canopies, marquees, roof extensions, mansards, eaves, balconies and similar projections extending beyond the exterior walls of buildings shall be constructed of noncombustible materials.

**EXCEPTION:** For Types III, IV and V construction, projections from buildings may be of unprotected combustible materials provided the projections are separated from the remainder of the building by walls of at least one-hour fire-resistive construction. When combustible projections extend into the set-backs specified in Tables 17-B and 17-C, the projections shall be of one-hour fire-resistive construction.

(b) **Projections.** Projections from buildings extending over public property shall be constructed as specified in Chapter 45.

**SECTION 1712. RANGES, HOT PLATES, AND COUNTERTOP UNITS.** Gas and electric ranges, hot plates and countertop units shall bear the label of an approved testing laboratory, and shall be installed with clearances from combustible materials specified in the testing laboratory approval. Ventilation shall be as specified in Chapter 52.

**SECTION 1713. Heliports and Helistops.**

(a) **General.** Heliports and helistops shall conform to the requirements of this Building Code, the Fire Code, the Zoning Ordinance and the Revised Municipal Code.

(b) **Heliports and Helistops on Buildings.** Heliports shall not be located on buildings. Helistops may be located on buildings provided they conform to the following requirements:

1. **Landing Area.** The landing area shall be surrounded on all sides by a clear area having a minimum average width of 15 feet, but no width shall be less than 5 feet.
2. **Design.** Helicopter landing areas and supporting structures shall be of noncombustible construction. Landing areas shall be designed to conduct fuel spillage away from all exits. Structural design and loading shall be as specified in Chapter 23.
3. **Exits and Stairways.** Helistops located on buildings shall have at least two exits. Exits and stairways shall comply with the provisions of Chapter 33. For landing areas less than 60 feet in length or less than 2000 square feet in area, the second exit may be a fire escape or ladder leading to the floor below.

**SECTION 1714. GUARDRAILS.** All unenclosed floor and roof openings, open and glazed sides of stairs, ramps and landings, balconies and porches
more than 15 inches above grade, occupied roofs and areaways located within 5 feet of a public way shall be protected by guardrails. Guardrails shall be at least 42 inches high, except that stair guardrails may be the height specified in Chapter 33 for handrails. Open guardrails shall have intermediate rails, balusters or other members with not more than 9 inches clear spacing. Guardrails shall be designed to support the railing live loads specified in Chapter 23.

**EXCEPTIONS:**
1. Guardrails in Group I occupancies may be 36 inches high with intermediate members as specified above.
2. Guardrails in Groups E and G occupancies may have one intermediate rail at mid-height.
3. Guardrails need not be provided on the loading side of loading docks.
4. When the open side of a stair is within 12 inches horizontally of an adjacent stair, the stair guardrail may have one intermediate rail at mid-height.
5. Tempered glass at least 3/16 inch thick or laminated safety glass at least 1/4 inch thick, with adequate structural support and protection of edges, may be used in lieu of required guardrails.
6. Areaways may be protected by gratings in lieu of required guardrails.
7. Guardrails in the seating areas of auditoriums, reviewing stands, grandstands and bleachers may be as specified in Chapter 33.

**SECTION 1715. MEZZANINES.**
(a) **General.** Mezzanines shall be constructed as specified in Chapters 18, 19, 20, and 21.
(b) **Mezzanine Limitations.**
1. Not more than two mezzanine floors shall be located in any room of a building.
2. No mezzanine floor or floors shall cover more than one-third of the area of any room.
3. The clear height below a mezzanine floor shall be at least 7 feet.
4. Mezzanine exits shall be as specified in Chapter 33.

**SECTION 1716. FURNACE AND BOILER ROOM ENCLOSURE.**
Unless otherwise required by special occupancy provisions, every furnace and boiler room shall be provided with a one-hour fire-resistive occupancy separation. Doors shall be one-hour rated with self-closing devices.

**EXCEPTION:** Furnace and boiler rooms in Groups H-3, I, and J occupancies.

**SECTION 1717. CRAWL SPACE VENTILATION AND ACCESS.**
(a) **Ventilation.** Crawl spaces below wood construction shall be ventilated by mechanical means or by openings in exterior walls. The openings shall have a net area of 1/2 square foot for each 25 linear feet of exterior walls adjacent to the crawl space. Openings shall be located on opposite sides of the building, and as near to the corners as practicable. At least four openings shall be provided covered with corrosion resistant wire mesh having not less than 1/4 inch nor more than 1/2 inch mesh size.
(b) **Access.** Except when heating equipment is located in a crawl space, ac-
cess may be from the interior of the building. The interior access shall be at least 30 inches in its smallest dimension. Exterior access to a crawl space shall be as specified in Chapter 52. Except as specified in Chapter 52, the minimum clearance between the bottom of the floor structure and the crawl space surface shall be 18 inches.

SECTION 1718. ATTIC VENTILATION AND ACCESS. See Chapter 32.

SECTION 1719. EMERGENCY POWER EQUIPMENT ROOM ENCLOSURE. Emergency power equipment rooms shall be provided with a one-hour fire-resistive occupancy separation. Doors shall be one-hour rated with self-closing devices. See Chapter 53.

SECTION 1720. TENTS AND CLOTH COVERED STRUCTURES. Tents and cloth covered structures exceeding 150 square feet in floor area shall be subject to approval of the Department and may be erected for a period of time not to exceed 120 days. In addition, Fire Department approval shall be required prior to the issuance of a permit for a tent or cloth covered structure.

SECTION 1721. TRAILERS. In addition to the requirements of Article 633 of the Revised Municipal Code, the following shall apply:

(a) For the purpose of this Building Code, a trailer shall be considered a vehicle when it is mobile, equipped with wheels and is not connected to a sewer or power supply.

(b) Trailers shall be permitted for dwelling occupancies only when located in a trailer park as defined in Article 633 of the Revised Municipal Code, and when approved by the Zoning Administration.

(c) Trailers shall not be permitted for any other occupancy unless meeting the requirements for buildings of this Building Code, and specifically approved by the Department.

EXCEPTION: Trailers used for temporary occupancy at construction sites.

SECTION 1722. VEHICLE EXIT FACILITIES. Where ramps are provided for vehicle exiting from buildings, the ramps shall be within 2 feet of the ground level at least 20 feet inside the property line of the building.

SECTION 1723. CONSTRUCTION IN A FLOOD PLAIN DISTRICT.

(a) All new buildings and additions to existing buildings hereafter erected in a Flood Plain District, as designated in Section 612.32 of the Revised Municipal Code, shall be located so that the lowest occupied level, including basements and cellars, is one foot above the level of the intermediate regional flood.

EXCEPTION: Buildings and additions to buildings of A,B,C,E,F,G and J Occupancies may be located below the level of the intermediate regional flood, provided an engineer certifies that the structure and utilities are adequately flood proofed to withstand flood depths, pressures, velocities, impact and uplift forces and other factors associated with flood waters to a level one foot above the level of the intermediate regional flood. No D Occupancy building or addition to an existing building shall be constructed in a Flood Plain District.

(b) Water Supply and Sanitary Sewer System. New or replacement
water supply and sanitary sewer systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into the flood waters.

(c) **Design.** The proposed construction shall be designed and anchored to prevent flotation, collapse, or lateral movement of the building or structure.

(d) **Intermediate Regional Flood.** A flood having a one percent annual probability or an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year.

SECTION 1724. RESIDENTIAL UNITS FOR THE HANDICAPPED. Group H-1 and H-2 occupancy structures containing 8 or more units shall provide one unit for each 7 units which is fully accessible and which complies with all requirements applicable to handicapped facilities. See Chapters 5, 33 and 50.

SECTION 1725. EMERGENCY VEHICLE ACCESS. Every building shall be provided with access capable of sustaining the load of emergency vehicles as approved by the Department and Fire Department. See Fire Code.

SECTION 1726. TABLES.
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<th>Materials of Construction</th>
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See Section 1707 and Table 17-C

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<td>J-1</td>
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<td>2 hours less than 20 feet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 hour elsewhere</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1 hour less than 20 feet</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1 hour less than 5 feet</td>
</tr>
<tr>
<td>J-2</td>
<td>1, 2</td>
<td>Noncombustible construction not regulated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combustible construction shall be 1 hour.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Not regulated</td>
</tr>
</tbody>
</table>

Distances given are from the adjacent property line or center line of a street or alley to the wall.
NA - Not Applicable
# TABLE NO. 17-C

**SET-BACKS REQUIRING PROTECTION OF OPENINGS IN EXTERIOR WALLS**  
(See Section 1707)

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Fire Zone</th>
<th>Type of Construction</th>
<th>Set-Backs in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1,2,3</td>
<td>I</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1,2,3</td>
<td>II,III,IV,V</td>
<td>NP</td>
</tr>
<tr>
<td>B-1</td>
<td>1,2,3</td>
<td>I,II,III</td>
<td>20</td>
</tr>
<tr>
<td>B-2</td>
<td>1</td>
<td>IV,V</td>
<td>20</td>
</tr>
<tr>
<td>B-3</td>
<td>2,3</td>
<td>IV,V</td>
<td>10</td>
</tr>
<tr>
<td>C-1</td>
<td>1,2,3</td>
<td>I,II,III</td>
<td>20</td>
</tr>
<tr>
<td>C-2</td>
<td>1</td>
<td>IV,V</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2,3</td>
<td>IV,V</td>
<td>10</td>
</tr>
<tr>
<td>D-1</td>
<td>1,2,3</td>
<td>I,II</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1,2,3</td>
<td>III,IV,V</td>
<td>NP</td>
</tr>
<tr>
<td>D-2</td>
<td>1,2,3</td>
<td>I,II,III</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>IV,V</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2,3</td>
<td>IV,V</td>
<td>10</td>
</tr>
<tr>
<td>E-1</td>
<td>1,2</td>
<td>I,II,III,IV,V</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I,II,III,IV,V</td>
<td>20</td>
</tr>
<tr>
<td>E-2, E-3, E-4</td>
<td>1,2,3</td>
<td>I,II,III,IV,V</td>
<td>20</td>
</tr>
<tr>
<td>E-5</td>
<td>1,2</td>
<td>I,II,III,IV,V</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I,II,III,IV,V</td>
<td>60 (See Chapter 10)</td>
</tr>
<tr>
<td>F-1</td>
<td>1,2,3</td>
<td>I,II,III</td>
<td>20</td>
</tr>
<tr>
<td>F-2</td>
<td>1</td>
<td>IV,V</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2,3</td>
<td>IV,V</td>
<td>10</td>
</tr>
<tr>
<td>G-1</td>
<td>1,2,3</td>
<td>I,II,III</td>
<td>20</td>
</tr>
<tr>
<td>G-2</td>
<td>1</td>
<td>IV,V</td>
<td>20</td>
</tr>
<tr>
<td>G-3</td>
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<td>10</td>
</tr>
<tr>
<td>H-1</td>
<td>1,2,3</td>
<td>I,II</td>
<td>20</td>
</tr>
<tr>
<td>H-2</td>
<td>1</td>
<td>III,IV,V</td>
<td>20</td>
</tr>
<tr>
<td>H-3</td>
<td>2</td>
<td>III,IV,V</td>
<td>10</td>
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<td></td>
<td>3</td>
<td>III,IV,V</td>
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<td>1,2,3</td>
<td>I,II,III</td>
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<td>1</td>
<td>IV,V</td>
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<td>IV,V</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>IV,V</td>
<td>N</td>
</tr>
<tr>
<td>J</td>
<td>1,2,3</td>
<td>I,II,III</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>IV,V</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>IV,V</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>IV,V</td>
<td>N</td>
</tr>
</tbody>
</table>

NP - Type of Construction not permitted  
N  - No protection required beyond 3 feet.
CHAPTER 18
TYPE I BUILDINGS

SECTION 1801. GENERAL. The structural elements in Type I buildings shall be of steel, concrete or masonry. Walls and partitions shall be noncombustible fire-resistive construction except that interior nonbearing partitions of one hour or 2 hour fire-resistive construction, which are not part of a vertical enclosure, may have fire retardant treated wood within the rated assembly. Materials of construction and fire-resistive requirements shall be as specified in Chapter 17.

SECTION 1802. STRUCTURAL FRAMEWORK. Structural framework shall be of structural steel as specified in Chapter 27, reinforced concrete as in Chapter 26 or masonry as in Chapter 24.

SECTION 1803. EXTERIOR WALLS AND OPENINGS.
(a) Exterior Walls. Exterior walls and all structural members therein shall comply with the requirements specified in Table 17A.

EXCEPTIONS:
1. Nonbearing walls fronting on streets or yards having a width of at least 40 feet may be of unprotected noncombustible construction.
2. In Groups F, G and H occupancies, exterior bearing walls may be of 2 hour fire-resistive noncombustible construction where openings are permitted.
3. In other than Group E occupancies, exterior nonbearing walls may be of one hour fire resistive noncombustible construction where unprotected openings are permitted and 2 hour fire-resistive noncombustible construction where fire protection of openings is required.

(b) Openings in Walls. All openings in exterior walls shall conform to the requirements of Chapter 17 and Table 17C.

SECTION 1804. FLOORS.
(a) Floor Construction. Floor assemblies shall be of noncombustible fire-resistive construction as specified in Table 17A except that wood flooring may be applied over a concrete floor slab. See Chapter 17.
(b) Mezzanine Floors. Mezzanine floors shall be constructed of one hour fire-resistive noncombustible materials. See Chapter 17 for mezzanine limitations.

SECTION 1805. STAIRS. Stairs and landings shall be constructed of reinforced concrete or structural steel. Stairs shall be designed as specified in Chapter 33.

SECTION 1806. ROOFS. In Groups A, B, and C occupancies with fixed seating, except exhibition halls as defined herein, and where every part of the roof structure is at least 25 feet above any floor, the roof construction may be of unprotected noncombustible materials. In exhibition halls, and in all occupancies other than Groups A, B, and C where every part of the roof structure is at least 25 feet above any floor, the roof construction may be of
noncombustible materials protected by one of the following:
1. A water spray fixed sprinkler system designed to provide the equivalent of one hour fire-resistive protection to the roof structure.
2. A water deluge or foam-water deluge sprinkler system designed to control fire at floor level.
3. One hour fire-resistive protection of all structural members and the roof deck.
4. A continuous ceiling equivalent to that required for one hour fire-resistive construction.
5. An approved fire sprinkler system installed throughout the building.
For the purpose of this Section, exhibition hall shall be defined as any assembly building having facilities for trade shows, merchandise displays, conventions, carnivals, etc. when the combustible load exceeds 10 pounds or 9000 Btu per square foot of floor area in the display areas.
CHAPTER 19
TYPE II BUILDINGS

SECTION 1901. GENERAL. The structural elements in Type II buildings shall be of steel, concrete or masonry. Walls and partitions shall be of non-combustible fire-resistive construction except that interior nonbearing partitions of one-hour or 2 hour fire-resistive construction, which are not part of a vertical enclosure, may have fire-retardant treated wood within the rated assembly. Materials of construction and fire-resistive requirements shall be as specified in Chapter 17. Allowable floor area and maximum height shall as specified in Chapter 5.

SECTION 1902. STRUCTURAL FRAMEWORK. Structural framework shall be of structural steel as specified in Chapter 27, reinforced concrete as in Chapter 26, or masonry as in Chapter 24.

SECTION 1903. EXTERIOR WALLS AND OPENINGS.
(a) Exterior Walls. Exterior walls and all structural members therein shall comply with the requirements specified in Table 17-A.

EXCEPTIONS:
1. Nonbearing walls fronting on streets or yards having a width of at least 40 feet may be of unprotected noncombustible construction.
2. In Groups F, G and H occupancies, exterior bearing walls may be of 2 hour fire-resistive noncombustible construction where openings are permitted.
3. In other than Group E occupancies, exterior nonbearing walls may be of one-hour fire-resistive noncombustible construction where unprotected openings are permitted and 2 hour fire-resistive noncombustible construction where fire protection of openings is required.

(b) Openings in Walls. All openings in exterior walls shall conform to the requirements of Chapter 17 and Table 17-C.

SECTION 1904. FLOORS.
(a) Floor Construction. Floor assemblies shall be of noncombustible fire-resistive construction as specified in Table 17-A except that wood flooring may be applied over a concrete floor slab. See Chapter 17.

(b) Mezzanine Floors. Mezzanine floors shall be constructed of one-hour fire-resistive noncombustible materials. See Chapter 17 for mezzanine limitations.

SECTION 1905. STAIRS. Stairs and landings shall be constructed of reinforced concrete or structural steel. Stairs shall be designed as specified in Chapter 33.

SECTION 1906. ROOFS. In Group A, B, and C occupancies with fixed seating, except exhibition halls as defined herein, and where every part of the roof structure is at least 25 feet above any floor, the roof construction may be of unprotected noncombustible materials. In exhibition halls, and in all occupancies other than Group A, B, and C, where every part of the roof structure is at least 25 feet above any floor, the roof construction may be of
noncombustible materials protected by one of the following:
1. A water-spray fixed sprinkler system designed to provide the equivalent of one-hour fire resistive protection to the roof structure.
2. A water deluge or foam-water deluge sprinkler system designed to control fire at floor level.
3. One-hour fire-resistive protection of all structural members and the roof deck.
4. A continuous ceiling equivalent to that required for one-hour fire-resistive construction.
5. An approved fire sprinkler system installed throughout the building.

For the purpose of this Section, exhibition hall shall be defined as any assembly building having facilities for trade shows, merchandise displays, conventions, carnivals, etc., when the combustible load exceeds 10 pounds or 9000 Btu per square foot of floor area in the display areas.
CHAPTER 20
TYPE III BUILDINGS

SECTION 2001. GENERAL. The structural elements of Type III buildings may be of any materials permitted by this Building Code. Type III One Hour buildings shall be of one hour fire-resistive construction. Type III Heavy Timber buildings shall conform to Section 2007 except that structural members and partitions may be of other materials having a fire-resistive rating of at least one hour. Materials of construction and fire-resistive requirements shall be as specified in Chapter 17. Allowable floor area and maximum height shall be as specified in Chapter 5.

SECTION 2002. STRUCTURAL FRAMEWORK. Structural framework shall be of aluminum as specified in Chapter 28, structural steel as in Chapter 27, reinforced concrete as in Chapter 26, masonry as in Chapter 24, or wood as in Chapter 25 and this Chapter.

SECTION 2003. EXTERIOR WALLS.

(a) Exterior Walls. Exterior walls shall be constructed of noncombustible materials and shall comply with the fire-resistive requirements specified in Chapter 17 and Table 17-A.

EXCEPTIONS:
1. Nonbearing walls fronting on streets or yards having a width of at least 40 feet may be of unprotected noncombustible construction.
2. Exterior nonbearing walls may be one hour fire-resistive construction where unprotected openings are allowed and 2 hour fire-resistive construction where protection of openings is required.
3. Exterior bearing walls may be 2 hour fire-resistive construction where openings are permitted.
4. Approved fire retardant treated wood framing may be used within the assembly of exterior walls allowed by Exceptions 1, 2 and 3 if the required fire-resistance is maintained, and not less than one hour fire rated construction is provided.
5. Wood columns, beams and arches conforming to heavy timber sizes may be used externally where exterior walls are permitted to be unprotected, noncombustible construction, or where one hour fire-resistive exterior walls are permitted.

(b) Openings in Walls. All openings in exterior walls shall conform to the requirements of Chapter 17 and Table 17C.

SECTION 2004. FLOORS.

(a) Floor Construction. Floors may be of any materials permitted by this Building Code.

(b) Mezzanine Floors. Mezzanine floors located above the first story shall be one hour fire-resistive construction or heavy timber construction. See Chapter 17 for mezzanine limitations.

SECTION 2005. STAIRS. Stairs in Type III One Hour and Type III-N buildings may be constructed of any materials allowed by this Code. Stairs in
Type III Heavy Timber buildings shall be constructed as specified in Section 2007. In Type III buildings more than 3 stories in height, stairs shall be reinforced concrete, structural steel, wood protected on the underside with 5/8" Type X gypsum board or heavy timber. Stairs shall be designed as specified in Chapter 33.

SECTION 2006. ROOFS. Roofs may be of any materials permitted by this Building Code.

SECTION 2007. HEAVY TIMBER CONSTRUCTION.

(a) GENERAL. Heavy Timber Construction shall be in accordance with the requirements of this Section. Unless otherwise specified, all dimensions are nominal, as defined in Chapter 25.

(b) COLUMNS. Columns shall be sawn or structural glued laminated timber at least 8 x 8 inches when supporting floor loads and at least 6 x 6 inches when supporting roof loads only.

(c) FLOOR FRAMING. Beams and girders shall be sawn or structural glued laminated timber at least 6 inches wide and 10 inches deep. Sawn or structural glued laminated timber arches which spring from floor level shall be at least 8 x 8 inches. Sawn or structural glued laminated timber trusses shall have members at least 8 x 8 inches.

(d) ROOF FRAMING. Beams, girders, and trusses shall be sawn or structural glued laminated timber at least 4 inches wide and 6 inches deep. Arches shall be sawn or structural glued laminated timber at least 6 inches wide and 8 inches deep to a point 25 feet above the floor, and at least 6 x 6 inches above that point. Spaced members at least 3 inches wide with spaces blocked solid or closed on the underside with wood cover plates at least 2 inches thick may be used. Beams, girders and trusses shall be at least 3 inches wide and 5 inches deep where protected by an approved fire sprinkler system under the deck.

(e) FLOOR DECKS. Floor decks shall be tongue and groove planks at least 3 inches thick, or boards at least 4 inches wide set on edge. Decks shall be overlaid with one inch tongue and groove flooring or 1/2 inch plywood.

(f) ROOF DECKS. Roof decks shall be tongue and groove planks at least 2 inches thick, a double thickness of one inch boards with tongue and groove or staggered joints, boards at least 3 inches wide set on edge or 1-1/8 inches actual thickness plywood.

(g) PARTITIONS. Nonbearing partitions shall be solid wood construction as required for roof decks or one hour fire-resistive construction. Bearing partitions shall be one-hour fire-resistive construction.

(h) STAIRS. Stairs shall have wood treads and risers at least 2 inches thick or, if built on inclines constructed as required for floor decks, treads and risers may be one inch thick. Stairs may be constructed as required for Type I buildings.
CHAPTER 21
TYPE IV BUILDINGS

SECTION 2101. GENERAL. The structural elements of Type IV buildings shall be of noncombustible materials. Type IV One Hour buildings shall be of one hour fire-resistive noncombustible construction. Materials of construction and fire resistive requirements shall be as specified in Chapter 17. Allowable floor area and maximum height shall be as specified in Chapter 5.

SECTION 2102. STRUCTURAL FRAMEWORK. Structural framework shall be of aluminum as specified in Chapter 28, structural steel as in Chapter 27, reinforced concrete as in Chapter 26, or masonry as in Chapter 24.

SECTION 2103. EXTERIOR WALLS AND OPENINGS. Exterior walls shall be constructed of noncombustible materials and shall comply with the fire-resistive requirements specified in Chapter 17 and Tables 17-B and 17-C.

EXCEPTIONS:
1. Nonbearing walls fronting on streets or yards having a width of at least 40 feet may be of unprotected noncombustible construction.
2. Exterior walls of Type IV-N buildings not exceeding one story in height or 2500 square feet in area housing Group F, G, and J occupancies may be of unprotected noncombustible construction if the walls are located 20 feet from adjacent property lines in Fire Zone 1, or 10 feet from adjacent property lines in Fire Zone 2.
3. Exterior walls of Type IV-N buildings not exceeding one story in height, or 1500 square feet in area, housing Group F, G, or J occupancies in Fire Zone 2 and Group F occupancy in Fire Zone 3 may be of unprotected noncombustible construction if the walls are located 5 feet from adjacent property lines.

SECTION 2104. INTERIOR WALLS, PARTITIONS AND CEILINGS. Interior walls, partitions and ceilings shall be of noncombustible materials or fire retardant treated wood except that combustible partitions and ceiling assemblies of one hour fire-resistive construction shall be permitted.

SECTION 2105. FLOORS.
(a) Floor Construction. Floor assemblies shall be of noncombustible materials except that wood flooring may be applied over a concrete floor slab.
(b) Mezzanine Floors. Mezzanine floors shall be of noncombustible materials except that combustible floor assemblies of one hour fire-resistive construction shall be permitted. See Chapter 17 for mezzanine limitations.

SECTION 2106. STAIRS. Stairs and landings shall be of noncombustible materials except that stairs and landings serving mezzanine floors may be of wood of at least 2 inches nominal thickness. Stairs shall be designed as specified in Chapter 33.

SECTION 2107. ROOFS. Roof assemblies shall be of noncombustible
materials. In Type IV One Hour buildings, roofs may be as specified in Chapter 18.
CHAPTER 22
TYPE V BUILDINGS

SECTION 2201. GENERAL. Type V buildings may be of any materials allowed by this Building Code. Type V One Hour buildings shall be of one-hour fire-resistive construction. Materials of construction and fire-resistive requirements shall be as specified in Chapter 17. Allowable floor area and maximum height shall be as specified in Chapter 5.

SECTION 2202. STRUCTURAL FRAMEWORK. Structural framework shall be of aluminum as specified in Chapter 28, structural steel as in Chapter 27, reinforced concrete as in Chapter 26, wood as in Chapter 25, or masonry as in Chapter 24.

SECTION 2203. EXTERIOR WALLS AND OPENINGS. Fire protection of exterior walls and openings shall comply with the requirements specified in Chapter 17 and Tables 17-B and 17-C.

EXCEPTION: Exterior walls fronting on streets or yards having a width of at least 40 feet may be of unprotected construction.

SECTION 2204. STAIRS. Stairs and landings may be constructed of any material permitted by this Building Code. Stairs shall be designed as specified in Chapter 33.
CHAPTER 23
STRUCTURAL DESIGN AND LOADING

SECTION 2301. GENERAL.
(a) Scope. In addition to the other requirements of this Building Code, this Chapter shall govern all loads and forces acting upon a building or structure in such a manner to cause stresses and deformation within the building or structure, or any part thereof. All loads specified in this Chapter shall supersede loads indicated in other portions of this Building Code.

SECTION 2302. DEFINITIONS.
(a) Dead Load. The dead load of a building, structure, or utility shall include the weight of the walls, permanent partitions, framing, floors, roof and other permanent stationary construction.
(b) Live Load. The live load shall include the total of all loads and forces on the building, structure or utility except dead loads, wind loads and earthquake loads.

SECTION 2303. LOADS.
(a) General. Buildings, structures and all parts thereof shall be of sufficient strength to support, in addition to the dead loads, live loads at least those specified in the following Sections, without exceeding the stresses specified elsewhere in this Building Code. Impact, vibration and moving loads shall be considered in the design of any structure where these loads occur and shall not be reduced in combination with unit live loads. Except in Group H, I, and J occupancies, floors shall be designed for a minimum load of 2000 pounds or other known concentrated loading upon any area 2-1/2 feet square wherever this load upon an otherwise unloaded floor would produce stresses greater than those induced by a uniformly distributed load as specified in Table 23-A.
(b) Critical Distribution of Live Loads. Where structural members are arranged to create continuity, the loading conditions which would cause maximum shear and bending moments along the member shall be considered. Where uniform floor loads are involved, consideration may be limited to full dead load on all spans in combination with full live load on adjacent spans and on alternate spans.
(c) Temporary Loads. Temporary loads imposed during construction shall be provided for by the person imposing these loads.

SECTION 2304. METHODS OF DESIGN. Any system or method of construction used shall consist of a rational analysis in accordance with well established principles of mechanics, and with design criteria and methods specified in Chapters 24, 25, 26, 27, 28, 29 and 30. Design calculations shall be submitted to the Department when requested. Design uniform live loads and concentrated loads shall be indicated on all drawings submitted to the Department. All allowable stresses and soil bearing values specified in this Building Code may be increased 1/3 due to wind or earthquake forces either acting alone or when combined with vertical loads. No increase of stresses shall be allowed for vertical loads acting alone. Wind and earthquake loads need not be assumed to act simultaneously.

23-1
SECTION 2305. UNIT LIVE LOADS. The unit loads set forth in Table No. 23-A shall be considered the minimum live loads to be used in the design of buildings for the occupancies listed. For occupancies or uses not listed, the live loads shall be subject to approval by the Department.

SECTION 2306. ROOF LOADS.

(a) General. Roofs shall sustain, within the stress limitations of this Building Code, all dead loads plus unit snow loads set forth in Table 23-B. The snow loads shall be assumed to act vertically on the area projected on a horizontal plane. Potential accumulation of snow at valleys, parapets, roof structures and offsets in roofs of uneven configuration, shall be considered. Unbalanced loading shall be considered when the loading will result in larger members or connections.

(b) Special Purpose. Greenhouses, lath houses and farm accessory buildings shall be designed for a vertical live load of at least 10 pounds per square foot.

(c) Trusses and Arches. Trusses and arches shall be designed to resist the stresses caused by snow loads on 1/2 of the span if the loading results in a reversal of stresses, or stresses greater in any portion than the stresses produced by the required snow load upon the entire span.

(d) Water Accumulation. All roofs shall be provided with slope or camber to assure drainage after the longtime deflection from dead load, or shall be designed to support maximum loads, including possible ponding of water, due to deflection.

SECTION 2307. REDUCTION OF LIVE LOADS. The following reductions in unit live loads as set forth in Table 23-A for floors shall be permitted in the designing of columns, piers, walls, foundations, trusses, beams, and slabs. Except for places of public assembly and for live loads greater than 100 pounds per square foot, the design live load on any member supporting 150 square feet or more may be reduced at the rate of 0.08 percent per square foot of area supported by the member.* The reduction shall not exceed 40 percent for horizontal members, 60 percent for vertical members, nor R as determined by the following formula:

\[ R = 23.1 \left(1 + \frac{D}{L}\right) \]  

WHERE:

\begin{align*}
R &= \text{Reduction in percent;} \\
D &= \text{Dead load supported by the member;} \\
L &= \text{Live load supported by the member.}
\end{align*}

* In a multiple joist system, a member is defined as an individual joist. For storage loads exceeding 100 pounds per square foot, no reduction shall be made except that design live loads on columns may be reduced 20 percent. For roof decks used for parking, 50 psf of the total live load shall be considered reducible. The area for determining live load reduction for slabs shall be no more than the square of the shorter span.

SECTION 2308. LATERAL LOADS AND FORCES.

(a) Design Requirements.

1. Building Separations. All portions of structures shall be designed and constructed to act as an integral unit in resisting horizontal forces unless separated structurally by a distance sufficient to avoid contact under deflection from seismic action or wind forces.
2. **Minor Alterations.** Minor structural alterations may be made in existing buildings and other structures, but the resistance to lateral forces shall be at least that before alterations were made unless the building as altered meets the requirements of this Section.

3. **Combined Vertical and Horizontal Forces.** In computing the effect of seismic force in combination with vertical loads, gravity load stresses induced in members by dead load plus live load, except roof live load, shall be considered.

4. **Exterior Elements.** Precast, nonbearing, nonshear wall panels or other elements which are attached to or which enclose the exterior, shall accommodate movements of the structure resulting from lateral forces or temperature changes. The concrete panels or other elements shall be supported by means of poured in place concrete or by mechanical fasteners in accordance with the following provisions:

   A. Connections and panel joints shall allow for a relative movement between stories of at least 2 times story drift caused by wind or seismic forces, or 1/4 inch, whichever is greater.

   B. Connections shall have sufficient ductility and rotation capacity to preclude fracture of the concrete or brittle failures at or near welds. Inserts in concrete shall be attached to or hooked around reinforcing steel, or otherwise terminated to transfer forces to the reinforcing steel.

   C. Connections to permit movement in the plane of the panel for story drift may be designed sliding connections using slotted or oversize holes or may be connections which permit movement by bending of the steel.

(b) **Definitions.** The following definitions apply only to the provisions of this Section:

**BOX SYSTEM.** A structural system without a complete vertical load-carrying space frame. In this system, the required lateral forces are resisted by shear walls or braced frames as hereinafter defined.

**BRACED FRAME.** A vertical truss, or its equivalent, which is provided to resist lateral forces in the frame system, and in which the members are subjected primarily to axial stresses.

**LATERAL FORCE RESISTING SYSTEM.** That part of the structural system to which the lateral forces prescribed in Section 2308(f)5B are assigned.

**SHEAR WALL.** A wall designed to resist lateral forces parallel to the wall.

**SPACE FRAME.** A 3 dimensional structural system composed of interconnected members, other than bearing walls, laterally supported to function as a complete self-contained unit with or without the aid of horizontal diaphragms or floor bracing systems.

**SPACE FRAME, DUCTILE MOMENT RESISTING.** One complying with the requirements of Section 2308(f)4.

**SPACE FRAME, MOMENT RESISTING.** A vertical load carrying space frame in which the members and joints are capable of resisting design lateral forces by bending moments.

**SPACE FRAME, VERTICAL LOAD CARRYING.** A space frame designed to carry all vertical loads.
(c) **Distribution of Horizontal Shear.** Total shear in any horizontal plane shall be distributed to the various elements of the lateral force resisting system in proportion to their rigidities compared to the rigidity of the horizontal bracing system or diaphragm. Rigid elements which are assumed not to be part of the lateral force resisting system may be incorporated into buildings provided that their effect on the action of the system is provided for in the design.

(d) **Drift.** Lateral deflections, or drift, of a story relative to its adjacent stories shall be designed in accordance with accepted engineering practice.

(e) **Overturning.** Every building or structure shall be designed to resist the overturning effects caused by the wind forces and related requirements specified in Section 2308(g) or the earthquake forces specified in Section 2308(f), whichever governs. The overturning moment calculated from the wind or earthquake forces shall in no case exceed two thirds of the dead load resisting moment. The weight of earth superimposed over footings may be used to calculate the dead load resisting moment.

(f) **Earthquake Regulations.**

1. **General.** All structures and their parts shall be designed to resist seismic forces. Seismic forces on structures which have highly irregular shapes, large differences in lateral resistance or stiffness between different stories or other unusual structural features affecting seismic response shall be determined by an accepted dynamic analysis. The analysis may take inelastic response into account. More regular, usual structures shall be designed to resist minimum seismic forces as specified in this Section unless an accepted dynamic analysis is made to determine forces more accurately. Forces shall be assumed to act horizontally at each floor level above the foundation, and at the roof. Forces shall be assumed to come from either direction along both main axes of a structure but not along both axes simultaneously. Provisions shall be made for the increase in shear resulting from the horizontal torsion due to an eccentricity between the center of mass and the center of rigidity. Negative torsional shears shall be neglected. When the vertical resisting elements depend on diaphragm action for shear distribution at any level, the shear resisting elements shall be capable of resisting a torsional moment assumed to be equivalent to the story shear acting with an eccentricity of not less than five percent of the maximum building dimension at that level.

2. **Symbols and Notations.** The following symbols and notations apply only to the provisions of this Section:

- \( C = \) Numerical coefficient for base shear as specified in Section 2308(f)5A.
- \( C_p = \) Numerical coefficient as specified in Section 2308(f)5B and as set forth in Table No. 23-G.
- \( D = \) The dimension of the building in feet in a direction parallel to the applied forces.
- \( D_s = \) The plan dimension of the vertical lateral force resisting system in feet.
- \( F_i, F_n, F_x = \) Lateral forces applied to level i, n, or x respectively.
- \( F_p = \) Lateral forces on the part of the structure and in the direction under consideration.
\[ F_t = \text{That portion of } V \text{ considered concentrated at the top of the structure, at the level } n. \text{ The remaining portion of the total base shear } V \text{ shall be distributed over the height of the structure, including level } n, \text{ according to Formula 23-8.} \]

\[ h_i, h_n, h_x = \text{Height in feet above the base to level } i, n, \text{ or } x \text{ respectively.} \]

\[ K = \text{Numerical coefficient as set forth in Table No. 23-F} \]

\[ \text{Level } i = \text{Level of the structure referred to by the subscript } i. \]

\[ \text{Level } n = \text{That level which is uppermost in the main portion of the structure.} \]

\[ \text{Level } x = \text{That level which is under design consideration.} \]

\[ M = \text{Overturning moment at the base of the building or structure.} \]

\[ M_x = \text{The overturning moment at level } x. \]

\[ N = \text{Total number of stories above exterior grade.} \]

\[ T = \text{Fundamental period of vibration of the building or structure in seconds in the direction under consideration.} \]

\[ V = \text{Total lateral load or shear at the base.} \]

\[ V = F_t + \sum_{i=1}^{n} F_i \ldots \ldots \ldots (23-2) \]

where \( i = 1 \) designates first level above the base.

\[ W = \text{Total dead load as defined in Section 2301 including the partition loading specified in Table 23-A where applicable.} \]

**EXCEPTION:** \( W \) shall be equal to the total dead load plus 25 percent of the floor live load in storage and warehouse occupancies.

\[ w_i, w_x = \text{That portion of } W \text{ which is located at or is assigned to level } i \text{ or } x \text{ respectively.} \]

\[ W_p = \text{The weight of a part or portion of a structure.} \]

3. **Setbacks.** Buildings having setbacks wherein the plan dimension of the tower in each direction is at least 75 percent of the corresponding plan dimension of the lower part may be considered as a uniform building without setbacks for the purpose of determining seismic forces.

For other conditions of setbacks, the tower shall be designed as a separate building using the larger of the seismic coefficients at the base of the tower determined by considering the tower as either a separate building for its own height, or as part of the overall structure. The resulting total shear from the tower shall be applied at the top of the lower part of the building which shall be otherwise considered separately for its own height.

4. **Structural Systems.**

A. **Design Requirements.** All buildings designed with a horizontal force factor \( K \cdot 0.67 \) or 0.80 shall have ductile moment resisting space frames. Moment resisting space frames and ductile moment resisting space frames may be enclosed by or adjoined by more rigid elements which would tend to prevent the space frame from resisting lateral forces where it can be shown that
the action of the more rigid elements will not impair the vertical and lateral load resisting ability of the space frame. Other structural concepts may be approved by the Department when evidence is submitted that equivalent ductility and energy absorption are provided.

B. **Construction.** The necessary ductility for a ductile moment resisting space frame shall be provided by a frame of structural steel with moment resisting connections complying with Chapter 27 or by a reinforced concrete frame complying with Chapter 26. Braced frames in buildings shall be composed of axially loaded bracing members of structural steel with ASTM designations having yield points from 36 to 50 ksi; or reinforced concrete members conforming to the requirements of Chapter 26. In buildings where K = 0.67 and K = 0.80 all structural elements below the base required to transmit seismic forces to the foundation shall be composed of structural steel complying with Chapter 27, or reinforced concrete complying with Chapter 26.

5. **Minimum Earthquake Forces for Structures.**

A. **Total Base Shear and Vertical Distribution.** The minimum base shear force to be considered in design shall be

\[ V = 0.25 K C W \]  \hspace{1cm} (23-3)

in which K is a coefficient reflecting the lateral stiffness of the structure and is given in Table No. 23-F

\[ C = \frac{0.05}{3\sqrt{T}} \leq 0.10 \]  \hspace{1cm} (23-4)

Except that C = 0.10 for all one and two story buildings T is the fundamental period of vibration of the structure in seconds in the direction considered.

Unless a more accurate determination is made,

\[ T = \frac{0.05h_n}{\sqrt{D}} \]  \hspace{1cm} (23-5)

except when the lateral force resisting system consists of a moment-resisting space frame which resists all the lateral forces and which is not enclosed by or adjoined by more rigid elements which would tend to prevent the frame from resisting lateral forces:

\[ T = 0.10N \]  \hspace{1cm} (23-6)

The base shear force, V shall be distributed vertically according to the following equations.

\[ F_t = 0.004V \left(\frac{h_n}{D_s}\right)^2 \leq 0.15V \]  \hspace{1cm} (23-7)

\[ F_t = 0 \text{ for } \left(\frac{h_n}{D_s}\right) \leq 3 \]
\[ F_x = \frac{(V-F_l)w_x h_x}{\sum_{i=1}^{n} w_i h_i} \]  \hspace{1cm} (23-8)

For one and two story buildings, the distribution shall be considered uniform rather than as given above.

The force, \( F \) at each level shall be assumed distributed horizontally in the same manner as the mass at that level.

B. **Lateral Force on Parts or Portions of Structures.** The minimum force on a part or portion of a structure shall be taken as

\[ F_p = 0.25 \ C_p \ W_p \]  \hspace{1cm} (23-9)

in which \( C_p \) is a coefficient given in Table 23-G.

The force shall be assumed distributed in the same manner as the weight.

(g) **Wind Forces on Structures.**

1. **General.** Buildings or other structures shall be designed to withstand the minimum wind loads set forth below, or set forth in the American National Standard Institute A58.1, at the option of the engineer. The A58.1 Standard, if used, is to be applied in accordance with the requirements of Section 2308(g)8. If the A58.1 method is not used, the structures shall be designed to withstand the minimum horizontal pressures set forth in Table No. 23-C.

2. **Walls.** All exterior walls shall be capable of withstanding the basic wind loads at that level, acting either inwardly or outwardly, and all construction shall be anchored to resist these loads.

3. **Doors and Windows.** Doors and windows shall be capable of withstanding the same positive pressures and 1-1/4 times the negative pressure for walls.

4. **Wind Loads on Roofs.**
   
   A. **Test Determination.** The effect of the shape of irregular or unusual roofs may be determined by wind tunnel tests. In determining the effect of shape, the assumed wind velocity shall be 90 miles per hour and the relative air density 0.85.

   B. **Pitched Roofs.** The external wind forces on pitched roofs with a slope greater than 7 to 12 shall be assumed to be at least 1/2 the basic pressure at that level normal to the windward side, and negative pressure of not less than 1/2 the basic pressure at that level normal to the leeward side. All roofs with a slope of 7 to 12 or less shall be designed for uplift of 3/4 times the basic pressure at that level.

   C. **Uplift of Eaves.** Roofs of buildings unenclosed on one or more sides, marquees, or similar structures, overhanging eaves, cornices, and other roof projections shall be designed and constructed to withstand a total uplift of 2 times the basic pressure at that level.

   D. **Anchorages.** Roof framing shall be anchored to supporting members, which in turn shall be anchored to the foundations to
resist wind uplift and sliding. 75 percent of the dead load shall be considered in resisting these forces.

5. **Solid Towers.** Chimneys, tanks, and solid towers shall be designed and constructed to withstand the pressures specified in this Section, multiplied by the factors specified in Table No. 23-D.

6. **Open Frame Towers.** Radio towers and other towers of trussed construction shall be designed and constructed to withstand wind pressures specified in this Section, multiplied by the shape factors in Table No. 23-E. Wind pressures shall be applied to the total normal projected area of all the elements of one face excluding ladders, conduits, lights, elevators, etc., which shall be accounted for separately by using the indicated factor for these individual members.

7. **Signs.**
   A. Signs in which the open area is less than one-third of the gross area shall be considered as solid signs and the gross area shall be used in computing wind loads. Solid signs shall be designed to withstand the wind loads given in Table 23-C.
   B. Open signs shall be designed to withstand one-and-one-half times the wind loads, applied to the net exposed surface.
   C. The requirements for structural drawings, specifications, and analysis indicated in Chapter 3 shall apply when required by the Department.
   D. For signs not covered in A through C, see 5 and 6 of this Section.

8. **Option.** Where the option is taken to determine the structural loading in accordance with ANSI A58.1 Code, the following conditions shall be utilized:
   A. The value of air density used in equation 2 of paragraph 6.3.4 shall be taken at 85 percent of air density at sea level.
   B. The basic windspeed (extreme fastest mile) shall be taken as 80 miles per hour for a 50-year mean recurrence interval, and 90 mph for a 100-year mean recurrence interval.
   C. All structures over 2 stories or 30 feet in overall height shall be designed for at least 50-year mean recurrence interval wind.
   D. All structures over 10 stories or 120 feet in overall height shall be designed for at least a 100-year mean recurrence interval wind.

9. **Miscellaneous Structures.** Greenhouses, lath houses, and agricultural buildings shall be designed for a wind pressure of at least 10 pound per square foot.

10. **Unusual Configuration.** All structures of unusual configuration or heights as defined by the Department shall be designed in accordance with analysis and testing procedures approved by the Department.

(h) **Structural Masonry And Concrete.** All elements within a structure which are of masonry or concrete, and which are intended to resist either seismic or wind lateral forces shall be calculated by accepted structural analysis. When this analysis indicates stresses greater than allowed for unreinforced masonry or concrete, the elements shall be reinforced to qualify as partially reinforced masonry, reinforced masonry, or reinforced concrete as specified in Chapters 24 and 26 respectively.
### LEGEND

<table>
<thead>
<tr>
<th>AASHTO</th>
</tr>
</thead>
</table>

### ORGANIZATION

<table>
<thead>
<tr>
<th>American Association of State and Transportation Officials</th>
</tr>
</thead>
<tbody>
<tr>
<td>341 National Press Building</td>
</tr>
<tr>
<td>Washington, D.C. 20004</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>American National Standards Institute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1430 Broadway</td>
</tr>
<tr>
<td>New York, N.Y. 10018</td>
</tr>
</tbody>
</table>

### SECTION 2314. TABLES.
(i) **Anchorage.** Concrete or masonry walls shall be anchored to all floors and roofs which provide lateral support for the wall or which are required to provide stability for the wall. The anchorage shall be capable of resisting the horizontal forces specified in this Chapter or a minimum force of 100 pounds per lineal foot of wall, whichever is the larger.

**SECTION 2309. LIVE LOADS POSTED.** Live loads used for the design of warehouses, parking structures, or manufacturing buildings shall be conspicuously posted by the owner in that part of each story to which they apply. Durable metal signs shall be used, and it shall be unlawful to remove or deface such notices. The occupant of the building shall be responsible for maintaining actual loading equal to or below these posted loads.

**SECTION 2310. RETAINING WALLS.** Retaining walls shall be designed to resist the lateral pressure of the retained material in accordance with accepted engineering practice. Walls retaining drained earth may be designed for pressure equivalent to that exerted by a fluid weighing not less than 30 pounds per cubic foot and having a depth equal to that of the retained earth. Any surcharge shall be in addition to the equivalent fluid pressure.

**SECTION 2311. INTERIOR WALLS.** Interior walls, permanent partitions, and temporary partitions which exceed 6 feet in height shall be designed to resist all loads to which they are subjected but not less than a force of five pounds per square foot applied perpendicular to the walls. The deflection of such walls under a load of five pounds per square foot shall not exceed 1/240 of the span for walls with brittle finishes and 1/120 of the span for walls with flexible finishes.

**SECTION 2310. HELISTOP LANDING AREAS.**

(a) In addition to other design requirements of this Chapter, helistop landing or touchdown areas shall be designed for the maximum stress induced by the following:

1. Dead load plus actual weight of the helicopter.
2. Dead load plus a single concentrated impact load covering 1 square foot. The impact load shall be .75 times the fully loaded weight of the helicopter if it is equipped with hydraulic type shock absorbers, or 1.5 times the fully loaded weight of the helicopter if it is equipped with a rigid or skid type landing gear.
3. The dead load plus a uniform live load of 50 pounds per square foot. The required live load may be reduced in accordance with the formula in Section 2307.

**SECTION 2313. STANDARDS.** Unless otherwise specified in other portions of this Building Code, the following Standards shall apply.

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
</table>
| ANSI         | Building Code Require
| AASHTO       | Policies on the Design of Urban Highways and Arterial Streets. |
# TABLE NO. 23-A
## UNIT LIVE LOADS

<table>
<thead>
<tr>
<th>OCCUPANCY OR USE</th>
<th>Live Load Lbs. Per Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly (Public)</td>
<td></td>
</tr>
<tr>
<td>Armories and drill rooms</td>
<td>150</td>
</tr>
<tr>
<td>Lobbies, foyers, vestibules, balconies and similar public spaces of hotels, workplaces, clubs and public buildings, churches and assembly halls without fixed seats, dance halls, public dining rooms and restaurants including kitchens, gymnasiums, skating rinks</td>
<td>100</td>
</tr>
<tr>
<td>Auditoriums, churches, and assembly halls with fixed seats, including aisles, passageways and balconies. Theatre stages, gridirons and fly galleries.</td>
<td>60</td>
</tr>
<tr>
<td>Business</td>
<td></td>
</tr>
<tr>
<td>Offices</td>
<td>50</td>
</tr>
<tr>
<td>Structures shall be designed for file, computer, and special equipment loads, when applicable.</td>
<td></td>
</tr>
<tr>
<td>Corridors</td>
<td></td>
</tr>
<tr>
<td>Serving assembly halls in theatres, penal institutions, churches, school buildings</td>
<td>100</td>
</tr>
<tr>
<td>Other Corridors: Same loading as heaviest occupancy from which they provide egress</td>
<td></td>
</tr>
<tr>
<td>Educational</td>
<td></td>
</tr>
<tr>
<td>Classroom, not exceeding 1200 sq. ft. in area, or larger size rooms with fixed seats</td>
<td>50</td>
</tr>
<tr>
<td>Class and lecture rooms in excess of 1200 sq. ft. in area without fixed seats</td>
<td>75</td>
</tr>
<tr>
<td>Libraries:</td>
<td></td>
</tr>
<tr>
<td>Stack rooms</td>
<td>150</td>
</tr>
<tr>
<td>Reading rooms</td>
<td>60</td>
</tr>
<tr>
<td>Garages (Loads include impact)</td>
<td></td>
</tr>
<tr>
<td>Passenger cars, floor and ramps used for parking</td>
<td>50</td>
</tr>
<tr>
<td>Passenger cars, roof decks used for parking including snow load</td>
<td>65</td>
</tr>
<tr>
<td>Trucks (Applicable AASHTO Loading)</td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>Equipment and machinery rooms designed for use, but not less than.</td>
<td>125</td>
</tr>
<tr>
<td>Manufacturing: Load to be determined from proposed use or occupancy, but never less than</td>
<td>100</td>
</tr>
</tbody>
</table>
### TABLE NO. 23-A

**UNIT LIVE LOADS**

<table>
<thead>
<tr>
<th>OCCUPANCY OR USE</th>
<th>Live Load Lbs. Per Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional</strong></td>
<td></td>
</tr>
<tr>
<td>Hospitals, asylums, infirmaries, sanitariums, nurseries, orphanages, home for aged, penal institutions, reformatories, jails and houses of correction</td>
<td>40</td>
</tr>
<tr>
<td>Operating and X-ray rooms</td>
<td>60</td>
</tr>
<tr>
<td><strong>Mercantile</strong></td>
<td></td>
</tr>
<tr>
<td>Retail (Light merchandise)</td>
<td>75</td>
</tr>
<tr>
<td>Wholesale (Light merchandise)</td>
<td>100</td>
</tr>
<tr>
<td><strong>Residential</strong></td>
<td></td>
</tr>
<tr>
<td>Lounge, recreational areas; exterior balconies</td>
<td>60</td>
</tr>
<tr>
<td>All parts of private dwellings, rooms and suites in apartment houses, lodging houses and clubs, educational and religious institutions, including corridors giving access thereto, and bedrooms of hotels</td>
<td>40</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>125</td>
</tr>
<tr>
<td>Heavy: (Load to be determined from proposed use or occupancy, but never less than</td>
<td>250</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
</tr>
<tr>
<td>Bleachers, grandstands, stadiums: 100 pounds per square foot of horizontal projection for the structure as a whole. Seatboards and floorboards shall be designed for 120 pounds of vertical load per linear foot. In addition, the structure shall be designed to resist sway forces of 10 pounds front-to-back and 24 pounds side-to-side per linear foot of seats. Sway forces, wind forces, and seismic forces need not be applied simultaneously. Ceiling Framing: (Does not apply to ceilings which have sufficient total access from below, such that access is not required within the space above the ceiling)</td>
<td>10</td>
</tr>
<tr>
<td>Elevators, dumbwaiters, escalators, and moving loads in accordance with Chapter 55.</td>
<td></td>
</tr>
</tbody>
</table>

**Impact:**

Moving or vibrating loads shall be increased as follows:

- Heavy equipment and moving loads, 25 percent.
- All craneways shall be designed to resist a horizontal transverse force equal to 20 percent to the sum of the crane capacity and the weight of the trolley applied at the top of runway rails in proportion to the stiffness of the supporting structure. In addition, all craneways shall be designed to resist horizontal longitudinal forces equal to 10 percent of the total of the maximum wheel loads applied at the top of each rail. Moving loads not specified involving an impact load shall be as approved by the Department.
### TABLE NO. 23-A

#### UNIT LIVE LOADS

<table>
<thead>
<tr>
<th>OCCUPANCY OR USE</th>
<th>Live Load Lbs. Per Sq. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Partitions:</strong></td>
<td></td>
</tr>
<tr>
<td>A uniform load equivalent to 1/12 of the weight of one linear foot of partition or the actual weight of the partitions if known.</td>
<td></td>
</tr>
<tr>
<td>Lateral load</td>
<td></td>
</tr>
<tr>
<td><strong>Railings:</strong></td>
<td>5</td>
</tr>
<tr>
<td>A uniform horizontal or vertical force applied at the top of the rail equal to 50 pounds per linear foot.</td>
<td></td>
</tr>
<tr>
<td><strong>Rest rooms:</strong></td>
<td></td>
</tr>
<tr>
<td>Loads shall be not less than the load for the occupancy with which they are associated but need not exceed 50 pounds per square foot.</td>
<td></td>
</tr>
<tr>
<td><strong>Sidewalks and driveways:</strong></td>
<td></td>
</tr>
<tr>
<td>Over area ways or basements</td>
<td>250</td>
</tr>
<tr>
<td>or in accordance with AASHTO H-20.</td>
<td></td>
</tr>
<tr>
<td><strong>Stairs:</strong></td>
<td>100</td>
</tr>
<tr>
<td>Except in Type I Occupancy</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE NO. 23-B

**SNOW LOADS**  
Roof Snow Loads, in PSF, on Horizontal  
Projection of Roof Member  
(Also see Section 2306)

<table>
<thead>
<tr>
<th>SLOPE</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 4 inches per foot</td>
<td>30</td>
</tr>
<tr>
<td>Between 4 inches and 12 inches per foot</td>
<td>25</td>
</tr>
<tr>
<td>Greater than 12 inches per foot</td>
<td>20</td>
</tr>
</tbody>
</table>

### TABLE NO. 23-C

**WIND PRESSURES**  
Wind Pressure in PSF For Various Height Zones Above Ground

<table>
<thead>
<tr>
<th>HEIGHT ZONE (Feet)</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>20</td>
</tr>
<tr>
<td>30 to 49</td>
<td>25</td>
</tr>
<tr>
<td>50 to 99</td>
<td>30</td>
</tr>
<tr>
<td>100 to 300</td>
<td>40</td>
</tr>
<tr>
<td>Over 300</td>
<td>Special Study</td>
</tr>
<tr>
<td></td>
<td>Required</td>
</tr>
</tbody>
</table>

### TABLE NO. 23-D

**MULTIPLYING FACTORS FOR WIND PRESSURES**  
**FOR CHIMNEYS, TANKS AND SOLID TOWERS**

<table>
<thead>
<tr>
<th>Horizontal Cross Section</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square or rectangular</td>
<td>1.00</td>
</tr>
<tr>
<td>Hexagonal or octagonal</td>
<td>0.80</td>
</tr>
<tr>
<td>Round or elliptical</td>
<td>0.60</td>
</tr>
<tr>
<td>Type of Exposure</td>
<td>Factor</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Wind normal to one face of tower:</td>
<td></td>
</tr>
<tr>
<td>four-cornered, flat or angular sections, steel or wood</td>
<td>2.20</td>
</tr>
<tr>
<td>three-cornered, flat or angular sections, steel or wood</td>
<td>2.00</td>
</tr>
<tr>
<td>Wind on corner:</td>
<td></td>
</tr>
<tr>
<td>four-cornered tower, flat or angular sections</td>
<td>2.40</td>
</tr>
<tr>
<td>Wind parallel to one face of three:</td>
<td></td>
</tr>
<tr>
<td>cornered tower, flat or angular sections</td>
<td>1.50</td>
</tr>
<tr>
<td>Factors for towers with cylindrical elements shall be two-thirds of those for similar towers with flat or angular sections.</td>
<td></td>
</tr>
<tr>
<td>Wind on individual members:</td>
<td></td>
</tr>
<tr>
<td>Cylindrical members</td>
<td></td>
</tr>
<tr>
<td>Two inches or less in diameter</td>
<td>1.00</td>
</tr>
<tr>
<td>Over two inches in diameter</td>
<td>0.80</td>
</tr>
<tr>
<td>Flat or angular sections</td>
<td>1.30</td>
</tr>
<tr>
<td>TYPE OF ARRANGEMENT OF RESISTING ELEMENTS</td>
<td>Value of K</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>All building framing systems except as hereinafter classified.</td>
<td>1.00</td>
</tr>
<tr>
<td>Buildings with a box system specified in Section 2308 (b)</td>
<td>1.33</td>
</tr>
<tr>
<td>Buildings with a dual bracing system consisting of a ductile moment resisting space frame and shear walls using the following design criteria: (1) The frames and shear walls shall resist the total lateral force in accordance with their relative rigidities, considering the interaction of the shear walls and frames. (2) The shear walls acting independently of the ductile moment resisting portions of the space frame shall resist the total required lateral forces. (3) The ductile moment resisting space frame shall have the capacity to resist not less than 25 percent of the required lateral force.</td>
<td>0.80</td>
</tr>
<tr>
<td>Buildings with a ductile moment-resisting space frame designed in accordance with the following criteria: The ductile moment-resisting space frame shall have the capacity to resist the total required lateral force.</td>
<td>0.67</td>
</tr>
<tr>
<td>Elevated tanks plus full contents on four or more cross-braced legs, and not supported by a building.</td>
<td>3.00</td>
</tr>
<tr>
<td>Structures other than buildings and other than those set forth in Table No. 23-G.</td>
<td>2.00</td>
</tr>
</tbody>
</table>

---

a Where wind loads as specified in Section 2306 would produce higher stresses, this load shall be used in lieu of the loads resulting from earthquake forces.
b The minimum value of "KC" shall be 0.12 and the maximum value of "KC" need not exceed 0.25.
c The tower shall be designed for an accidental torsion of five percent as specified in Section 2308 (f)
Elevated tanks which are supported by buildings or do not conform to type or arrangement of supporting elements as described above shall be designed in accordance with Section 2308 (f) SB using "C_\text{p} = .2".
<table>
<thead>
<tr>
<th>PART OR PORTION OF BUILDINGS</th>
<th>Direction of Force</th>
<th>Value of $C_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior bearing and nonbearing walls, interior bearing walls and partitions, interior nonbearing walls and partitions over 10 feet in height, masonry or concrete fences over 6 feet in height&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Normal to flat surface</td>
<td>0.20</td>
</tr>
<tr>
<td>Cantilever parapet and other cantilever walls, except retaining walls</td>
<td>Normal to flat surface</td>
<td>1.00</td>
</tr>
<tr>
<td>Exterior and interior ornamental and appendages</td>
<td>Any direction</td>
<td>1.00</td>
</tr>
<tr>
<td>When connected to, part of, or housed within a building: tanks, towers, and tanks plus contents, storage racks over 6 feet in height plus contents, chimneys, smokestacks, and penthouses</td>
<td>Any direction</td>
<td>0.20&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>When resting on the ground, tank plus effective mass of its contents</td>
<td>Any direction</td>
<td>0.10</td>
</tr>
<tr>
<td>Suspended ceiling framing systems&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Any direction</td>
<td></td>
</tr>
<tr>
<td>Floors and roofs acting as diaphragms&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Any direction</td>
<td>0.10</td>
</tr>
<tr>
<td>Connections for exterior panels or for elements complying with Section 2308 (a)</td>
<td>Any direction</td>
<td>2.00</td>
</tr>
<tr>
<td>Connections for prefabricated structural elements other than walls, with force applied at center of gravity of assembly&lt;sup&gt;f&lt;/sup&gt;</td>
<td>Any horizontal direction</td>
<td>0.30</td>
</tr>
</tbody>
</table>

<sup>a</sup> See also Table 23-A for minimum load criteria for interior partitions.

<sup>b</sup> When located in the upper portion of any building where the $h/D$ ratio is five to one or greater, the value shall be increased by 50 percent.

<sup>c</sup> "Wp" for storage racks shall be the weight of the racks plus contents. The value of "Cp" for racks over two storage support levels in height shall be .16 for the levels below the top two levels.

<sup>d</sup> For purposes of determining the lateral force, a minimum ceiling weight of 5 pounds per square foot shall be used.

<sup>e</sup> Floors and roofs acting as diaphragms shall be designed for minimum value of "Cp" of 10 percent applied to loads tributary from that story unless a greater value of "Cp" is required by the basic seismic formula $V = ZKCW$.

<sup>f</sup> The "Wp" shall be equal to the total load plus 25 percent of the floor live load in storage and warehouse occupancies.
CHAPTER 24
MASTERY

SECTION 2401. GENERAL.
(a) Scope. In addition to the other requirements of this Building Code, this
Chapter shall govern the design, construction, and materials of masonry
for any building or structure. In the event of conflict with provisions of
other Chapters, this Chapter shall govern.
(b) Masonry Defined. An assemblage of masonry units bonded together
with mortar.
(c) Design and Construction. Design and construction of masonry shall
conform to this Chapter and Colorado Masonry Institute Standard
301-76, "Building Code Requirements for Masonry Construction."

SECTION 2402. LOADS. Masonry shall be capable of supporting the
applicable loads specified in Chapter 23.

SECTION 2403. APPROVAL OF SPECIAL SYSTEMS OF DESIGN OR
CONSTRUCTION. See Chapter 1, Alternate Methods and Materials.

SECTION 2404. STRENGTH EVALUATION OF STRUCTURES.
(a) General. If doubt develops concerning the safety of a masonry struc-
ture or member, the Department shall have the right to order a struc-
tural strength investigation by analysis or by means of load tests.
(b) General Requirements for Analytical Investigations. If the
strength evaluation is by analytical means, a thorough field investiga-
tion shall be made of the dimensions and details of the members, prop-
ties of the materials, and other pertinent conditions of the structure as
actually built. The analysis based on this investigation shall satisfy the
Department that the load factors meet the requirements and intent of
this Building Code.
(c) Load Tests. If the strength evaluation is by load tests, a qualified
engineer, acceptable to the Department, shall conduct the tests.
1. A load test shall not be made until the portion of the structure sub-
ject to load is at least 56 days old unless the owner of the struc-
ture, the contractor, and all involved parties mutually agree that the
test may be made at an earlier age.
2. When a load test is required, the member or portion of the structure
under investigation shall be subject to a total load, including the
dead loads already in place, equivalent to 0.85 (1.4 D + 1.7 L). This
load shall be left in position for a period of 24 hours before removal.
If, during the test or upon removal of the load, the member or por-
tion of the structure shows evidence of failure, changes or modifica-
tions necessary to restore the structure to the rated capacity shall be
made, or a lower rated capacity shall be established. A flexural
member shall be considered to have passed the test if the maximum
deflection "Δ" at the end of the 24-hour period does not exceed:

\[ \Delta = \frac{l}{200} \text{ nor } \Delta = \frac{L^2}{4000t} \]
and the beams and slabs show a recovery of least 75% of the observed deflection within 24 hours after removal of the load.

NOMENCLATURE:

\[ D = \text{dead load} \]

\[ L = \text{live load} \]

\[ \Delta = \text{deflection} \]

\[ \ell = \text{span of a member} \]

\[ t = \text{thickness or depth of a member} \]

SECTION 2405. APPLICABLE STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply.

ORGANIZATION

<table>
<thead>
<tr>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM</td>
</tr>
<tr>
<td>Aggregate for Masonry Mortar, C144. - 1970</td>
</tr>
<tr>
<td>Aggregate for Masonry Grout, C404. - 1970</td>
</tr>
<tr>
<td>Hydrated Lime for Masonry Purposes, C207. - 1974</td>
</tr>
<tr>
<td>Masonry Cement, C91. - 1971</td>
</tr>
<tr>
<td>Portland Cement, Type I, IA, II, IIA, III, or IIIA, C150. - 1974</td>
</tr>
<tr>
<td>Facing Brick, C216. - 1971</td>
</tr>
<tr>
<td>Calcium Silicate Face Brick (Sand-Lime Brick). - 1972</td>
</tr>
<tr>
<td>Hollow Non-Load-Bearing Concrete Masonry Units, C129. - 1973</td>
</tr>
<tr>
<td>Hollow Load-Bearing Concrete Masonry Units, C90. - 1970</td>
</tr>
<tr>
<td>Gypsum Partition Tile or Block, C52. - 1972</td>
</tr>
<tr>
<td>Sampling and Testing of Concrete Masonry Units, C140. - 1970</td>
</tr>
<tr>
<td>Welded Steel Wire Fabric For Concrete Reinforcement, A185. - 1975</td>
</tr>
<tr>
<td>Deformed Steel Wire for Concrete Reinforcement, A496. - 1972</td>
</tr>
<tr>
<td>Deformed Billet-Steel Bars for Concrete Reinforcement, A615. - 1974</td>
</tr>
<tr>
<td>Rail-Steel Deformed Bars for Concrete Reinforcement, A616. - 1972</td>
</tr>
<tr>
<td>Axle-Steel Deformed Bars for Concrete Reinforcement, A617. - 1972</td>
</tr>
<tr>
<td>Zinc Coating (Hot Dip) on Iron or Steel Hardware, Class B-1, B-2, or B-3, A153. - 1973</td>
</tr>
<tr>
<td>Hard-Drawn Copper Covered Steel Wire, Grade 30HS, B227. - 1970</td>
</tr>
<tr>
<td>Electrodeposited Coatings of Cadmium On Steel, A165. - 1971</td>
</tr>
<tr>
<td>Building Sandstone, C616. - 1972</td>
</tr>
<tr>
<td>Structural Granite, C615. - 1972</td>
</tr>
<tr>
<td>Structural Slate, C629 - 1972</td>
</tr>
</tbody>
</table>
ICBO  
Cast Stone, UBC Standard No. 24 - 14 - 1973

CMI  
Building Code Requirements for Masonry Construction, Standard 301. - 1976

ASTM  
Hollow Brick, C652. - 1970
Structural Clay Facing Tile, C212. - 1970
Structural Clay Load-Bearing Wall Tile, C34. - 1970
Structural Clay Non-Load-Bearing Tile, C56. - 1971
Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units, C126. - 1971
Concrete Building Brick, C55 - 1971
Solid Load-Bearing Concrete Masonry Units, C145. - 1971

LEGEND

ORGANIZATION

ASTM  
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa.  19103

ICBO  
International Conference of Building Officials (Uniform Building Code)
5360 South Workman Mill Road
Whittier, Calif.  90601

CMI  
Colorado Masonry Institute
3003 East Third Avenue
Denver, Co.  80206
CHAPTER 25
WOOD

SECTION 2501. GENERAL.

(a) Quality and Design. The quality and design of wood members and their fastenings shall conform to the provisions of this Chapter, and to the Standards hereinafter specified.

(b) Construction. All members shall be framed, anchored, tied, and braced so as to develop the strength and rigidity necessary for the purposes they are intended.

(c) Fabrication. Preparation, fabrication, and installation of wood members and their fastenings shall conform to accepted engineering practice and to the requirements of this Building Code.

(d) Rejection. The Department may deny permission for the use of a wood member where grade characteristics or defects are present in such a combination that they affect the serviceability of the member.

(e) Minimum Quality.
   1. Minimum capacity of structural framing members may be established by performance tests. When tests are not made, capacity shall be based upon allowable stress and design criteria specified in this Building Code.

   2. Studs, joists, rafters, foundation plates, or sills, planking 2 inches or more in depth, beams, stringers, posts, structural sheathing and similar load-bearing members shall be of at least the minimum grades set forth in the NFPA-NDS. Approved end-jointed lumber may be used interchangeably with solid sawn members of the same species and grade. Such use shall include, but not be limited to light framing joists, planks and decking.

   3. Plywood shall be of species Group 1, 2, 3, or 4 and shall be one of the grades specified in PS-1.

(f) Shrinkage. Design consideration shall be given to the possible effect of cross grain dimensional changes considered vertically which may occur in lumber fabricated in a green condition.

SECTION 2502. DEFINITIONS AND SYMBOLS.

(a) Definitions. The following terms used in this Chapter shall have the meanings indicated in this Section:

FIBERBOARD. A fibrous-felted, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot but more than 10 pounds per cubic foot and conforming to ASTM D2277, ASTM C-208 or PS-57.

GLUED BUILT-UP MEMBERS. Structural elements, the sections of which are composed of built-up lumber, plywood, or plywood in combination with lumber with all parts bonded together with adhesive.

GRADE. The classification of lumber with respect to strength and utility in accordance with the grading rules of an approved lumber grading agency listed at the end of this Chapter.

NOMINAL SIZE (lumber). The commercial size designation of width and depth in standard sawn lumber and glued-laminated lumber grades.
in accordance with PS-20 for sawn lumber and AITC-113 for structural glued-laminated timber.

NORMAL LOADING. A design load that stresses a member or fastening to the full allowable stress tabulated in the NFPA-NDS. This loading may be applied for approximately 10 years, either continuously or cumulatively, and 90 percent of this load may be applied for the remainder of the life of the member or fastening.

PARTICLE BOARD. A mat-formed panel manufactured from lignocellulosic materials in the form of discrete pieces or particles, as distinguished from fibers, combined with a binder and bonded together under heat and pressure in accordance with CS-236.

PLYWOOD. A built-up panel of laminated veneers conforming to PS-1.

STRUCTURAL GLUED-LAMINATED TIMBER. Any member comprising and assembly of laminations of lumber in which the grain of all laminations is approximately parallel longitudinally; in which the laminations are bonded with adhesives; and which is fabricated in accordance with PS-56 and AITC 117, 119, and 120.

TREATED WOOD. Wood treated with an approved preservative under the treating and quality control requirements specified in AWPA and AWPB Standards.

WOOD OF NATURAL RESISTANCE TO DECAY. The heartwood of bald cypress, black locust, black walnut, the cedars and redwood.

SECTION 2503. SIZE OF STRUCTURAL MEMBERS. Size of lumber and structural glued-laminated timber referred to in this Building Code are nominal sizes. Computations to determine the required sizes of members shall be based upon net dimensions (actual sizes) and not the nominal sizes.

SECTION 2504. STRESSES.

(a) General.

1. Except as hereinafter provided, stresses shall not exceed the allowable unit stresses for the respective species and grades or fabricated products as set forth in the NFPA-NDS for lumber and AITC-117, 119 and 120 for structural glued-laminated timber.

2. The values for allowable unit stress for extreme fiber in bending and for compression parallel to grain tabulated in the NFPA-NDS for visually stress-rated and machine stress-rated lumber are for the design of structures when the strength of an individual member is premised on the assumption that each individual piece carries its full design load.

3. The repetitive member design values for allowable unit stress for extreme fiber in bending tabulated in the NFPS-NDS may be used for the design of an assembly of repetitive framing such as joists, rafters, and studs not over 4 inches in thickness spaced not more than 24 inches, not less than 3 in number and joined by transverse load distributing elements adequate to support the design load.

4. Values for species and grades not tabulated shall be approved by the Department.

5. Values for plywood shall be in accordance with Plywood Design Specifications APA Y510. All plywood designed to be exposed in outdoor applications shall be exterior type.
(b) **Wood Poles and Piles.** The values tabulated in Table 25-E shall be used for the design of round timber poles and piles. Poles shall conform to the requirements set forth in ANSI 05.1. Piles shall conform to the requirement set forth in ASTM D-25 and ASTM D-2899.

(c) **Adjustment of Stresses.**

1. **General.** The allowable unit stresses specified in this Chapter shall be subject to the adjustments set forth in the footnotes to the appropriate stress tables and to the requirement of this Subsection.

2. **Preservative treatment.** The values for wood pressure impregnated with an approved process and preservative need no adjustment.

3. **Fire-retardant treatment.** The values shall be reduced 10 percent for lumber pressure impregnated with approved fire-retardant chemicals. The stress values for plywood so treated shall be reduced 16 percent, and modulus of elasticity shall be reduced 10 percent. Other adjustments are applicable. Where structural glued-laminated timber is fire-retardant treated, values shall be approved by the Department upon submission of test data.

4. **Duration of load.** Values for wood and mechanical fastenings (when the wood determines the load capacity) are subject to the follow-adjustments for the various durations of loading:

   A. Where a member is fully stressed to the maximum allowable stress, either continuously or cumulatively, for more than 10 years under the conditions of maximum design load, the values shall not exceed 90 percent of those in the tables.

   B. When the duration of the full maximum load during the life of the member does not exceed the period indicated below, the values may be increased in the tables as follows:
   
   15 percent for 2 months duration, as for snow.
   25 percent for 7 days duration, as for construction loads.
   33 1/3 percent for wind or earthquake.
   100 percent for impact.

   The foregoing increases are not cumulative. For combined duration of loadings the resultant structural members shall not be smaller than required for the longer duration of loading.

   C. Values for normal loading conditions may be used without regard to impact if the stress induced by impact does not exceed the values for normal loading.

**SECTION 2505. IDENTIFICATION.**

(a) **General.** All lumber, plywood, particleboard, structural glued-laminated timber, end-jointed lumber, piles and poles regulated by this Building Code shall conform to the applicable standards or grading rules specified in this Chapter and shall be identified by the grade mark or a Certificate of Inspection issued by an approved agency.

(b) **Treated.** All preservative treated lumber and plywood shall be identified by the Quality mark of an approved inspection agency.

**SECTION 2506. BEAM AND COLUMN DESIGN.**

(a) **General.** Provisions and formulas from NFPA-NDS shall be used in the
design of wood beams and columns. Allowable stresses shall be as permitted in AITC-120 or NFPA-NDS.

(b) Notching. If possible, notching of beams shall be avoided. For a beam notched at or near the middle of the span, the net depth shall be used when determining the flexural strength. For effect of notch on shear strength, See NFPA-NDS.

(c) Lateral Moment Distribution. Lateral moment distribution of a concentrated load from a critically loaded beam to adjacent parallel beams shall be calculated.

(d) Lateral Support for Horizontal Members.
   1. Floor joists having a depth of more than 6 inches shall be supported laterally by cross bridging installed at intervals not exceeding 8 feet.
   2. Roof joists having a depth of more than 6 inches shall be supported laterally by cross bridging installed at intervals not exceeding 10 feet.
   3. Joists shall be blocked at supports as required by the provisions of Section 2506(d).

(e) Combined Loading. Members subjected to both flexure and axial loading shall be proportioned in accordance with the provisions of NFPA-NDS.

SECTION 2507. TIMBER CONNECTIONS AND FASTENINGS.

(a) Connections. Timber connectors and other fasteners such as bolts drift pins, wood screws, lag screws, nails, and spikes may be used to transmit stress between wood members and between wood and metal members. The allowable loads and installation of timber fasteners shall be as set forth in the NFPA-NDS.

(b) Loads. Safe loads and design practices for types of connectors not mentioned or fully covered in the NFPA-NDS may be determined in a manner approved by the Department.

(c) Spacing.
   1. For wood to wood joints, the fastener spacing center-to-center shall be not less than the required penetration.
   2. Edge and end distances of fasteners shall be at least 1/2 of the required penetration.
   3. Holes for nails, where necessary to prevent splitting, shall be bored to a diameter smaller than that of the nails.

(d) Joist Hangers and Framing Anchors. Connections depending upon joist hangers or framing anchors, ties, and other mechanical fastenings not otherwise covered may be used where approved.

(e) Metal Plate Connector. Metal plate connector employed as joint connector in light wood trusses shall conform to Design Specification for Light Metal Plate Connected Wood Trusses (TPI). Manufacturers shall provide certification that Metal Plate connected wood trusses have been fabricated in accordance with the requirements of the quality control manual of the Truss Plate Institute (TPI).

SECTION 2508. STRUCTURAL GLUED-LAMINATED TIMBER DESIGN.

(a) General Provisions.
   1. Design Requirements. Except as otherwise provided in this Sec-
tion, structural glued-laminated timber members shall be designed in accordance with the applicable engineering formulas used for sawn members or glued-laminated timber included in NFPA-NDS.

2. **Fastenings.** The pertinent provisions and allowable loads for fastenings stated in this Chapter shall apply to structural glued-laminated timber members.

3. **Allowable Unit Stresses.** The allowable unit stresses for structural glued-laminated timber shall be in accordance with AITC-117, 119, 120 and as modified by this Section.

(b) **Standard Sizes.** Standard finished widths of laminated members shall be as set forth in AITC-113. Depth of straight and curved members, length of all members and net dimensions shall be specified on the drawings.

(c) **Specifications.** For structural glued-laminated timber, the following shall be specified on the drawings:
   - Whether for dry or wet conditions of use.
   - Species and applicable standard.
   - Stress requirements.
   - If the temperature of the timber exceeds 150 degrees F. in service.

(d) **Design Stresses.**

1. **Dry Conditions of Use.** Allowable stress values for dry conditions of use shall be applicable for normal loading when the moisture content in service is less than 16 percent, as in most covered structures.

2. **Wet Conditions of Use.** Allowable stress values for wet conditions of use shall be applicable for normal loading when the moisture content in service is 16 percent or more, as may occur in exterior and submerged construction.

(e) **Tapered Faces.** No sawn tapered cuts shall be permitted on the tension face of any simple beam. Pitched or curved beams shall be so fabricated that the laminations are parallel to the tension face. Straight, pitched, or curved beams may have sawn tapered cuts on the compression face. For other members subject to bending, the slope of tapered faces, measured from the tangent to the lamination of the section under consideration, shall be not steeper than 1:24 on the tension side.

   **EXCEPTIONS:**
   - 1. This requirement shall not apply to arches.
   - 2. Taper may be steeper at sections increased in size beyond design requirements for architectural projections.

(f) **Manufacture and Fabrication.** The manufacture and fabrication of structural glued-laminated timber shall be in accordance with PS-56. All work shall be under the supervision of qualified personnel.

**SECTION 2509. FORM FACTORS.** The allowable unit flexural stresses in nonprismatic members shall not exceed the value established by multiplying such stress by the form factor determined from NFPA-NDS.

**SECTION 2510. DESIGN OF GLUED BUILT UP MEMBERS.** Plywood components shall be designed, fabricated and identified in accordance with APA Y510, Y815 and Y820.

**SECTION 2511. WOOD DIAPHRAGMS.**

(a) **General.** Lumber and plywood diaphragms may be used to resist
horizontal forces in horizontal and vertical distributing or resisting elements, provided the deflection in the plane of the diaphragm, as determined by calculations, tests, or analogies drawn therefrom, does not exceed the permissible deflection of attached distributing or resisting elements. See APA Y815 for a method of calculating the deflection of a blocked plywood diaphragm.

1. Permissible deflection shall be that deflection up to which the diaphragm and any attached distributing or resisting element will maintain its structural integrity under assumed load conditions, i.e. continue to support assumed loads without danger to occupants of the structure.

2. Connections and anchorages capable of resisting the design forces shall be provided between the diaphragms and the resisting elements. Openings in diaphragms which materially affect their strength shall be fully detailed on the plans, and shall have their edges adequately reinforced to transfer all shearing stresses.

3. Size and shape of diaphragms shall be limited as set forth in APA Y815.

4. In buildings of wood frame construction where rotation is provided for, the depth of the diaphragm normal to the open side shall not exceed 25 feet or 2/3 the diaphragm width whichever is the smaller depth. Straight sheathing shall not be permitted to resist shears in diaphragms acting in rotation.

EXCEPTIONS:

1. One-story, wood-framed structures with the depth normal to the open side not greater than 25 feet, may have a depth equal to the width.

2. Where calculations show that diaphragm deflections can be tolerated, the depth normal to the open end may be increased to a depth to width ratio not greater than 1-1/2: 1 for diagonal sheathing or 2:1 for special diagonal sheathed or plywood diaphragms.

3. In masonry or concrete buildings lumber and plywood diaphragms shall not be considered as transmitting lateral forces by rotation.

(b) Diagonally Sheathed Diaphragms.

1. Conventional Construction. Lumber diaphragms shall be made up of 1-inch nominal sheathing boards laid at an angle of approximately 45 degrees to supports. Sheathing boards shall be directly nailed to each intermediate bearing member in accordance with the requirements of Table 25-A for sub-floor. An additional nail shall be used at diaphragm boundaries. End joints in adjacent boards shall be separated by at least one joist or stud space, and there shall be at least 2 boards between joints on the same support. Boundary members at edges of diaphragms shall be designed to resist direct tensile or compressive chord stresses and shall be tied together at corners. Conventional lumber diaphragms may be used to resist shear due to wind or seismic forces not exceeding 300 pounds per lineal foot.

2. Special Construction.

A. Special diagonally sheathed diaphragms shall conform to conventional construction and, in addition, shall have all elements
designed in conformance with the provisions of this Building Code.

B. Each chord or portion thereof may be considered as a beam loaded with a uniform load per foot equal to 50 percent of the unit shear due to diaphragm action. The load shall be assumed as acting normal to the chord, in the plane of the diaphragm, and either toward or away from the diaphragm. The span of the chord or portion thereof shall be the distance between structural members of the diaphragm such as the joists, studs, and blocking, which serve to transfer the assumed load to the sheathing.

C. Special diagonally sheathed diaphragms shall include conventional diaphragms sheathed with 2 layers of diagonal sheathing at 90 degrees to each other and on the same face of the supporting members.

D. Special diagonally sheathed diaphragms may be used to resist shears due to wind or seismic loads, provided such shears do not stress the nails beyond their allowable safe lateral strength and do not exceed 600 pounds per lineal foot.

(c) **Plywood Diaphragms.** Horizontal and vertical diaphragms sheathed with plywood may be used to resist horizontal forces not exceeding those set forth in APA V815.

1. Plywood for horizontal diaphragms shall be as set forth in APA V815 for corresponding joist spacing and loads. Plywood in shear walls shall be at least 5/16 inch thick for studs spaced 16 inches on center and 3/8 inch thick where studs are spaced 24 inches on center.

2. Maximum spans for plywood subfloor underlayment shall be as set forth in APA Y405. Plywood used for horizontal and vertical diaphragms shall conform to PS-1.

3. All boundary members shall be proportioned and spliced where necessary to transmit direct stresses. Framing members shall be at least 2-inch nominal in the dimension to which the plywood is attached. In general, panel edges shall bear on the framing members and butt along their center lines. No unblocked panels less than 12 inches wide shall be used.

**SECTION 2512. FIBERBOARD SHEATHING DIAPHRAGMS.** Wood stud walls sheathed with fiberboard sheathing complying with ASTM-C208, D2277, or PS57 may be used to resist horizontal forces not exceeding those set forth in Table 25-D. Nailing specified in Table 25-D shall be provided at the perimeter of the sheathing board, and at intermediate studs. Blocking not less than 2-inches in thickness shall be provided at horizontal joints when wall height exceeds length of sheathing panel, and specified in Table 25-D. Nails shall be spaced not less than 3/8 inch from edges and ends of sheathing. Marginal studs of shear walls or shear-resisting elements shall be anchored at top and bottom and designed to resist all forces. The maximum height-width ratio shall be 1:1/2:1.

**SECTION 2513. WOOD COMBINED WITH MASONRY OR CONCRETE.**
(a) **Dead Load.** Wood members shall not be used to permanently support the dead load of any masonry or concrete.

**EXCEPTIONS:**
1. Masonry or concrete nonstructural floor or roof surfacing not more than 4 inches thick may be supported by wood members.
2. Structures may rest upon wood piles constructed in accordance with the requirements of Chapter 29.

(b) **Horizontal Forces.** Wood members shall not be used to resist horizontal faces contributed by masonry or concrete construction in buildings over one story in height.

**EXCEPTION:** Wood floor and roof members may be used in horizontal trusses and diaphragms to resist horizontal forces imposed by wind, earthquake, or earth pressure, provided the forces are not resisted by rotation of the truss or diaphragm.

**SECTION 2514. GENERAL CONSTRUCTION REQUIREMENTS.**

(a) **General.** The requirements in this Section shall apply to all wood frame construction.

(b) **Protection Against Decay and Termites.**
1. **Wood Support Embedded in Ground.** Wood embedded in the ground, in direct contact with the earth or embedded in concrete or masonry, and used for the support of permanent structures, shall be treated wood unless continuously below the ground waterline or continuously submerged in fresh water.

2. **Underfloor Clearance.** Wood joists or the bottom of wood floors closer than 18 inches, or wood girders closer than 12 inches to the ground under floor areas and their supports, shall be of treated wood or all-heartwood of approved naturally durable species listed in Section 2514(b) 3.

3. **Plates, Sills and Sleepers.** All foundation plates or sills and sleepers on a concrete or masonry slab which is in direct contact with earth shall be treated wood, or Foundation cedar, or No. 2 Foundation redwood marked or branded by an approved agency. Sills which rest on concrete or masonry foundations, may be any species of wood permitted by this Building Code. Where stud bearing walls rest on a concrete floor, in contact with the earth a concrete or masonry curb shall be installed under the stud walls. The curb shall be at least 2-inches above the finished floor.

4. **Columns and Posts.** All wood columns and posts shall be framed to true end bearings. Supports shall be designed to hold the column or post securely in position and to protect its base from deterioration. In areas exposed to water splash, in exterior locations, and where the column base is at the level of a floor in contact with the ground, wood columns and posts shall be supported by piers projecting at least 2 inches above the finished floor and shall bear on a metal base plate or a foundation plate or sill as specified in Section 2514(b) 3. Posts or columns of treated wood or of Foundation cedar or No. 2 Foundation redwood may be placed directly on concrete, solid masonry, or grouted masonry.

5. **Girders Entering Masonry or Concrete.** Walls shall be provided with a 1/2 inch air space on tops, sides, and ends unless treated wood
or approved wood of natural resistance to decay is used.

6. **Foundation Ventilation.** For Foundation Ventilation requirements, see Chapter 17.

7. **Wood and Earth Separation.** No wood other than that permitted in Paragraph 3 above, shall be nearer than 6 inches to any earth unless separated by concrete at least 3 inches in thickness with an impervious membrane installed between the earth and concrete.

(c) **Wall Framing.** The framing of exterior and interior walls shall be in accordance with provisions specified in Section 2515 unless a specific design is furnished.

(d) **Floor Framing.**
   1. Wood joist floors shall be anchored to supporting wood stud or masonry walls.
   2. For draft stops, see Chapter 32.

(e) **Firestopping.** Firestopping shall be provided to cut off all concealed draft openings (both vertical and horizontal) and shall form an effective barrier between stories, and between a top story and roof space. It shall be used in specific locations as follows:
   1. In exterior or interior stud walls, at ceilings and floor levels.
   2. In all stud walls and partitions, including furred spaces, so placed that the maximum dimension of any concealed space is not over 10 feet.
   3. Between stair stringers at top and bottom and between studs along and in line with run of stair adjoining stud walls and partitions.
   4. Around top, bottom, sides and ends of sliding door pockets.
   5. In spaces between chimneys and wood framing, loose noncombustible materials shall be placed in noncombustible supports, or a metal collar tightly fitted to the chimney and nailed to wood framing may be used.
   6. Any other locations not specifically mentioned above, such as holes for pipes, shafting, behind furring strips and similar places which could afford a passage for flames.
      A. Firestops when of wood shall be 2-inch nominal thickness. If the width of the opening is such that more than one piece of lumber is necessary, there shall be two thickness of 1-inch nominal material with joints broken or one thickness of 3/4 inch plywood with joints backed by 3/4 inch plywood.
      B. Firestops may also be of gypsum board, cement asbestos board, mineral wool or other approved noncombustible materials, securely fastened in place.

(f) **Exterior Wall Coverings.**
   1. **General.** Exterior wood stud walls shall be covered on the outside with the materials and in the manner specified in this Section and elsewhere in this Building Code. Studs or sheathing shall be covered on the outside face with a weather resistive barrier when required by Chapter 17. Exterior wall coverings of the minimum thickness specified in this Section are based upon a maximum stud spacing of 16 inches.

   **EXCEPTION:**
   **CORRUGATED METAL.** Corrugated metal may be used on stud walls without sheathing. Walls shall be braced, and nailing
strips shall be provided to support the metal at intervals not exceeding 4 feet. Steel shall be 28 gauge minimum. Aluminum shall be 0.021 inches minimum.

2. **Siding.** Siding shall have a minimum thickness of 3/8 inch unless placed over sheathing permitted by this Building Code.
   A. Siding patterns known as rustic, drop siding, or shiplap shall have an average thickness in place at least 19/32 inch and shall have a minimum thickness of not less than 3/8 inch. Bevel siding shall have a minimum thickness measured at the butt section of not less than 7/16 inch and a tip thickness of not less than 3/16 inch. Siding of lesser dimensions may be used, provided the wall covering is placed over sheathing which conforms to the provisions specified elsewhere in this Building Code.
   B. All siding shall be securely nailed to each stud with at least one nail, or to solid 1-inch nominal wood sheathing or 1/2-inch plywood with at least one line of nails in each piece of the siding.

3. **Plywood.** Where plywood is used for covering the exterior of outside walls, it shall be exterior type not less than 3/8 inch thick, except the siding may be 5/16 inch thick when complying with special crossband requirements such as those given in APA Manufacturing Specifications for specialty siding. Plywood panel siding shall be installed in accordance with APA Y405.
   A. Unless applied over 1-inch wood sheathing or 1/2 inch plywood sheathing, joints shall occur over framing members and shall be covered with a continuous wood batt, shall be lapped horizontally, or otherwise made waterproof.

4. **Shingles or Shakes.** Wood shingles or shakes and asbestos cement shingles may be used for exterior wall covering provided the frame of the structure is covered with building paper as specified in Chapter 17. All shingles or shakes attached to sheathing other than wood sheathing shall be secured with approved corrosion resistant fasteners, or on furring strips attached to the studs. Wood shingles or shakes may be applied over fiberboard shingle backer and sheathing with annular grooved nails. The thickness of wood shingles or shakes between wood nailing boards shall be not less than 3/8 inch. Wood shingles or shakes and asbestos shingles or siding may be nailed directly to approved fiberboard nailbase sheathing not less than 1/2 inch nominal thickness with corrosion resistant annular grooved nails. Fiberboard nailbase sheathing and shingle backer shall comply with ASTM-C208 and PS57 and D2277.
   A. The weather exposure of wood shingles or shake siding used on exterior walls shall not exceed maximums set forth in Table 25-F.

5. **Particleboard.** Where particleboard is used for covering the exterior of outside walls, it shall be exterior type 2-B-1 conforming to CS-236, not less than 3/8 inch thick when applied directly to framing spaced 16 inches on center and 3/4 inch thick when applied directly to framing spaced 24 inches on center. Unless applied over 5/8 inch net wood sheathing, or 1/2 inch plywood sheathing, or 1/2 inch particleboard sheathing, joints shall occur over framing members and
shall be covered with a continuous wood batt; or joints shall be lapped horizontally and otherwise made waterproof.

6. **Plaster.** For exterior plaster, see Chapter 47.

7. **Nailing.** All fasteners used for the attachment of siding shall be corrosion-resistant.

(g) **Structural Floor and Roof Sheathing.** Structural floor and roof sheathing shall be designed in accordance with the general provisions of this Building Code, the provisions of Chapter 23 and Y300 and Y405. See Standards.

1. Roof sheathing conforming to the provisions of Table 25-B or Table 25-C shall be deemed to meet the requirements of this Subsection.

2. Plywood roof sheathing shall be bonded by intermediate or exterior glue.

(h) **Fastenings.**

1. **Nailing Requirements.** Unless otherwise required by structural design, the number and size of nails connecting wood members shall be not less than that set forth in Table 25-A. Other connections shall be fastened to provide equivalent strength. End and edge distances and nail penetrations shall be in accordance with the applicable provisions of NFPA-NDS.

2. **Joist Hangers and Framing Anchors.** Connections depending upon joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered may be used where approved.

(i) **Water Splash.** Where wood frame walls and partitions are covered on the interior with plaster, tile or similar materials and are subject to water splash, the framing shall be protected with approved waterproof conforming to Chapter 17.

(j) **Mechanically Laminated Floors and Decks.** A mechanically laminated lumber floor or deck built up of wood members set on edge, may be designed as a solid floor or roof deck of the same thickness, when meeting the requirements of this Building Code.

(k) **Post-Beam Connections.** Where post and beam or girder construction is used, the design shall be in accordance with the provisions of this Building Code. Positive connection shall be provided to ensure against uplift and lateral displacement.

**SECTION 2515. LIGHT FRAME CONSTRUCTION PROVISIONS.**

(a) **General.** These provisions, as well as the requirements of other Sections of this Chapter, are minimum requirements for light frame construction.

**EXCEPTION:** For buildings more than one story in height, refer to Chapter 3 for design responsibility.

(b) **Foundation Plates or Sills.** Foundation plates or sills shall be bolted to the foundation or foundation wall with not less than 1/2-inch diameter steel bolts embedded at least 7 inches into the concrete or reinforced masonry or 15 inches into unreinforced grouted masonry and space not more than 6 feet apart. There shall be a minimum of two bolts per piece with one bolt located within 12 inches of each end of each piece. Foundation plates and sills shall be the kind of wood specified in Section 2514(b).
(c) **Girders.**

1. Girders shall be designed to support all loads. Laminated built-up beams with laminations not less than 2 inches in thickness may be used for girders when the laminations are parallel to applied load. See Table 25-A for Nailing Requirements. The end joints shall occur over supports. Where a girder is spliced over a support, a tie shall be provided.

2. The ends of beams or girders supported on masonry or concrete shall provide 4-inch minimum bearing.

(d) **Floor Joists.**

1. **General.** Spans for joists shall be in accordance with NFPA Span Tables for Joists and Rafters.

2. **Bearings.** The end of each joist shall have not less than 1 1/2 inch minimum bearing on wood or metal, 3-inch minimum on masonry.

3. **Framing Details.**
   - A. Joists shall be supported laterally at the ends and at each support by solid blocking except where the ends of joists are nailed to a header, band or rim joist, or to an adjoining stud, or by other approved means. Solid blocking shall be not less than 2 inches in thickness and the full depth of joist.
   - B. Notches in the top or bottom joists shall not exceed 1/6 the depth and shall not be located in the middle third of the span. Holes bored in joists shall not be within 2 inches of the top or bottom of the joist and the diameter of any such hole shall not exceed 1+ the depth of the joist.
   - C. Joists framing from opposite sides of a beam, girder, or partition shall be lapped at least 4 inches over the supports, or the opposing joists shall be tied together.
   - D. Joists framing into the side of a wood girder shall be supported by framing anchors or joist hangers.

4. **Framing Around Openings.** Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, when the span of the header exceeds 4 feet. The ends of header joists more than 6 feet long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition, or wall. Tail joist over 12 feet long shall be supported at a header by framing anchors or joist hangers.

5. **Supporting Bearing Partitions.** Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth. Joists under and parallel to bearing partitions shall be doubled.

6. **Blocking.** Floor joists shall be blocked and bridged as required by the provisions of Section 2506(d) and 2515(d) 3.

(e) **Subflooring.**

1. **Lumber Subfloor.** Sheathing used as structural subfloor shall conform to the limitations set forth in Table No. 25-B. Joints in subflooring shall occur over supports unless end matched lumber is used, in which case each piece shall bear on at least 2 joists. Subflooring may be omitted when joist spacing does not exceed 16 inches and one-inch nominal tongued-and-grooved wood strip flooring is applied perpendicular to the joists.

2. **Plywood.** Where used as structural subflooring, plywood shall be
as set forth in Table 25-C. Plywood combination subfloor-underlay-
ment shall have maximum spans as set forth in APA Y405 or, where
glued, the floor framing in Item 1 shall provide spans conforming to
those given in APA U405.

3. **Plank Flooring.** Plank flooring shall be designed in accordance
with the general provisions of this Building Code. In lieu of this
design, 2 inch tongue-and-groove planking may be used in accord-
dance with NFPA-Plank and Beam Framing Manual. Joints in this
planking may be randomly spaced provided the system is applied to
not less than 3 continuous spans, planks are center-matched and
end-matched or splined, each plank bears on at least 24 inches in ad-
jacent pieces. One inch nominal strip square edged flooring, 1/2
inch tongue and-groove flooring, or 3/8 inch plywood shall be applied
over random length decking used as a floor. The 'strip' and tongue-
and-groove flooring shall be applied at right angles to the span of the
planks. The 3/8 inch plywood shall be applied with the face grain at
right angles to the span of the planks.

(f) **Wall Framing.**

1. **Size.** Unless otherwise required by engineering analysis studs in
exterior walls and interior bearing walls of buildings 2 stories in
height shall be at least 2 inches by 4 inches in size. For three story
buildings these studs shall be not less than 3 inches by 4 inches or 2
inches by 6 inches to the bottom of the second floor joists, and 2 in-
ches by 4 inches for the 2 upper stories. Interior nonbearing parti-
tions may be framed with 2 inch by 2 inch studs.

2. **Height.**
   A. Unless supported laterally by framing, the maximum allowable
      height for studs shall be 10 feet for 2 inch by 3 inch studs; 14
      feet for 2 inch by 4 inch and 3 inch by 4 inch studs; and 20 feet
      for 2 inch by 6 inch studs.
   B. When approved for use by the Department, the maximum
      allowable height for utility grade studs shall be 8 feet for load
      bearing and exterior wall studs, and 10 feet for interior nonload-
      bearing studs. When used in bearing walls, utility grade studs
      shall support not more than a roof and ceiling load.

3. **Spacing.** Studs supporting floors shall be spaced not more than 16
   inches. Except for Utility grade studs, 2 inch by 4 inch studs not
   more than 10 feet in length may be spaced not more than 24 inches
   when supporting only a ceiling and roof. The spacing of studs in
   nonbearing walls shall not exceed 24 inches. The spacing of 2 inch
   by 3 inch studs shall not exceed 16 inches. Roof trusses shall center
   over studs or solid blocking equal in size to the studs shall be in-
   stalled to reinforce the plate above.

4. **Framing Details.**
   A. Studs shall be placed with their wide dimension perpendicular
to the wall. At least 3 studs shall be installed at every corner of
an exterior wall.
   B. Bearing and exterior wall studs shall be capped with double top
plates installed to provide overlapping at corners and at inter-
sections with other partitions. End joints in double top plates
shall be offset at least 48 inches. Interior nonbearing partitions
may be capped with a single top plate installed to provide overlapping at corners and at intersections with other walls and partitions. The plate shall be continuously tied at joints by solid blocking at least 16 inches in length and equal in size to the plate or by 1/8 x 1 1/2 inch metal ties with spliced sections fastened with 2 16d nails on each side of the joint. Studs shall provide full bearing on a plate or sill not less than 2 inches in thickness having a width not less than that of the wall studs.

5. Bracing. All exterior walls and main cross stud partitions shall be braced at each end and at least every 25 feet of length by one of the following methods:

A. Nominal 1 inch by 4 inch continuous diagonal braces let into top and bottom plates and intervening studs and placed at an angle not more than 60 or less than 45 from the horizontal.

B. Wood boards of 5/8 inch net minimum thickness applied diagonally on studs spaced not over 24 inches.

C. Plywood sheathing with a thickness not less than 5/16 inch for 16 inch stud spacing and not less than 3/8 inch for 24 inch stud spacing in accordance with APA Y405.

D. Fiberboard sheathing panels 4 foot by 8 foot size at least 7/16 inch thick applied vertically on studs spaced not over 16 inches.

E. Gypsum sheathing panels not less than 1/2 inch thick on studs spaced not over 16 inches, when installed in accordance with Chapter 47.

F. Particleboard Exterior Type 2-B-1 sheathing panels not less than 3/8 inch thick on studs spaced not more than 16 inches.

G. Gypsum wallboard not less than 1/2 inch thick on studs spaced not over 24 inches, when installed in accordance with Chapter 47.

H. For methods B, C, D, E, and F, the braced panel must be at least 48 inches in width, covering 3 stud spaces where studs are spaced 16 inches apart and covering 2 stud spaces where studs are spaced 24 inches apart.

I. Solid sheathing of one of the materials specified in paragraph B through F herein shall be applied on the exterior walls of the first story of all wood framed buildings 3 stories in height.

J. All vertical joints of panel sheathing shall occur over studs. Horizontal joints shall occur over blocking equal in size to the studding.

6. Cripple Walls. Cripple walls shall be framed of studs not less in size than the adjacent studding, or shall be framed of solid blocking. When exceeding 4 feet in height, these walls shall be framed of studs providing the size required for an additional story. Cripple walls shall be braced as required in Section 2515(f)5 for the first story exterior walls.

7. Headers. All openings 4 feet wide or less in bearing walls shall be provided with headers consisting of either 2 pieces of 2 inch framing lumber placed on edge and fastened together, or 4 inch lumber of equivalent cross section. All openings more than 4 feet wide shall be provided with headers or lintels with not less than 2 inch solid bearing at each end to the floor or bottom plate, unless other approved.
framing methods or joint devices are used.

8. **Pipes in Walls.** Stud partitions containing pipes shall be framed, and the joists underneath so spaced, to provide proper clearance for the piping. Where a partition containing piping runs parallel to the floor joists, the joist underneath the partitions shall be doubled and spaced to permit the passage of pipes, and shall be bridged. When pipes are placed in or partly in a partition, necessitating cutting the soles or plates, a metal tie not less than 1/8 inch thick and 1 1/2 inches wide shall be fastened across the plate and to each side of the opening.

9. **Bridging.** Unless covered by interior or exterior wall coverings or sheathing meeting the minimum requirements of this Building Code, all stud partitions or walls with studs having a height to thickness ratio exceeding 50 shall have bridging not less than 2 inches in thickness and the same width as the studs fitted snugly and nailed to provide lateral support.

10. **Cutting and Notching.** In exterior walls and bearing partitions, a wood stud may be cut or notched to a depth not exceeding 25 percent of its width. In nonbearing partitions supporting no loads other than the weight of the partition, cutting or notching of a stud to a depth not exceeding 40 percent of its depth shall be permitted.

11. **Bored Holes.** A hole not greater in diameter than 40 percent of the stud width may be bored in a wood stud. Bored holes not greater than 60 percent of the width of the stud are permitted in nonbearing partitions or in a wall where each bored stud is doubled provided not more than 2 succesive doubled studs are bored. In no case shall the edge of the bored hole be nearer than 5/8 inch to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

(g) **Roof and Ceiling Framing.**

1. **General.** The framing details required in this Section apply to roofs having a pitch of 3:12 or more. When the roof pitch is less than 3:12, ridge boards, hips and valleys, and other members supporting rafters and ceiling joists shall be designed as beams.

2. **Spans.** Allowable spans for rafters and ceiling joists shall be in accordance with NFPA Span Tables for Joists and Rafters.

3. **Framing.** Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board at least one inch thickness at all ridges and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a single valley or hip rafter not less than 2 inches thickness and not less in depth than the cut end of the rafter.

4. **Rafter Ties.** Rafters shall be nailed to adjacent ceiling joists to form a continuous tie between exterior walls when such joists are parallel to the rafters. Where not parallel, rafters shall be tied to 1 inch by 4 inch minimum size cross-ties located as low on the rafter as possible. Rafter ties shall be spaced not more than 4 feet on center.

5. **Purlins.** Purlins to support roof loads may be installed to reduce the span of rafters within allowable limits and shall be supported by struts to bearing walls, but in no case shall the purlin be smaller
than the supported rafter. Struts to bearing walls shall be not smaller than 2 inch by 4 inch members. The unbraced length of struts shall not exceed 8 feet and the minimum slope of the struts shall be at least 45 degrees from the horizontal.

6. **Blocking.** Rafters more than 8 inches in depth shall be supported laterally at the ends and at each support by solid blocking not less than 2 inches in thickness and the full depth of the rafter unless nailed to a header, band or rim joist, or to an adjoining stud.

7. **Roof Sheathing.**
   A. Roof sheathing shall be in accordance with Table 25-C for plywood or Table 25-B for lumber.
   B. Joints in lumber sheathing shall occur over supports unless end matched lumber is used, in which case each piece shall bear on at least 2 supports.
   C. Plywood used for roof sheathing shall be bonded by intermediate or exterior glue.

8. **Roof Planking.**
   A. Planking shall be designed in accordance with the provisions of this Building Code.
   B. In lieu of this design, tongue-and-groove planking may be used in accordance with NFPA Plank and Beam Framing Manual. Joints in the planking may be randomly spaced provided the system is applied to not less than three continuous spans, planks are center-matched and end-matched or spliced, each plank bears on at least one support and joints are separated by at least 24 inches adjacent pieces.

**SECTION 2516. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

**ORGANIZATION**

**TITLE OF PUBLICATION**

- **AITC**
  - AITC 113-71 Standard for Dimensions of Glued Laminated Structural Members.

- **ANSI**
  - ANSI 05.1-72 Specifications and Dimensions for Wood Poles.

- **APA**
  - Plywood Construction Systems - Y300-75.
  - Plywood Design Specification - Y510-75.
  - Design Specifications for Plywood Lumber Components (includes curved panels, beams,
stressed-skin panels, sandwich panels, diaphragm construction, and folded plates) V815-75.
Fabrication Specifications for Plywood Lumber Components (includes curved panels, beams, stressed-skin panels, sandwich panels, and folded plates) V820-74.

ASTM

C-208-72 Specification for Insulating Board (Cellulose Fiber) Structural and Decorative.
D-25-73 Specifications for Round Timber Piles.
D-2899-74 Establishing Design Stresses for Round Timber Piles.
D-805-63 Testing, Veneer, Plywood and Other Glued Veneer Constructions.

AWPA


AWPB


CS 236


HPMA LF-71

Interim Industry Standards for Laminated Hardwood Block Flooring.

NFPA-NDS

Plank and Beam Framing Wood Construction Data No. 4, 1970.

PS-20


PS-1


PS-56


PS-51


PS-57


TPI

Design Specifications for Light Metal Plate Connected Wood Roof Trusses TPI-70.

GRADING AGENCIES AND RULES:
Standard Grading Rules for Canadian Lumber U.S. Edition (July 1, 1973) of the National Lumber Grades Authority. (NLGA)
Standard Grading Rules for West Coast Lumber No. 16 (Sept. 1970) of the
West Coast Lumber Inspection Bureau. (WCLIB)
Standard Grading Rules for Western Lumber of the Western Wood Products
Association (June 1, 1972) and Supplement No. 1, Dec. 1, 1972. (WWPA)
Grading Rules, Northen Hardwood and Pine Manufacturers Association, Inc.
Sept. 1, 1970. (NHPMA)
Grading Rules, Southern Pine Inspection Bureau (Sept. 1, 1970) (SPIB)
Standard Specifications for Grades of California Redwood Lumber of the
Redwood Inspection Service (Nov. 1970), Supplement No. 1, Oct. 1, 1972 and
Supplement No. 2, March 1, 1974. (RIS)
Grading Rules of the Northeastern Lumber Manufacturers Association, Inc.
(Sept. 1, 1970). (NELMA)

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<td>2-20d at ends and at each splice</td>
</tr>
<tr>
<td>Built-up girder and beams</td>
<td>2-16d at each bearing</td>
</tr>
</tbody>
</table>

---

### Particleboard:
- Wall sheathing (to framing):
  - 3/8” + 1/2”
  - 5/8” + 3/4”

### Plywood:
- Subfloor, roof and wall sheathing (to framing):
  - 1/2” and less
  - 5/8” + 3/4”
  - 7/8” + 1”
  - 1 1/8” - 1 1/4”

### Combination Subfloor-underlayment (to framing):
- 3/4” and less
- 7/8” + 1”
- 1 1/8” - 1 1/4”

### Panel Siding (to framing):
- 1/2” or less
- 5/8”

---

*a Common or box nails may be used except where otherwise stated.

*b Common or deformed shank.

*c Common.

*d Deformed shank.
### TABLE NO. 25-A
### NAILING SCHEDULE

<table>
<thead>
<tr>
<th>CONNECTION</th>
<th>NAILING&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiberboard Sheathing:</td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>No. 11 ga.&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>25/32&quot;</td>
<td>No. 16 ga.&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>No. 11 ga.&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>8d&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>No. 16 ga.&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Common or box nails may be used except where otherwise stated.
<sup>b</sup> Common or deformed shank.
<sup>c</sup> Common.
<sup>d</sup> Deformed shank.
<sup>e</sup> Nails not less than 3/8" from panel edge and end and spaced at 6 inches on center at edges, 12 inches at intermediate supports (10 inches at intermediate supports for floors), except 6 inches at all supports where spans are 48 inches or more. Nails for wall sheathing may be common, box or casing.
<sup>f</sup> Corrosion resistant siding and casing nails.
<sup>g</sup> Fasteners spaced 3 inches on center or exterior edges and 6 inches on center at intermediate supports.

<sup>h</sup> Galvanized roofing nails with 7/8 inch diameter head and 1 1/2 inch length for 1/2 inch sheathing and 1 3/8 inch for 23/32 inch sheathing.
<sup>i</sup> Galvanized staple with 7/8 inch crown and 1 1/8 inch sheathing and 1 1/2 inch length for 25/32 inch sheathing.
<sup>j</sup> Nails shall be placed not less than 3/8 inch in from the panel edge, nor more than 12 inches apart along intermediate supports and 6 inches along panel edge bearings, and shall be firmly driven into the framing members.
### TABLE NO. 25-B
ALLOWABLE SPANS FOR LUMBER
FLOOR AND ROOF SHEATHING

<table>
<thead>
<tr>
<th>Span (inches)</th>
<th>Minimum Net Thickness (inches) of Lumber Placed</th>
<th>Perpendicular to Supports</th>
<th>Daigonally to Supports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Surfaced Dry</td>
<td>Surface Unseasoned</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Floors</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>3/4</td>
<td>25/32</td>
<td>3/4</td>
</tr>
<tr>
<td>16</td>
<td>5/8</td>
<td>11/16</td>
<td>5/8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Roofs</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>5/8</td>
<td>11/16</td>
<td>3/4</td>
</tr>
</tbody>
</table>

Installation details shall conform to Section 2515 (e) 1 and 2515 (g) 7 for floor and roof sheathing respectively.
Maximum 19 percent moisture content.

### SHEATHING LUMBER SHALL MEET THE FOLLOWING MINIMUM REQUIREMENTS:

<table>
<thead>
<tr>
<th>Solid Floor or Roof Sheathing</th>
<th>Spaced Roof Sheathing</th>
<th>Grading Rules Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility</td>
<td>Standard</td>
<td>NLGA, WCLIB, WWPA</td>
</tr>
<tr>
<td>4 Common Utility</td>
<td>3 Common, or Standard</td>
<td>NLGA, WCLIB, WWPA</td>
</tr>
<tr>
<td>No. 3 Merchantable</td>
<td>No. 2 Construction Common</td>
<td>SPIB, NELMA, RIS</td>
</tr>
</tbody>
</table>
# TABLE NO. 25-C
ALLOWABLE SPANS FOR PLYWOOD SUBFLOOR AND ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND FACE GRAIN PERPENDICULAR TO SUPPORTS

<table>
<thead>
<tr>
<th>Panel Identification Index&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Maximum Span (In Inches)</th>
<th>Load (In Pounds Per Square Foot)</th>
<th>Floor Maximum Span&lt;sup&gt;d&lt;/sup&gt; (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Edges Blocked</td>
<td>Edges Unblocked</td>
<td>Total Load</td>
</tr>
<tr>
<td>12/0</td>
<td>12</td>
<td></td>
<td>130</td>
</tr>
<tr>
<td>16/0</td>
<td>16</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>20/0</td>
<td>20</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>24/0</td>
<td>24</td>
<td>16</td>
<td>60</td>
</tr>
<tr>
<td>30/12</td>
<td>30</td>
<td>26</td>
<td>55</td>
</tr>
<tr>
<td>32/16</td>
<td>32&lt;sup&gt;f&lt;/sup&gt;</td>
<td>28</td>
<td>50&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>36/16</td>
<td>36</td>
<td>30</td>
<td>50&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>42/20</td>
<td>42</td>
<td>32</td>
<td>45&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>48/24</td>
<td>48</td>
<td>36</td>
<td>40&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> These values apply for Structural I and II Standard Sheathing and C-C Grades only. Spans shall be limited to values shown because of possible effect of concentrated loads.

<sup>b</sup> Uniform load deflection limitation: 1/180th of the span under live load plus dead load. 1/240th under live load only. Edges may be blocked with lumber or other approved type of edge support.

<sup>c</sup> Identification index appears on all panels in the construction grades listed in Footnote No. 1.

<sup>d</sup> Plywood edges shall have approved tongue and groove joints or shall be supported with blocking unless 1/4-inch minimum thickness underlayment is installed, or finish floor is 25/32 inch wood strip. Allowable uniform load based on deflection of 1/360 of span is 165 pounds per square foot.

<sup>e</sup> May be 16 inch if 25/32 inch wood strip flooring is installed at right angles to joists.

<sup>f</sup> One-half inch thick structural grade 1, when continuous over two or more spans, may be laid with face grain parallel to supports, provided all panel edges are blocked or exceed 24 inch on center, and the live load does not exceed 25 pounds per square foot. For other grades, a thickness of 3/4 inch 5 ply is required.

<sup>g</sup> For roof live load of 40 pounds per square foot or total load of 55 pounds per square foot, decrease spans by 13 percent or use panel with next greater identification index.

<sup>h</sup> May be 24 inch if 25/32 inch wood strip flooring is installed at right angles to joists.
### TABLE NO. 25-D
ALLOWABLE SHEARS FOR WIND OR SEISMIC LOADING
ON VERTICAL DIAPHRAGMS OF FIBERBOARD SHEATHING BOARD
CONSTRUCTION FOR TYPE V CONSTRUCTION ONLY

<table>
<thead>
<tr>
<th>Size and Application</th>
<th>Nail Size</th>
<th>Shear value 3 inch Nail Spacing Around Perimeter and 6 inch At Intermediate Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/16&quot; x 4' x 8&quot;c</td>
<td>No. 11 ga. gal. roofing nail 1 1/2&quot; long, 7/16 head</td>
<td>125b</td>
</tr>
<tr>
<td>25/32&quot; x 4' x 8&quot;c</td>
<td>No. 11 ga. gal. roofing nail 1 3/4&quot; long, 7/16 head</td>
<td>175</td>
</tr>
</tbody>
</table>

a Fiberboard sheathing diaphragms shall not be used to brace concrete or masonry walls.  
b The shear value may be 175 for 1/2 inch x 4 foot x 8 foot fiberboard nailing sheathing.  
c Fiberboard sheathing diaphragms shall be applied vertically to wood studs not less than 2 inch nominal in thickness spaced 16" on centers.

### TABLE NO. 25-E
ALLOWABLE UNIT STRESSES FOR ROUND TIMBER POLES AND PILES
(In p.s.i. and for Normal Duration of Load)

<table>
<thead>
<tr>
<th>Species</th>
<th>Extreme Fiber In Bendinga</th>
<th>Compression Parallel to Grain (L/D=11 or Less)</th>
<th>Compression Perpendicular to Grain</th>
<th>Horizontal Shear</th>
<th>Average Modulus of Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Pine</td>
<td>2400</td>
<td>1200</td>
<td>250</td>
<td>115</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Douglas Fir (Coast)</td>
<td>2450</td>
<td>1250</td>
<td>230</td>
<td>115</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Western Larch</td>
<td>2450</td>
<td>1250</td>
<td>230</td>
<td>115</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Red Oak</td>
<td>2450</td>
<td>1100</td>
<td>350</td>
<td>135</td>
<td>1,250,000</td>
</tr>
<tr>
<td>Ponderosa Pine</td>
<td>1200</td>
<td>830</td>
<td>100</td>
<td>80</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Lodgepole Pine</td>
<td>1200</td>
<td>800</td>
<td>100</td>
<td>80</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Red (Norway) Pine</td>
<td>1900</td>
<td>900</td>
<td>155</td>
<td>85</td>
<td>1,280,000</td>
</tr>
</tbody>
</table>

a Extreme fiber in bending values include 18 percent increase allowed for round shape.

### TABLE NO. 25-F
WOOD SHINGLE AND SHAKE SIDEWALL EXPOSURES

<table>
<thead>
<tr>
<th>Shingle or Shake</th>
<th>MAXIMUM WEATHER EXPOSURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length and Type</td>
<td>Single-Couring</td>
</tr>
<tr>
<td>No. 1</td>
<td>No. 2</td>
</tr>
<tr>
<td>16-inch Shingles</td>
<td>7 1/2&quot;</td>
</tr>
<tr>
<td>18-inch Shingles</td>
<td>8 1/2&quot;</td>
</tr>
<tr>
<td>24&quot;-inch Shingles</td>
<td>11 1/2&quot;</td>
</tr>
<tr>
<td>18-inch Resawn Shakes</td>
<td>8 1/2&quot;</td>
</tr>
<tr>
<td>18-inch Straight Split Shakes</td>
<td>8 1/2&quot;</td>
</tr>
<tr>
<td>24-inch Resawn Shakes</td>
<td>11 1/2&quot;</td>
</tr>
</tbody>
</table>
CHAPTER 26

CONCRETE

SECTION 2601. GENERAL.

(a) **Scope.** In addition to the other requirements of this Building Code, this Chapter shall govern the design and construction of reinforced concrete or composite structural concrete elements of any building or structure. This Chapter shall govern in all matters pertaining to design and construction whenever it is in conflict with the requirements of other Chapters of the Building Code.

(b) **Design and Construction.** Design and Construction shall conform to the requirements of this Chapter and ACI-318 including all revisions through the 1975 Supplements. The provisions of Chapter 1 and Appendix A of ACI-318 shall be excluded. See Standards.

(c) **Special Structures.** For special structures such as arches, chimneys, tanks, reservoirs, grain elevators, shells, domes, and blast-resistant structures, the provisions of this Chapter shall govern wherever applicable.

SECTION 2602. COLD WEATHER REQUIREMENTS. When the ambient temperature falls below 40 degrees Fahrenheit, adequate equipment shall be provided for heating the concrete materials and protecting the concrete. All concrete materials and all reinforcement, forms, fillers, and ground with which the concrete is to come in contact shall be free from frost. No frozen material or materials containing ice shall be used. See "Recommended Practice for Cold Weather Concreting": ACI-306.

SECTION 2603. HOT WEATHER REQUIREMENTS. When the ambient temperature reaches or exceeds 90 degrees Fahrenheit, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation which will impair the required strength or serviceability of the member or structure. See "Recommended Practice for Hot Weather Concreting": ACI-305.

SECTION 2604. APPROVAL OF SPECIAL SYSTEMS OF DESIGN OR CONSTRUCTION. See Chapter 1, Alternate Methods and Materials.

SECTION 2605. STRENGTH EVALUATION OF EXISTING STRUCTURES.

(a) **Analysis.** If doubt develops concerning the safety of a concrete structure or member, the Department may order a structural strength investigation by analysis or by means of load tests.

(b) **Load Tests.** Load tests shall be conducted in accordance with ACI 318, Chapter 20, "STRENGTH EVALUATION OF EXISTING STRUCTURES".

SECTION 2606. SEISMIC DESIGN. Space frames designed for continuity may be deemed as ductile moment-resisting if design consideration is given to the column and girder shears produced by seismic loads acting in combination with any other loads as specified in Chapter 23.

26-1
SECTION 2607. ACCEPTABLE CRITERIA FOR WALL PANELS.

(a) General.
1. The design provisions of ACI 318 shall be followed in conjunction with these criteria, including symbols noted herein. Where conflicts arise, these criteria shall govern.
2. All members subjected to a compression load shall be designed for the eccentricity, e, corresponding to the maximum moment which can accompany the load, but not less than 1.0 inch or 0.10 h, whichever is larger.
3. Prestressed wall panels shall be designed for behavior under service loads and for strength under design loads.
4. Non prestressed, precast wall panels shall be designed either by strength design or by the alternate design method outlined in Section 2607 (c).
5. Minimum thickness shall be determined by:

\[ k \ell_0 / h \leq 50 \left( \frac{3 E_c}{4080} \right) \]

where \( E_c \) is in ksi.

In computing the ratio \( k \ell_0 / h \) for sections other than solid rectangular panels, an equivalent thickness, \( h_e \), shall be substituted for \( h \) where:

\[ h_e = \frac{3}{12} (\ell_0 / b) \]

For single spans, the effective length factor, \( k \), shall be assumed as follows:

- \( k = 1.0 \) for pinned ends, braced against sidesway
- \( k = 0.85 \) for partially fixed ends, braced against sidesway
- \( k = 2.0 \) for cantilevered condition

For other conditions, refer to ACI Commentary (318) Section 10.11.3.

(b) Strength Design.
1. Strength design shall consider the moment magnification effects, and the analysis shall be based on accepted principles of mechanics. In addition to the assumptions of Section 10.2 of the ACI Code (318), the following assumptions shall be used:
   (a) The stress-strain curves for steel and concrete display nonlinear characteristics.
   (b) Cracking occurs in concrete wherever concrete tension exceeds \( 7.5 \sqrt{f_c} \)
   (c) Failure is assumed to occur whenever concrete strain in compression, exclusive of creep and shrinkage strains, reaches 0.003 or whenever the load reaches its maximum on the load-deflection curve.
   (d) Additional deflections due to creep shall be considered.
2. The load factors and capacity reduction factors shall be in accord with Section 9.3 of the ACI Code (318), with the following addition:
   (a) When only wind load is acting, the required strength shall be at least \( U = 1.4 \).

(c) Alternate Design Method.
1. Non prestressed wall panels shall be designed in accord with Section 8.10.2, ACI Code (318).
2. The minimum equivalent thickness requirements of Section 2607(a)5, and the deflection requirements of Section 2607(e)4, shall not be exceeded.

(d) Concrete Stresses at Service Load.
1. For prestressed concrete wall panels, the concrete stresses at service loads, after all losses, shall not exceed the following:
   (a) Compression under full dead + live load ................. 0.45 $f'_c$
   (b) Compression under critical combination of all loads, including lateral loads due to either wind or earthquake. ... 1.33 (0.45 $f'_c$)
   (c) Tension under critical combination of all loads, including lateral loads ........................................ 12$\sqrt{f'_c}$
   (d) Tension under all sustained loads .......................... 3$\sqrt{f'_c}$

(e) Control of Deflections.
1. Whenever tension in the concrete does not exceed $7.5\sqrt{f'_c}$, the deflection calculation may be based on the uncracked gross section. For tensions greater than $7.5\sqrt{f'_c}$, the effect of cracking of the section shall be considered in computing the stiffness.
2. To account for inelastic effects under sustained loads, the additional time-dependent deflections shall be assumed equal to 1.75 times the initial deflection due to the sustained load.
3. Except for cantilevered members, maximum deflection may be assumed anywhere in the middle fifth of the span.
4. Deflections shall be limited as follows:
   Maximum deflection under full service loads, including lateral loads.
   - if attaching elements are not likely to be damaged by large deflections .......... $\ell_u/180$
   - if attaching elements are likely to be damaged by large deflections .......... $\ell_u/360$

(f) Notations.
   b = Width of Section.
   e = Eccentricity of design load parallel to axis measured from the centroid of the section.
   $E_c$ = Modulus of elasticity of concrete (ksi).
   $f'_c$ = Specified compressive strength of concrete (psi).
   $h$ = Overall thickness of member.
   $h_e$ = Equivalent thickness of member.
   $I_g$ = Moment of inertia of gross concrete section about the centroidal axis neglecting the reinforcement.
   $k$ = Effective length factor for compression members.
   $\ell_u$ = Unsupported length of compression member.
   $U$ = Required strength to resist design loads or their related internal moments and forces.
   $W$ = Wind load or its related internal moment and forces.

SECTION 2608. STANDARDS. Unless provided for in other portions of
this Building Code, the ACI-301-72 (Chapter 1), and ACI-318, 1971 (Chapter 3), the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPMB</td>
<td>Concrete Plant Mixer Standards of the Plant Mixer Manufacturers Division, 1970.</td>
</tr>
<tr>
<td>CRSI</td>
<td>CRSI Recommended Practice for Placing Reinforcing Bars, 1975.</td>
</tr>
<tr>
<td>NRMCA</td>
<td>Check List for Certification of Ready Mixed Concrete Production Facilities, 1967.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACI</td>
<td>American Concrete Institute P.O. Box 4754, Redford Station Detroit, Michigan</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society, Inc. 2501 N.W. 7th Street Miami, Florida 33125</td>
</tr>
<tr>
<td>CPMB</td>
<td>Concrete Plant Manufacturers Bureau 900 Spring Street Silver Spring, Maryland 20910</td>
</tr>
<tr>
<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute 228 North LaSalle St. Chicago, Ill. 60601</td>
</tr>
<tr>
<td>NRMCA</td>
<td>National Ready Mixed Concrete Assn. 900 Spring Street Silver Spring, Maryland 20910</td>
</tr>
</tbody>
</table>
CHAPTER 27
STEEL AND IRON

SECTION 2701. SCOPE. In addition to the other provisions of this Building Code, this Chapter shall govern the design, fabrication, and erection of structural steel, open web steel joists, and cold formed steel for buildings, structures and utilities.

SECTION 2702. MATERIAL.
(a) Structural Steel. Structural steel shall conform to one or more of the following specifications.
   1. Structural Steel - ASTM A36.
   2. Welded and Seamless Steel Pipe - ASTM A53, Grade B.
   4. Flat-Rolled Carbon Steel Sheet of Structural Quality - ASTM A570-A61l (For Cold Formed Steel Only).
   5. High-Strength Low-Alloy Structural Manganese-Vanadium Steel - ASTM A44l.
   6. Zinc-Coated Steel Sheets of Structural Quality, Coils, and Cut-Lengths ASTM A446 (For Cold Formed Steel Only.)
   7. Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes - ASTM A500.
   8. Hot-Formed Welded and Seamless Carbon Steel Structural Tubing - ASTM A50l.
   10. Structural Steel with 42,000 psi Minimum Yield Point - ASTM A529.
   11. Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality - ASTM A570, Grades D and E.
   13. High-Strength Low-Alloy Structural Steel with 50,000 psi Minimum Yield Point to 4 Inch Thick - ASTM A588.
   15. High-Strength Low-Alloy Cold-Rolled Steel Sheets and Strip - ASTM A606.
   16. Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy, Columbium and/or Vanadium - ASTM A607.
   17. Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing - ASTM A618.
   18. Certified Mill test reports shall constitute evidence of conformity with the specifications designated in this Section.
   19. Unidentified steel may be used where the precise physical properties of the steel and/or its weldability would not affect the strength of the structure.

(b) Other Metals.
   1. Cast steel shall conform to one or more of the following specifications.
A. Mild-to-Medium Strength Carbon-Steel Castings for General Application - ASTM A272, Grade 65-35.
B. High-Strength Steel Castings for Structural Purposes - ASTM A148, Grade 80-50.

2. Steel forgings shall conform to one or more of the following specifications.
   A. Carbon Steel Forgings for General Industrial Use, ASTM A235, Class CI, F and G. (Class CI Forgings that are to be welded shall be ordered in accordance with Supplemental Requirements S5 of ASTM A235.)
   B. Alloy Steel Forgings for General Industrial Use ASTM - A237, Class A.

3. Certified test reports shall constitute evidence of conformity with the specifications designated in this Section.

(c) Rivets. Rivets shall conform to the provisions of the Specifications for Structural Rivets - ASTM A502, Grade 1 or 2.
   1. Manufacturer's certification shall constitute evidence of conformity with the specifications designated in this Section.

(d) Bolts. High strength steel bolts shall conform to one or more of the following specifications.
   1. High Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers - ASTM A 325.
   2. Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints - ASTM A490.
   4. Manufacturer's certification shall constitute evidence of conformity with the specifications designated in this Section.

(e) Filler Metal for Welding.
   2. Bare electrodes and granular flux used in the submerged-arc process shall conform to F60 and F70 AWS-flux classifications of the Specifications for Bare Mild Steel Electrodes and Fluxes for Submerged Arc Welding - AWS A5.17.
   3. E60S or E70S electrodes used in gas metal-arc process shall conform to the Specification for Mild Steel Electrodes for Gas Metal-Arc Welding - AWS A5.18.
   4. E60T or E70T electrodes used in Flux-Cored-Arc process shall conform to the Specification for Mild Steel Electrodes for Flux-Cored-Arc Welding - AWS A5.20.
   5. Manufacturer's certification shall constitute evidence of conformity with the specifications designated in this Section.

(f) Used Steel. Used steel shall be permitted provided proper allowance is made for any reduction in section by corrosion, holes or other defects, and provided that the stresses used for an unidentified used steel do not exceed 73 percent of the stresses permitted by this Building Code for ASTM A36 steel. Unidentified used steel shall not be permitted in
plastically designed structures. Allowable stresses for an identified used steel shall be that permitted for existing structures. See Section 2703(a).

SECTION 2703. SPECIFICATIONS FOR DESIGN, FABRICATION, AND ERECTION. Unless specified elsewhere in this Building Code, the following specifications shall apply.

(a) **Structural Steel.** The materials, design, fabrication, application, handling, and erection of structural steel shall conform to the American Institute of Steel Construction (AISC) Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

1. **Existing Structures.** The permissible maximum stresses permitted by this Building Code for analyzing or reinforcing existing structures shall be a percentage of the stresses specified for ASTM-A36 steel. The applicable percentage shall be governed by the year in which the structure was erected, in accordance with the following:

   Prior to 1923 73 percent  
   1923 through 1935 82 percent  
   1936 through 1959 91 percent  
   1960 or thereafter 100 percent

   unless it can be indicated that steel stronger than ASTM-A36 was used in all or part of the structure.

   The above percentages are conservative for columns and struts.

   It is permissible, therefore to use the applicable AISC Specifications and/or load tables for those eras prior to 1960 in analyzing columns and struts.

(b) **Open Web Steel Joists.** The materials, design, fabrication, application, handling, and erection of open web steel joists shall conform to the Steel Joist Institute (SJI) Specifications and Load Tables for Open Web Steel Joists, Longspan Steel Joists, and Deep Longspan Joists.

(c) **Cold Formed Steel.** The materials, design, fabrication, application, handling, and erection of cold formed steel shall conform to the American Iron and Steel Institute (AISI) Specifications for the design of Cold-Formed Steel Structural Members.

SECTION 2704. APPROVAL OF SPECIAL SYSTEMS OF DESIGN OR CONSTRUCTION.

(a) **General.** Sponsors of any system of design or construction within the scope of this Chapter, the adequacy of which has been proven by analysis or test, and the design of which is either not consistent with, or not provided for by this Building Code, shall have the right to present data on which their design is based to the Department for approval or disapproval.

SECTION 2705. LOAD TESTS OF STRUCTURES.

(a) **General.** The Department may order a load test of any portion or all of a structure when there is doubt about its safety. A qualified Colorado Registered Professional Engineer, acceptable to the Department, shall supervise such tests. If the tests indicate evident failure of any part of the structure, the changes required to provide the structure adequate for its rated capacity shall be made, or a lower rating shall be provided.
SECTION 2706. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AISI</td>
<td>Specification for the Design of Cold-Formed Steel Structural Members, 1968.</td>
</tr>
</tbody>
</table>
Bare Mild Steel Electrodes and Fluxes for Submerged Arc Welding - A5.17-69.
Mild Steel Electrodes for Gas Metal Arc Welding - A5.18-69.
Mild Steel Electrodes for Flux-Cored Arc Welding - A5.20-69.

SJII

LEGEND
AISC
American Institute of Steel Construction
1221 Avenue of the Americas
New York, New York 10020.

AISI
American Iron and Steel Institute
1000-16th St., N.W.
Washington, D.C. 20036

ASTM
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

AWS
American Welding Society, Inc.
2501 N. 7th Street
Miami, Florida 33125.

SJII
Steel Joist Institute
2001 Jefferson Davis Highway
Arlington, Va. 22202.

ORGANIZATION
CHAPTER 28
ALUMINUM

SECTION 2801. ALUMINUM

(a) General. The quality, design, fabrication, and erection of aluminum used in buildings and structures shall conform to the requirements of Section 1 - Specifications for Aluminum Structures, as published by the Aluminum Association (S.A.S.-1).

(b) Alloys. The use of aluminum alloys and tempers other than those covered by specifications for aluminum structures shall be permitted for structural members and assemblies, provided standards of performance at least equal to those required by specification for aluminum structures are used and are substantiated to the satisfaction of the Department. Certification by the fabricator that the alloys and tempers specified on the drawings and specifications shall be provided to the Department.

(c) Identification. Aluminum for structural elements shall be handled in the fabricator's plant so the separate alloys and tempers are positively identified. Identification markings shall be affixed to structural members, prior to shipment.

SECTION 2802. ALLOWABLE STRESSES FOR MEMBERS AND FASTENERS.

(a) Allowable Unit Stresses. Allowable unit stresses in aluminum alloy structural members shall be determined in accordance with the formulas of Section 1 - Specifications For Aluminum Structures (S.A.S.-1). All safety factors shall be utilized. When 2 formulas are given, the formula resulting in the lower stresses shall be used.

(b) Welded Structural Members. The unit stresses shall be those specified in S.A.S.-1.

(c) Bolts and Rivets.
   1. The unit stresses for Aluminum Alloy fasteners shall be those specified in S.A.S.-1.
   2. The unit stresses for aluminized, galvanized, or double cadmium-plated steel fasteners shall be 20,000 pounds per square inch in tension on the threaded root area of cross section; 10,000 pounds per square inch in shear, and shall be those stresses specified in S.A.S.-1 for bearing on aluminum alloy.
   3. The unit stresses for stainless steel (300 series) fasteners shall be 32,000 pounds per square inch in tension on the threaded root area of the cross section; 19,000 pounds per square inch in shear, and shall be those stresses specified in S.A.S.-1 for bearing on aluminum alloy.

SECTION 2803. FABRICATION AND ERECTION

(a) Fasteners. Bolts and other fasteners shall be aluminum, stainless steel (300 series) or aluminized steel, hot-dip galvanized or electro-galvanized steel, or double-cadmium plated AN steel bolts, conforming to SECTION 2802 (a).

(b) Dissimilar Materials. Where the aluminum alloy parts are in contact
with dissimilar materials they shall be installed in accordance with S.A.S.-1.

(c) **Painting.** Painting or coating of aluminum alloy parts shall be in accordance with S.A.S.-1.

(d) **Welding.** Aluminum parts shall be welded with an insert gas shielded arc or resistance welding process. No welding process requiring a welding flux shall be used. Filler alloys shall comply with the requirements of S.A.S.-1.

(e) **Welder Qualification.** All welds of structural members shall be performed by welders qualified in accordance with the procedures of the American Welding Society.

(f) **Attachment.** Methods of joining aluminum parts other than specified herein shall be submitted to the Department for their review and approval.

(g) **Erection.** During erection, structural aluminum shall be braced and fastened to resist dead, wind and erection loads.

**SECTION 2804. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>The Aluminum Association 750 Third Avenue New York, N.Y. 10017</td>
</tr>
<tr>
<td>A.W.S.</td>
<td>The American Welding Society, Inc. 2501 N.W. 7th Street Miami, Florida 33125</td>
</tr>
</tbody>
</table>
CHAPTER 29
EXCAVATIONS, FOUNDATIONS AND RETAINING WALLS

SECTION 2901. SCOPE.

(a) General. In addition to the other requirements of this Building Code, this Chapter shall govern the construction of excavations, foundations and retaining walls.

(b) Structural Design. All foundations shall be designed in accordance with accepted engineering practice by an Engineer or as approved by the Department.

(c) Quality and Design. The quality and design of materials used structurally in excavations and foundations shall conform to the requirements set forth in Chapters 23, 24, 25, 26, 27, and 28 of this Building Code.

SECTION 2902. EXCAVATIONS.

(a) General. Excavations for buildings and excavations accessory thereto shall be protected and guarded against danger to life and property, and shall be made in accordance with the requirements set forth in this Chapter. Excavations shall be retained by supports designed to retain the adjacent soils together with any surcharge loads.

1. All excavations shall be protected so that the adjoining property will not cave or settle. The person or persons making or causing the excavation to be made shall give notice, in writing at least 10 days before the excavation is started, to the owners of adjoining properties, advising them that the excavation is to be made. A copy of the notice shall be submitted to the Department.

(b) Footings. Whenever an excavation for footings is carried below the planned depth, the space excavated below the proposed footing shall be filled solidly with concrete or structural fill as defined in Section 2905, or the footing shall be extended to adequate bearing.

(c) Trench Excavations. All trenches shall provide protection against cave-in.

(d) Inspection. Provisions shall be made to permit for inspection of footings, excavations and foundations.

SECTION 2903. FOUNDATIONS.

(a) General. Every structure shall be supported by a foundation designed to accomodate the bearing material and maximum allowable soil pressures as defined in Table 29-C. Foundations and foundation walls shall be designed to withstand all vertical and horizontal loads. The minimum foundation required for Types III, IV and V buildings as specified in Tables 29-A and 29-B may be waived when designed by an Engineer.

1. Every superstructure shall be anchored to the foundation to resist all superimposed loads.

2. Except for the special provisions of Section 2907 covering the design of cast-in-place piers, and Section 2908 covering the design of piles, all portions of footings shall be designed in accordance with this
Building Code, and shall be designed to minimize differential settlement.

3. Foundations shall not be placed on frozen soil, and shall not be placed in freezing weather unless the foundations and adjacent soil areas are protected against freezing.

4. One story buildings of Type IV and V construction which do not exceed 200 square feet in area may be constructed without a masonry or concrete foundation if the walls are supported on wood mudsills. The structure shall be anchored to prevent uplift or overturning.

**EXCEPTION:** Group I Occupancies.

(b) **Different Levels.** Where foundations are supported at different levels or at different levels from foundations of adjacent structures, the effect of such differences in foundation levels shall be included in the design.

(c) **Materials and Construction.** Footings shall be constructed of concrete as specified in this Chapter. Foundation walls shall be of masonry or concrete as specified in Chapters 24 and 26, and shall be designed in accordance with the provisions of this Chapter.

(d) **Depth.** Exterior foundations, footings, and grade beams of permanent structures, except when founded on rock, shall be placed not less than 3 feet below the finished grade.

**EXCEPTION:** Buildings housing a Group J Occupancy may be placed on a minimum 4 inch reinforced concrete slab, with thickened edges. The bottom of the thickened edges shall extend at least 12 inches below the final exterior finished grade.

(e) **Height Above Ground.** Foundation walls supporting wood members directly above shall extend at least 6 inches above the finished grade.

(f) **Dampproofing.**

1. All foundation walls enclosing a basement or crawl space below finished grade shall be dampproofed outside by the application of an approved dampproofing material.

2. When masonry units are used in foundation walls below grade, the exterior surfaces shall be plastered with at least 1/4 inch cement plaster before the application of dampproofing.

(g) **Ventilation.** The space between the bottom of floor joists or slab and the ground under the building (except the space as may be occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls to insure ventilation of the crawl space area. The openings shall be covered with a corrosion-resistant wire mesh not greater than 1/2 inch nor less than 1/4 inch in any dimension. The minimum total area of ventilating openings shall be proportioned on the basis of 1/2 square foot for each 25 lineal feet of exterior wall. Openings shall be located on opposite sides of the building, and as near to the corner as practicable.

(h) **Crawl Space.** Minimum clearance between any obstruction and the ground beneath a crawl space shall be at least 18 inches. Access to a crawl space shall be at least 18 by 24 inches. See Chapter 52 for equipment access requirements.

**SECTION 2904. SOIL INVESTIGATION.**

(a) **General.** Prior to the issuance of a permit for erection or alteration of a permanent structure, the Department may require the owner to provide
a soil investigation report performed by an Engineer.

(b) **Borings and Test Pits.** Borings and/or test pits shall be made at locations and depths with the materials sampled and tested, to provide a basis for determining the engineering performance characteristics of the materials underlying the site of the proposed structure.

(c) **Classification of Materials.** The classification of rock and soil shall be in accordance with generally accepted geological or engineering nomenclature.

(d) **Report.** The engineer shall prepare a report presenting the data gathered on soil, rock, and ground water conditions; the results of laboratory testing; the analysis of the data gathered; the recommendation on the best type and depth of foundations.

**SECTION 2905. FOOTINGS OR MAT FOUNDATIONS.**

(a) **General.** Footings or mat foundations shall rest upon undisturbed virgin soils or rock, or on compacted controlled structural fill.

(b) **Allowable Bearing Pressure.** The maximum pressure on soils beneath foundations shall not exceed the values set forth in Table 29-C, unless otherwise recommended by an engineer. Footings shall be placed at least one foot below the surface of virgin soil or on rock, except as otherwise specified for structural fill.

(c) **Erratic Foundation Soils.** Where portions of the foundation of a building or structure rest directly upon are underlain by soils having substantially different supporting capacities or layers of different materials which vary greatly in thickness, the magnitude and distribution of the probable settlement shall be investigated. If necessary, the allowable bearing pressures shall be reduced or special provisions be made in the design of the structure to minimize the risk of detrimental differential settlements.

(d) **Structural Fill.** Footings for buildings or structures may rest upon compacted structural fill if recommended by an engineer after a soil investigation as set forth in Section 2904. The fill shall be of approved materials placed at the moisture content and compacted to the density specified by the engineer. Placement and compaction of the structural fill shall be observed by the engineer. Footings placed on the fill shall be designed in accordance with the criteria recommended by the engineer.

(e) **Inflow of Water Into Excavation.** Whenever an inward or upward flow of water develops in an excavation in an otherwise satisfactory bearing material, special methods approved by the Department shall be immediately adopted to stop or control the flow, to prevent disturbance of the bearing material. If the flow of water seriously impairs the stability of the bearing material, the material shall be removed to adequate bearing.

**SECTION 2906. LOAD TESTS.** Where the bearing capacity of the soil is not definitely known or is in question, the Department may require suitable load tests or other proof of the permissible safe bearing capacity at that particular location. The load test shall be designed and supervised by an engineer.

**SECTION 2907. CAST-IN-PLACE PIERs.**

(a) **General.** The allowable axial and lateral loads on cast-in-place piers
shall be determined by a foundation investigation in accordance with Section 2904.

(b) **Quality.** Concrete piers cast-in-place against earth in drilled or bored holes shall be made in a manner to insure the exclusion of any foreign matter, and to secure a full sized shaft. Concrete shall have an ultimate compressive strength of at least 2,500 pounds per square inch.

(c) **Design.** Cast-in-place piers shall be designed in accordance with accepted engineering practice by an engineer.

1. **Downdrag and Lateral Loads.** Design of piers shall take into account downdrag and lateral loads where applicable.

2. **Column Action.** All piers standing unbraced in air, water, or in material not capable of lateral support shall conform with the applicable column formulae as specified in this Building Code. Piers drilled into firm ground may be considered laterally supported continuously.

3. **Group Action.** Provision shall be made for the reduction of allowable pier load when piers are placed in groups.

4. **Static Load Tests.** When the allowable axial load of a single pier is determined by load test, it shall not exceed 50 percent of the yield point under test load. The yield point shall be defined as that point at which an increase in load produces a disproportionate increase in settlement. In addition, the allowable design load shall not exceed 50 percent of that load under which, during a 40-hour period of continuous load application, no additional settlement takes place.

**SECTION 2908. PILES.**

(a) **General.** The allowable axial and lateral loads on piles shall be determined by a foundation investigation made in accordance with Section 2904, by load test, or by recognized pile driving formulae.

(b) **Design.**

1. **Group Action.** Provision shall be provided for the reduction of allowable pile load when piles are placed in groups.

2. **Static Load Tests.** When the allowable axial load of a single pile is determined by load test, the test shall be designed and supervised by an engineer, and shall be in accordance with Section 2907 (c) 4.

3. **Column Action.** All piles standing unbraced in air, water, or material not capable of lateral support shall conform with the applicable column formula specified in this Building Code. Piles driven into firm ground may be considered laterally supported continuously.

4. **Downdrag and Lateral Loads.** Design of piles shall take into account downdrag and lateral loads where applicable.

5. **Protection of Pile Materials.** Where the boring records of site conditions indicate possible deleterious action on pile materials due to soil constituents, changing water levels, or other factors, the materials shall be protected by methods or processes approved by the Department. The effectiveness of the methods or processes used shall have been thoroughly established by satisfactory service records or other evidence which demonstrates the effectiveness of the protective measures.

(c) **Jetting.** Jetting shall not be used except where and as specifically per-
mitted by the Department. When used, jetting shall be carried out in a manner that the carrying capacity of existing piles and structures shall not be impaired. After withdrawal of the jet, piles shall be driven down until the required resistance is obtained.

SECTION 2909. SPECIFIC PILE REQUIREMENTS.

(a) Round Wood Piles.

1. Material. Except where untreated piles are permitted, wood piles shall be pressure treated in accordance with the Standards of Chapter 25. The basic material shall conform to that of untreated piles. Untreated piles may be used only when it has been established that the cutoff will be below lowest ground water level assumed to exist during the life of the structure. Every wood pile shall conform to the specifications for Class A or Class B piles. See Section 2911.

2. Allowable Stresses. The allowable unit stresses for round wood piles shall not exceed those set forth in Chapter 25.

(b) Uneased Cast-In-Place Concrete Piles.

1. Material. Concrete piles cast-in-place against earth in drilled or bored holes shall be placed to insure the exclusion of any foreign matter and to secure a full-sized shaft. The length of the piles shall be limited to not more than 30 times the average diameter. Concrete shall have an ultimate compressive strength of at least 2500 pounds per square inch.

2. Allowable Stresses. The allowable compressive stress in the concrete shall not exceed 0.33 of the ultimate compressive strength of the concrete. The allowable stress in the reinforcing steel shall not exceed that specified for tied columns in Chapter 26.

(c) Metal-Cased Concrete Piles.

1. Material. All concrete used in metal-cased concrete piles shall have an ultimate compressive strength of at least 2500 pounds per square inch.

2. Installation. Every metal casing for a concrete pile shall provide a sealed tip with a diameter of at least 8 inches.

   A. Concrete piles cast-in-place in metal shells shall have shells driven to their full length in contact with the surrounding soil and left permanently in place. The shells shall be designed to resist collapse and to exclude water and foreign material during the placing of concrete.

   B. Piles shall be driven in an order and spacing to insure against distortion of, or injury to, piles already in place. No pile shall be driven within four and one-half average pile diameters of a concrete-filled pile less than 24 hours old unless approved by the Department.

3. Allowable Stresses. Allowable stresses shall not exceed the values specified in Section 2909(b) 2, except that the allowable concrete stresses may be increased to a maximum value of 0.40 of the ultimate compressive strength of concrete for that portion of the pile meeting the following conditions:

   A. The thickness of the metal casing is not less than No. 14 gauge.
   B. The casing is seamless or is provided with seams of equal
strength and is of a configuration which will provide confinement to the cast-in-place concrete.

C. The ultimate compressive strength of the concrete does not exceed 5000 pounds per square inch and the ratio of metal yield strength to concrete ultimate strength shall be at least 6.

D. The pile diameter is not greater than 16 inches.

(d) **Precast Concrete Piles.**

1. **Material.** Precast concrete piles prior to driving after pouring shall develop an ultimate compressive strength of at least 3000 pounds per square inch.

2. **Reinforcement Ties.** The longitudinal reinforcement in driven precast concrete piles shall be laterally tied with steel ties or wire spirals. Ties and spirals shall be spaced not more than 3 inches apart, center to center, for a distance of 2 feet from the ends, and not more than 8 inches elsewhere. The gauge of ties and spirals shall be as follows:
   A. For piles having a diameter of 16 inches or less, wire shall be not smaller than No. 5 gauge.
   B. For piles having a diameter of more than 16 inches and less than 20 inches wire shall be not smaller than No. 4 gauge.
   C. For piles having a diameter of 20 inches and larger, wire shall be not smaller than 1/4 inch round or No. 3 gauge.

3. **Allowable Stresses.** Precast concrete piling shall be designed to resist permanent stresses induced by handling and driving as well as by loading. The allowable stresses shall not exceed the values specified in Section 2909(b) 2.

(e) **Precast Prestressed Concrete Piles (Pretensioned).**

1. **Material.** Precast prestressed concrete piles shall develop a compressive strength of not less than 4000 pounds per square inch before driving and an ultimate compressive strength of not less than 5000 pounds per square inch.

2. **Reinforcement.** The longitudinal reinforcement shall be high tensile wire strand conforming to the Standards of Chapter 26. Longitudinal reinforcement shall be laterally tied with steel ties or wire spirals.
   A. Ties or spirals reinforcement shall be spaced not more than 3 inches apart, center to center, for a distance of 2 feet from the ends, and not more than 8 inches elsewhere.
   B. At each end of the pile, the first 5 ties or spirals shall be spaced 1 inch center to center.
   C. For piles having a diameter of 24 inches or less, wire shall be not smaller than No. 5 gauge. For piles having a diameter greater than 24 inches but less than 36 inches, wire shall be not smaller than No. 4 gauge. For piles having a diameter greater than 36 inches, wire shall be not smaller than 1/4 inch round or No. 3 gauge.

3. **Allowable Stresses.** Precast prestressed piling shall be designed to resist stresses induced by handling and driving as well as by permanent loading. The effective prestress in the pile shall be not less than 400 pounds per square inch for piles up to 30 feet in length, 550 pounds per square inch for piles up to 50 feet in length, and 700 pounds per square inch for piles over 50 feet in length.
pounds per square inch for piles greater than 50 feet in length. The compressive stress in the concrete due to externally applied load shall not exceed:

\[ f_c = 0.33 f'_c - 0.27 f_{pc} \]

**WHERE:**

\( f_{pc} \) is the effective prestress stress on the gross concrete section. Effective prestress shall be based on an assumed loss of 30,000 pounds per square inch in the prestressing steel. The allowable stress in the prestressing steel shall not exceed the values specified in Chapter 26.

(f) **Structural Steel Piles.**

1. **Material.** Structural steel piles and fully welded steel piles fabricated from plates shall conform to the requirements of Chapter 27. No section shall have a nominal thickness of metal less than 3/8 inch.

2. **Allowable Stresses.** The allowable stresses shall not exceed 0.35 of the minimum specified yield strength. The yield strength shall not be assumed greater than 36,000 pounds per square inch for computation purposes.

(g) **Concrete-Filled Steel Pipe Piles.**

1. **Material.** Steel pipe piles shall conform to the requirements of Chapters 26 and 27. The concrete used in concrete-filled steel pipe piles shall have an ultimate compressive strength of not less than 2500 pounds per square inch.

2. **Allowable Stresses.** The allowable stresses shall not exceed 0.35 of the minimum specified yield strength of the steel plus 0.33 of the ultimate compressive strength of the concrete, provided the yield strength of the steel shall not be assumed greater than 36,000 pounds per square inch for computation purposes.

**SECTION 2910. RETAINING WALLS.** Retaining walls shall be designed to resist the lateral pressure of the retained material and other applied loads in accordance with accepted engineering practice. The Department may require a soil investigation as specified in Section 2904, and a design by an engineer. Walls retaining drained earth, where sufficient movement of the wall is allowable to enable mobilization of the soil strength, may be designed for pressure equivalent to that exerted by a fluid weighing least 30 pounds per cubic foot, and having a depth equal to that of the retained earth.

**EXCEPTION:** Where the elevation difference of retained earth (higher grade to lower grade) is 3 feet or less, and where the retaining wall is not part of any other structure, the depth below the lowest grade to the bottom of the footing as specified in Section 2903(d), may be reduced to 1 foot 6 inches.

**SECTION 2911. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards, and those included in Chapters 25, 26, and 27, shall apply:

**ORGANIZATION**

ASTM

**TITLE OF PUBLICATION**


Steel Sheet Piling. A328-1970.

**LEGEND**

**ASTM**

American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

**SECTION 2912. TABLES.**

**TABLE NO. 29-A**

**MINIMUM FOUNDATION REQUIREMENTS FOR TYPE III BUILDINGS**

<table>
<thead>
<tr>
<th>Number of Stories</th>
<th>Depth of Foundation Below Finish Grade in Inches</th>
<th>Width of Footing in Inches*</th>
<th>Thickness of Footing in Inches</th>
<th>Thickness of Foundation Wall in Inches</th>
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<tbody>
<tr>
<td>1</td>
<td>36**</td>
<td>20</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
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<tr>
<td>3</td>
<td>36</td>
<td>24</td>
<td>8</td>
<td>12</td>
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**NOTES:** For reinforced concrete see Chapter 26.
* Does not apply in the case of expansive soils--special investigation required. See Table 29-C.
** For J occupancy, 18” minimum or thickened edge slab as approved by the Department.

**TABLE NO. 29-B**

**MINIMUM FOUNDATION REQUIREMENTS FOR TYPES IV AND V BUILDINGS**

<table>
<thead>
<tr>
<th>Number of Stories</th>
<th>Depth of Foundation Below Finish Grade in Inches</th>
<th>Width of Footing in Inches*</th>
<th>Thickness of Footing in Inches</th>
<th>Thickness of Foundation Wall in Inches</th>
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<td>36**</td>
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<td>6</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>16</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>18</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

**NOTES:** For reinforced concrete see Chapter 26.
* Does not apply in the case of expansive soils--special investigation required. See Table 29-C.
** For J occupancy, 18” minimum or thickened edge slab as approved by the Department.
<table>
<thead>
<tr>
<th>CLASS OF MATERIAL</th>
<th>MAXIMUM ALLOWABLE SOIL PRESSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound unweathered claystone, sandstone, or siltstone</td>
<td>20,000 psf</td>
</tr>
<tr>
<td>Compact, course sand and/or gravel</td>
<td>4,000 psf</td>
</tr>
<tr>
<td>Compact, fine sand</td>
<td>3,000 psf</td>
</tr>
<tr>
<td>High density silt</td>
<td>2,000 psf</td>
</tr>
<tr>
<td>Claya, silty, or sandy claya, and weathered claystone</td>
<td>Usually expansive*</td>
</tr>
<tr>
<td>Loose sand</td>
<td>1,000 psf</td>
</tr>
<tr>
<td>Organic soils, very soft soils, muck, filled ground</td>
<td>*</td>
</tr>
</tbody>
</table>

* Special investigations required—see Section 2904. Provision shall be made for the possible effect of moisture changes on the bearing capacity of the soil.
CHAPTER 30
VENEER

SECTION 3001. SCOPE.

(a) General. All veneer (materials, design, application and maintenance) shall conform to the requirements of this Building Code.

(b) Limitations. Veneer shall not be attached to wood frame construction at a point more than 25 feet in height above the adjacent ground elevation except when approved by the Department considering special construction designed to provide for differential movement.

SECTION 3002. DEFINITIONS. For purposes of this Chapter, certain terms are defined as follows:

1. BACKING. The surface or assembly to which veneer is attached.
2. BONDING AGENT. An adhesive or cementing material used to adhere similar or dissimilar materials together in such manner that the agent develops the required bond stresses.
3. VENEER. A nonstructural facing of material attached to a backing for the purpose of ornamentation, protection, or insulation.
   A. Veneer, Adhered. Veneer secured and supported through adhesion to a bonding material applied over the backing.
   B. Veneer, Anchored. A veneer secured to, and supported by, mechanical fasteners attached to the backing.
   C. Veneer, Exterior. A veneer applied to weather-exposed surfaces, as defined on Chapter 4.
   D. Veneer, Interior. A veneer applied to surfaces other than weather-exposed surfaces, as defined in Chapter 4.

SECTION 3003. MATERIALS.

(a) General. Materials used in the application of veneer shall conform to the applicable requirements for materials as set forth elsewhere in this Building Code.
   For aluminum See Chapter 28.
   For glass See Chapter 54.
   For masonry units and mortar See Chapter 24.
   For plastics See Chapter 60.
   For portland cement plaster See Chapter 47.
   For precast concrete See Chapter 26.
   For steel and iron See Chapter 27.
   For wood See Chapter 25.

(b) Interior Veneers. Veneer used as interior finish shall conform to the requirements of Chapter 42.

(c) Anchors, Supports and Ties. Anchors, supports and ties shall be of noncombustible material and corrosion resistant.

SECTION 3004. DESIGN.

(a) General.
   1. The design of all veneer shall comply with the requirements of Chapter 23 and this Section.
   2. Veneer shall not be assumed to add to the strength of any structure.
3. Exterior veneer, including its backing, shall provide a weatherproof covering.
4. Veneer shall support no load other than its own weight.
5. Surfaces to which veneer is attached shall be designed to support the additional vertical and lateral loads imposed by, and transferred from the veneer.
6. For additional backing requirements, See Chapters 25 and 47.
7. Consideration shall be given for differential movements including that caused by expansion and contraction, shrinkage, creep, and deflection.

(b) **Adhered Veneer.**
1. Adhered veneer and its backing shall be designed to provide a bond to the supporting element sufficient to withstand a shearing stress of 50 pounds per square inch.
2. Backing shall be continuous and may be of any material permitted by this Building Code.
3. The height and length of veneered areas shall be unlimited except as required to control expansion and contraction and as limited elsewhere in this Chapter.
4. Veneer units shall not exceed 36 inches in total area and shall not exceed 36 inches in the greatest dimension, nor more than 720 square inches in total area, and shall weigh not more than 15 pounds per square foot unless approved by the Department.
   **EXCEPTION:** Veneer units weighing less than 3 pounds per square foot shall not be limited in dimensions or area.
5. In lieu of the design required by this Chapter, adhered veneer may be applied by one of the methods specified in U.B.C. Standard No. 30-1.
6. All material shall be compatible; and the bonding agent shall be insoluble in water, and shall retain its adhesive qualities.

(c) **Anchored Veneer.**
1. Anchored veneer and its attachments shall be designed to resist a minimum horizontal force equal to twice the weight of the veneer.
2. Anchored veneer shall be supported by noncombustible supports. Where anchored veneer is applied to a wall more than 25 feet above the adjacent ground elevation, it shall be supported by noncombustible, corrosion-resistant, structural framing having horizontal supports spaced not over 12 feet vertically above the 25-foot height.
3. Noncombustible, corrosion resistant lintels and noncombustible supports shall be provided over all openings where the veneer units are not self-spanning. The deflections of all structural lintels and horizontal supports shall not exceed 1/500 of the span under full load of the veneer.
4. The area and length of anchored veneer walls shall be unlimited except as required to control expansion and contraction and by this Chapter.
5. In lieu of the design required by Chapter 30, anchored veneer may be applied by one of the methods specified in U.B.C. Standard No. 30-1.

**SECTION 3005. STANDARDS.** Unless provided for in other portions of
this Building Code, the following Standards, and those applicable Standards in Chapter 24 shall apply.

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<td>U.B.C. (Uniform Building Code)</td>
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CHAPTER 31
REHABILITATION OF OLDER BUILDINGS

SECTION 3101. GENERAL.

(a) **Scope.** This Chapter shall govern the rehabilitation of buildings, structures, and utilities in Group B-3, C, F, H, I and J occupancies which were built prior to January 1, 1950, and shall supersede all the requirements of this Building Code which are in conflict with the provisions of this Chapter.

  **EXCEPTION:** This Chapter shall not supersede the requirements of Chapter 1 relating to unsafe buildings, structures, or utilities.

(b) **Declaration.** It is hereby declared, as a matter of public policy, that the rehabilitation, preservation, and restoration of older buildings located within the City is a public necessity and is required in the interest of the general welfare of the people. Special consideration shall be given to buildings that are Denver Landmarks or buildings on the National Register of Historic Places and National Historic Districts.

  **EXCEPTION:** Existing buildings, structures, or utilities may be granted an exception allowing the repair, rehabilitation, or change of occupancy of a building where the planned repairs, rehabilitation, or change of occupancy would not comply with the provisions of this Building Code. No exception shall be authorized hereunder unless the Director shall find the following conditions exist:

  1. The building was constructed prior to January 1, 1950.
  2. The building, structure, or utility is structurally sound and the proposed repair, rehabilitation, or change of occupancy will substantially improve the use, safety, and welfare of the occupants.

     **A.** The Director, in making this determination, may request an Engineer's or Architect's report to determine the condition of the building, structure, or utility.

  3. The proposed repair or rehabilitation of a building, structure, or utility for residential use does not violate the provisions of the Housing Code, Article 631, Revised Municipal Code.

  4. The Fire Department concurs in any alternative method, utility, appliance, or system related to fire safety.

SECTION 3102. REHABILITATION ADVISORY PANEL.

(a) **Creation.** An Advisory Panel of 25 persons, with experience in the rehabilitation of buildings, structures, or utilities shall be appointed by the Mayor. Individual members of City Council may submit names to the Mayor for consideration for appointment to the Advisory Panel. Their term of office shall be as follows:

  1. Five persons shall be appointed for a term of 1 year.
  2. Five persons shall be appointed for a term of 2 years.
  3. Five persons shall be appointed for a term of 3 years.
  4. Five persons shall be appointed for a term of 4 years.
  5. Five persons shall be appointed for a term of 5 years.

After the initial appointments are made, each appointment shall be
made for a 5 year term. The Advisory Panel shall serve without compensation.

(b) **Composition of Advisory Panel.** The Advisory Panel shall consist of the following:
1. Three members shall be Architects.
2. Three members shall be Engineers.
3. Two members shall be holders of a Class A or B Construction License.
4. Two members shall be holders of a Plumbing Contractor's Class A License; and one member shall be the holder of a Plumbing Journeyman's Certificate.
5. Two members shall be holders of a Heating and Ventilating Contractor's Class A License; and one member shall be the holder of a Heating and Ventilating Journeyman's Certificate.
6. Two members shall be holders of a Steam and Hot Water Contractor's Class A License; and one member shall be the holder of a Steam and Hot Water Journeyman's Certificate.
7. Two members shall be holders of an Electrical Contractor's Class A License; and one member shall be the holder of an Electrical Journeyman's Certificate.
8. The remaining five members of the Advisory Panel shall be appointed from the real estate and financial field.

(c) **Vacancy.** Should a vacancy occur on the Advisory Panel during a member's term, the Mayor may fill the vacancy for the unexpired term. Any member of the Advisory Panel, after serving a complete term, may be reappointed to another full term.

(d) **Guidelines.** The Advisory Panel shall adopt guidelines for use by the Director in determining compliance with this Chapter.

(e) The Advisory Panel may adopt rules, procedures, and organization.

**SECTION 3103. COMPLIANCE.** The Director, in determining compliance with the conditions set forth in this Chapter, may or shall, upon request of the applicant, establish a Sub-Panel consisting of 4 to 8 members of the Advisory Panel; a member of the Department of Health and Hospitals; and the Fire Department.

**SECTION 3104. CONSIDERATION.** The requirements of this Building Code shall be met in the rehabilitation of all buildings, structures, and utilities; but consideration for an exception may be given to existing buildings, structures, and utilities deemed safe and useable by the Department.
CHAPTER 32
ROOF AND ATTIC CONSTRUCTION

SECTION 3201. GENERAL. In addition to other requirements of this Building Code, this Chapter shall govern the materials, flashings, construction, application, alteration, and repair of all roof coverings.

SECTION 3202. DEFINITIONS. For the purposes of this Chapter, the following definitions shall apply:

1. **Asphalt.** A dark brown to black bitumen used in the manufacture of roofing materials.

2. **Asphalt (composition) Shingles.** Bituminous shingles surfaced with noncombustible granules.

3. **Asphalt Mastic.** A mixture of asphaltic material, graded mineral aggregate, and fine mineral matter which can be poured when heated, but which requires mechanical manipulation to form.

4. **Asphalt Primers.** A liquid asphalt of low viscosity.

5. **Backnailing.** The practice of blind-nailing, in addition to hot-mopping, all the plies to a substrate to prevent slippage.

6. **Base Sheet.** One or more layers of felt or combination sheet manufactured for use as a roofing base layer.

7. **Bitumen.** A class of black, cementation substances, natural or manufactured, composed principally of high molecular weight hydrocarbons, asphalts, tars, and pitches.

8. **Blister.** A spongy, raised portion of a roofing membrane.

9. **Bond.** Adhesive strength preventing delamination of two roofing components.

10. **Built-Up Roof Covering.** 2 or more layers of roofing consisting of a base sheet, cap sheets, and gravel or mineral aggregate, when used.

11. **Built-Up Roofing Membrane.** A continuous, semiflexible roof covering of laminations, or plies, or saturated or coated felts alternated with layers of bitumen, surfaced with mineral aggregate or asphalitic materials.

12. **Cant Strip.** A beveled strip placed in the angle or the abutting wall to avoid a sharp bend in the roofing material.

13. **Cap Sheet.** The top layer of a built-up roof.

14. **Cementing.** A solidly mopped application of hot asphalt, cold liquid asphalt compound, hot coal tar pitch, or other approved cementing material.

15. **Coal Tar Pitch.** A bituminous by-product of coke used in pitch felts.

16. **Coated Base Sheet (or Felt).** A felt that has previously been impregnated with asphalt, and later coated with harder, more viscous asphalt.

17. **Coatings.** Liquid bitumen without aditives, or with asbestos fibers added and sometimes thinned with petroleum solvent.

18. **Cold-Process Roofing.** A bituminous membrane consisting of layers of coated felts bonded with cold-applied asphalt roof cement, and surfaced with a cutback or emulsified asphalt roof coating.

19. **Combination Sheet.** A glass fiber felt integrally attached to kraft paper.

20. **Counterflashing.** See Flashing.
21. Cricket. A small false roof on the upper side of the junction of the roof with another surface, sloped to shed the water.
22. Cutback. An organic, solvent-thinned, soft, or fluid cold-process bituminous roof coating or flashing cement.
23. Edge Stripping. Application of felt strips to start the felt-shingling pattern at a roof edge.
24. Edge Venting. Regularly spaced openings at a roof perimeter to relieve the pressure of water vapor entrapped in the insulation.
25. Emulsion. A mixture of bitumen and water, with uniform dispersion of the bitumen globules achieved through a chemical or clay emulsifying agent.
26. Envelope. A continuous edge formed by folding an edge base felt over the plies above.
27. Exposure. The transverse dimension of a felt not overlapped by an adjacent felt in a built-up roofing membrane.
29. Flashing. A device to seal or cover open joints or edges where the membrane is interrupted.
30. Flashing Cement. A trowelable, plastic mixture of bitumen and asbestos, or other inorganic reinforcing fibers, and a solvent.
32. Glaze Coat. (1) The top layer of asphalt in a smooth-surfaced built-up roof assembly; (2) a thin protective coating of bitumen applied to the lower plies or top ply of a built-up embrane when the top pouring and aggregate surfacing are delayed.
33. Gravel. An inorganic material of rock, ceramic, and other approved materials used as top surfacing materials for built-up roofs.
34. Gravel Stop. A flanged device designed to prevent loose aggregate from washing off the roof and to provide a finished edge for a built-up roofing assembly.
35. Hip. The external angle formed by the junction of two sloping sides of a roof.
36. Metal Roofing. Metal shingles or sheets for application on solid roof surfaces, and corrugated or otherwise shaped metal sheets or sections for application on solid roof surfaces or roof framings.
37. Mineral-Surfaced Sheet. An asphalt saturated felt, coated on one or both sides and surfaced on the weather-exposed side with mineral granules.
38. Mopping. An application of bitumen applied hot with a mop or mechanical applicator to the substrate or to the felts of a built-up roofing membrane.
   A. Solid Mopping. A continuous mopping surface with no unmopped areas.
   B. Spot Mopping. A mopping pattern in which the hot bitumen is applied in roughly circular areas, generally about 18 inches in diameter, with a grid of unmopped, perpendicular bands.
   C. Strip Mopping. A mopping pattern in which the hot bitumen is applied in parallel bands, generally 8 inches wide with 4 inch unmopped spaces.
D. Sprinkle Mopping. A random pattern of heated bitumen beads hurled onto the substrate from a broom or mop.

39. Pitch Pans or Pitch Cups. Metal used to contain asphalt bitumen or plastic roof cement.

40. Ply. A layer of felt in a built-up roofing membrane.

41. Prepared Roofing. Manufactured or processed roofing material other than untreated wood shingles and shakes as distinguished from built-up roof covering.

42. Rake. The edge of a roof at its intersection with a gable.

43. Reglet. A groove in a wall or other vertical surface adjoining a roof surface for the embedment of counterflashing.

44. Roofing System. An assembly of interacting roof components designed to weather-proof a building’s top surface.

45. Roofing Square. 100 square feet of roofing surface.

46. Roof Tape. Cotton fabric asphalt saturated, burlap asphalt saturated, or treated glass fiber.

47. Saddle. A small false roof on the upper side of a roofing surface to divert drainage two ways from a projection through the roof.

48. Shingling. The pattern formed by laying parallel felt rolls with lapped joints so that one longitudinal edge overlaps the longitudinal edge of one adjacent felt.

49. Slope. The tangent of the angle between the roof surface and the horizontal.

50. Smooth Surfaced Roof. A built-up roofing membrane surfaced with a layer of hot mopped asphalt or cold-applied asphalt-clay emulsion or asphalt cutback, or sometimes with an unmopped, inorganic felt.

51. Substrate. The surface upon which the roofing membrane is placed.

52. Underlayment. One or more layers of felt or approved paper over which the prepared roofing is applied.

53. Valleys. The junction of two sloping roofs producing an acute angle.

54. Vapor Barrier. A material designed to restrict the passage of water vapor.

55. Wood Shakes. Tapered or nontapered pieces of Western red cedar or redwood of random widths.

56. Wood Shingles. Tapered pieces of Western red cedar or redwood, sawed both sides, of random widths.

SECTION 3203. GENERAL REQUIREMENTS.

(a) Except as provided for in this Chapter, roof coverings shall be Class A, B, or C built-up or prepared roofing.

(b) Roof coverings shall be securely fastened to the supporting roof construction and shall provide weather protection for the building.

(c) Roofing materials shall be delivered to the construction site in packages bearing the manufacturer’s label or identifying mark.

1. Each package of prepared roofing and built-up roof covering materials shall bear the label of an approved inspection bureau or agency, which provides and inspection service for the manufacturing process and the finished products.

2. Each bundle of wood shakes and wood shingles shall comply with the grading and packing rules of hand-split red cedar shakes of the Red
Cedar Shingle and Hand-Split Shake Bureau, and shall bear the label of an approved inspection bureau or agency specifying of the grade.

3. Slate shingles shall comply with ASTM - C 406.

4. Asphalt or pitch shall be delivered in one of the following methods:
   A. In cartons indicating the manufacturer and the softening point of the product.
   B. Bulk shipments of asphalt or pitch to the construction site shall be accompanied by a certification by the manufacturer of the softening point.

(d) A current copy of the manufacturer’s specifications shall be provided by the roofing contractor at the job site for reference during construction.

(e) All Class A, B, or C roof systems shall be approved and listed by an approved agency and shall be installed in accordance with the manufacturer’s specifications.

SECTION 3204. FIRE-RETARDANT REQUIREMENTS.

(a) **Fire Zones 1 and 2.** A Class A or B roof shall be required for buildings of all types of construction.

(b) **Fire Zone 3.** A Class A or B roof shall be required for buildings of construction types I, II, III, IV. A Class C roof shall be required for buildings of construction type V.

   **EXCEPTION:** In groups H-2, H-3, I, and J occupancies, wood shingles and shakes shall be permitted without classification.

SECTION 3205. BUILT-UP ROOF COVERINGS.

(a) **General.** Class A, B, built-up roof covering shall provide as a minimum, an incline not more than 3 inches per foot, and shall be constructed as follows:
   1. A manufacturer’s designated base sheet.
   2. 3 plies of Type 15 asphalt organic perforated felt.
   3. Slag, spread at the rate of approximately 300 pounds per roofing square, or gravel at the rate of approximately 400 pounds per roofing square.

   4. Attachment and inter-ply moppings shall conform to the Standards of this Chapter.

(b) **Class C Built-Up Roof.** A Class C built-up roof covering shall provide as a minimum an incline of not more than 3 inches per foot, and shall be constructed as follows:
   1. A manufacturer’s designated base sheet.
   2. Two plies of Type 15 asphalt organic perforated felt.
   3. Gravel spread at the rate of approximately 400 pounds per roofing square.

   4. Attachment and inter-ply mopping shall conform to the Standards of this Chapter.

   **EXCEPTIONS:** In group J occupancies, one layer of Type 90 heavy mineral-surfaced roll roofing may be used under the following conditions:
   A. With a roof incline of one inch per foot or greater, the roofing shall be applied with a minimum 2 inch lap.
B. With a roof incline of less than one inch per foot, the concealed nailing method shall be used.

SECTION 3206. ROOF AND ATTIC CONSTRUCTION.

(a) **Framing.** All roofs shall be framed and tied into the framework and supporting walls to form an integral part of the structure.

(b) **Joints.** The joints of all roof trusses shall be well fitted, and all tension members shall be tightened prior to being loaded.

(c) **Stresses.** The stresses of materials used in trusses shall be as specified in Chapters 23, 25, and 27. In determining the strength of a truss at any point, the minimum net section of the members after framing shall be used.

(d) **Plywood.** Plywood used for roof sheathing shall be a minimum of 1/2 inch thick and exterior type. No surface or edge shall be exposed to the weather, and the sheathing shall not exceed the spans set forth in Table No 25-C.

(e) **Ventilation of Enclosed Attic and Rafter Spaces.** Cross-ventilation shall be provided for all attics and for each separately enclosed space formed when ceilings are applied to the underside of roof rafters.
   1. Ventilating openings shall be protected against the entry of rain or snow.
   2. The net free opening of the ventilating area shall be at least 1/300th of the area of the space to be ventilated, and shall be located in the upper 1/2 of the space to be ventilated. In group H and I occupancies, soffit vents may be provided.

(f) **Attic Access.** Attic spaces with a vertical clear height of more than 30 inches, in buildings with combustible ceiling or roof construction, shall be provided with access from the top floor of the building.
   1. The access opening shall measure at least 22 by 30 inches.
   2. The access opening shall provide at least 30 inches clear head room above the opening.
   3. If mechanical equipment is located in an attic or roof, see Chapters 33 and 52.

(g) **Attic Area Separations.** Enclosed attic spaces formed of combustible construction shall be divided into horizontal areas not exceeding 3000 square feet by partitions extending from ceiling to the roof. These partitions shall be at least 1/2-inch thick gypsum wallboard, or other approved noncombustible material nailed to 2 X 4 inch studs. Openings in these partitions shall be protected by self-closing doors.

**EXCEPTION:** When the entire attic is equipped with an approved automatic fire-sprinkler system, the attic space may be divided into areas not to exceed 9000 square feet.

(h) **Curtain Boards.**
   1. **Required Curtain Boards.** Curtain boards shall be installed in all occupancies when any undivided floor area exceeds 35,000 square feet, or in Group E occupancies when the undivided floor area exceeds 15,000 square feet.
   2. **Construction.** Curtain boards shall be constructed of sheet metal, asbestos millboard, lath and plaster, gypsum wallboard.
   3. **Location and Depth.**
      A. Except in Group E occupancy, curtain boards shall extend down
from the ceiling a minimum distance of 6 feet, except that curtain boards need not extend below a point 8 feet above the floor.

B. In Group E occupancies, curtain boards shall extend down from the ceiling a distance of 12 feet, except that curtain boards need not extend below a point 8 feet above the floor if the curtain is not less than 6 feet in depth.

4. Spacing.
   A. Except in Group E occupancies the distance between curtain boards shall not exceed 200 feet, and the curtained area shall not exceed 35,000 square feet.
   B. In Group E occupancies the distance between curtain boards shall not exceed 100 feet and the curtained area shall not exceed 15,000 square feet.

SECTION 3207. NEW ROOF COVERINGS.

(a) Application. All roofing shall be applied on clean and dry decks in accordance with manufacturer’s current instructions.

(b) Construction of Built-Up Roofing.
   1. The Base sheet shall be cemented or spot mopped to nonnailable decks in accordance with the manufacturer’s instructions.
   2. The base sheet shall be nailed over an approved nailable surface in accordance with the manufacturer’s instructions.
   3. Successive layers shall be cemented using no less cementing material than that specified for a solidly cemented base sheet.
   4. Gravel surfaced roofs shall be surfaced with hot asphalt or pitch in which is embedded gravel or an approved surfacing material, installed in accordance with the manufacturer’s instructions.
   5. Cap sheets shall be cemented to the base or felts using no less cementing material than that required for solid mopping.
   6. Asphalt shall be heated and applied at temperatures specified by the manufacturer.
   7. Built-up roofing shall be applied by beginning at the low spots and working toward the ridges, or high point shingling the adjacent felts and cap sheets and applying all felts and cap sheets in solid, uniform moppings of bitumen.
   8. A base sheet used in built-up composition roofing shall be considered as one ply or layer.
   9. All non-nailable decks, parapet walls, party walls, or any protrusion through a roof shall be coated with primer prior to intermittent application, in accordance with the manufacturer’s specifications.
   10. 90 pound mineral roofing shall not be used on roofs having a slope of less than 1 inch in 12 inch rise except on a Group J occupancy and shall be applied when the atmospheric temperature is in excess of 45 degrees F.
   11. A cant strip shall be installed to all vertical projections where they meet the roof.
   12. Pitch pans and roof jacks shall be installed on top of finished felts with 2 layers of Type 15 felt applied over the top of metal flanges. All roof jack flashing around jpipes and projections protruding through roof decking, shall extend a minimum of 6 inches above the finished roof and be tightly fitted to the pipe. Flanges shall extend a
minimum of 4 inches onto the deck with all seams soldered. All
metal shall be set in and covered with plastic cement prior to the ap-
lication of the 2-plys of Type 15 felt.
13. Projections such as ladder struts, flag poles, sign braces, and similar
projections shall have pitch pans or pitch cups around the projec-
tions. The pans or cups shall be filled with a minimum of 2 inches of
plastic cement and rounded off. The base flange shall protrude 4 in-
ches beyond the outside edge of the cup and be installed on top of the
finished roofing and covered with 2-plys of Type 15 felt.
14. Gravel stops or guards with a minimum height of 3/4 inch and an
apron extending at least 4 inches onto the roofing shall be installed
on top of the finished membrane on all built-up roofs without
parapet walls. Gravel stops or guards shall be set in a bed of plastic
cement, nailed to the roof decking on 3 inch centers, covered with
plastic cement, and stripped or covered with 2 plys of Type 15 felt.
15. Nails.
A. Built-up roof nails shall be long enough to penetrate into the
deck 3/4 inch or through the thickness of the sheeting,
whichever is less.
B. Nails for wood deck shall be no less than No. 12 gauge, with with
3/8 or 7/16 inch heads driven through tin caps, or approved nails
with intregal caps.
C. On plywood decks, ring shank nails driven through tin caps or
approved nails with intrigal caps shall be used.
D. For decks made of gypsum, insulating concrete, cementitious
wood fiber, and other materials, nails as specified in Table 32-A
shall be used.
E. Fasteners recommended by deck manufacturers shall be used
for any deck material not covered in this Section.
(c) Asphalt Shingles.
1. Asphalt shingles may be applied to solid wood sheathed roofs with a
slope of more than 2 inches in 12 inch run.
2. When the roof slope is 2 to 4 inches in 12 inch run, two layers of Type
15 felt shall be applied shingle fashion prior to installation of the
shingles. The two layers of felt shall be cemented together from the
extreme edge of the roof for a distance of 2 feet.
3. When the roof slope is 4 inches or more in 12 inch run, one layer of
Type 15 felt shall be applied shingle fashion prior to installation of
the shingles.
4. Shingles shall be fastened according to manufacturer's instructions,
except that the following minimum number of nails shall be used:
   A. Self-scaling type shingles: 4 nails per 36 inch strip.
   B. Standard 3 tab (non-sealing) shingles: 6 nails per 36 inch strip.
   C. Individual shingles less than 18 inches wide: 2 nails per shingle.
5. Nails used to fasten asphalt shingles shall meet or exceed the
manufacturer's recommendations, and shall meet the following
minimum standards:
   A. Shall be at least 12 gauge wire with heads 3/8 to 7/16 of an inch
      in diameter.
   B. Shall be galvanized or corrosion resistant metal.
C. Shall be long enough to penetrate the roofing material and at least 3/4 of an inch into the wood deck lumber or through the sheathing, whichever is less.

**Staples shall be permitted on new installations only.**

6. Hips and ridges shall be centered and provided double coverage, with a maximum of 5 inches exposure.

(d) **Slate Shingles.** Slate shingles may be used when they comply with ASTM C 406, and are installed in accordance with the manufacturer's specifications.

(e) **Asbestos Cement Shingles.** Asbestos cement shingles may be installed when they meet the standards of ASTM - C 222, and are installed in accordance with the manufacturer's specifications.

(f) **Metal Shingles, Corrugated, or Flat Sheets.** Metal shingles may be used when installed in accordance with manufacturer's specifications and the Standards.

(g) **Tile of Clay or Concrete.** Tile of clay or concrete shall be installed in accordance with the manufacturer's specifications and shall be securely fastened to the deck with approved mechanical fasteners. Tile roofs shall have an underlayment of at least 2 layers of type 15 felt, or layer of type 30 felt.

(h) **Wood Shingles.** Wood shingles may be applied to roofs with solid sheathing or spaced sheathing with spaces not exceeding 2-1/2 inches. Wood shingles shall be applied as follows:

1. Shingles shall be laid with a side lap of at least 1-1/2 inches between joints in adjacent courses, and not in direct alignment in alternate course.
2. Spacing between shingles shall be not less than 1/4 of an inch.
3. Each shingle shall be fastened with not more than 2 nails or staples positioned approximately 3/4 of an inch from each edge and above the overlapping course lines.
4. Starter courses at eaves shall be doubled.
5. Weather exposures shall not exceed those specified in Table No. 32-B. Hip and ridge weather exposures shall not exceed those permitted for the field of the roof.

(i) **Wood Shakes.** Wood shakes shall be applied to roofs with solid sheathing only, and shall be applied over an underlayment of at least one layer of type 30 felt or 2 layers of type 15 felt, lapped 1/2 the width of the sheet. The installation of wood shakes shall be as follows:

1. Shakes shall be laid with a side lap of least 1-1/2 inches between joints in adjacent courses and not in direct alignment with alternate courses.
2. Spacing between shakes shall be not less than 3/8 of an inch.
3. Each shake shall be fastened to the sheathing with not more than 2 nails or staples, positioned approximately 1 inch from each edge and above the overlapping course lines.
4. The starter course at eaves shall be doubled, the bottom or first layer being wood shingles.
5. 15 or 18 inch shakes shall be used for the final course at the ridge.
6. Weather exposures shall not exceed those specified in Table No. 32-B. Hip and ridge weather exposures shall not exceed those permitted for the field of the roof.
7. Under each hip or ridge there shall be placed one layer of type 30 felt, at least 6 inches in width.

SECTION 3208. REROOFING.

(a) General. All reroofing shall comply with the requirements of this Chapter for the class and type of roof, and the following requirements:

1. Prior to any reroofing, the existing surface shall be carefully inspected, and all wrinkles, buckles, blisters, areas containing moisture, and unsecured layers of the existing surface shall be removed or repaired.

2. Built-up roofs shall not have more than a total of 2 roofing applications, including the original roof. Shingle roofs shall not have more than 3 roofing applications, including the original roof, without certification by an engineer of the structural capability of the existing framing to withstand the additional load. For purposes of this Section, 2 layers of 90 pound rolled roofing or 2 layers of split-roll roofing shall be counted as one covering.

3. Prior to reroofing of any shingle type roof, the existing hip and ridge shingles shall be removed.

4. Vent flashings, metal edgings, drain outlets, metal counterflashings, pitch pans, and collars may be reused when conforming to the requirements of this Chapter. Rusted metal shall be replaced. Metal shall be primed with cutback primer prior to installation. Collars and flanges shall be flashed per the roofing manufacturer's instructions.

(b) Reroofing of Built-up Roofs. One of the following methods of reroofing shall be followed for built-up roofs:

1. Existing roofing shall be completely removed and the deck prepared to receive a new roof in accordance with the manufacturer's instructions.

2. Existing gravel clay surfacing shall be completely removed to existing membrane unless otherwise approved by the Department. Existing membrane shall be made free of all wrinkles, buckles, blisters, or areas containing moisture or unsecured layers.

(c) Reroofing of Asphalt Shingle Roofs.

1. Prior to reroofing, the existing roofing shall be cleaned of loose and curled shingles and debris, and any damaged area repaired. The rake shall be trimmed to the edge board.

2. Wood shingles may be applied over asphalt shingles without the use of nailer strips.

   EXCEPTION: When specifically approved, the following method may be utilized:

   A. Existing roof shall be cleaned by a power broom, vacuum, or similar mechanical device, of all loose or fine materials and covered with a porous (self-venting) insulation. Insulation shall be a minimum of 11/16 inch thick if preformed type, and minimum of 2 inches thick if poured in place. Roofs shall not have more than one application of this method.

(d) Reroofing Over Slate, Asbestos Cement, Tile and Wood Shake Roofs. Reroofing over slate, asbestos cement, cement, tile, and wood shake roofs is prohibited.
(e) **Reroofing Over Wood Shingles.** Only composition shingles over a type 30 felt underlayment may be used over wood shingles.

(f) **Reroofing Over Metal Roofs.** Wood sheathing or rigid insulation shall be applied prior to any reroofing over metal roofs.

(g) **Staples.** Staples shall be permitted on new installations only.

**SECTION 3209. FLASHING.**

(a) **General.** Flashing shall be installed on all vertical walls and curbs in accordance with the manufacturer’s specifications and:

1. All flashing surfaces shall be primed.
2. A minimum of one ply of reinforced asbestos flashing sheet and one ply of asbestos finishing felt shall be used, but shall not be less than the manufacturer’s flashing recommendations.

   **EXCEPTION:** For Group I and J occupancies, the flashing shall be equivalent to the type of roofing being installed.
3. All flashing shall extend at least 8 inches, but not more than 12 inches, up all vertical surfaces, and at least 4 inches out onto the roof.
4. The top edges of the flashing shall be fastened at 3 inch intervals and sealed with plastic cement.
5. End laps shall be at least 3 inches long, nailed vertically and covered with 4 inches of asbestos felt embedded in plastic cement.
6. The entire base of the flashing shall be covered with a coating of the applicable surfacing materials in accordance with the manufacturer’s specifications.
7. The top edges of all felts and roofing shall be given a coating of approved plastic cement upon completion of the nailing requirements.
8. On smooth-surfaced roofs, the bottom edge of the flashing extending out onto the roof shall be covered with a 4 inch strip of asbestos felt.
9. All vertical walls and projections shall be counterflashed with a 2 piece metal system installed watertight.
10. Nailer strips shall be provided on vertical walls, drips in edge and curbs which will not accept conventional nailing.

(b) **Valley Flashings.**

1. Metal valley flashing for shingle roofing shall be at least 28 guage galvanized or corrosion-resistant metal over an underlayment of one layer of type 30 felt or 2 layers of type 15 felt. The metal shall extend at least 10 inches on each side of the center line of the valley, and each section of flashing shall overlap the adjacent section of flashing at least 4 inches.
2. When noninterlocking asphalt shingles are used, the valley flashing may be woven, closed-cut, or open-valley type, in accordance with the Standards.
3. When interlocking composition shingles are used, valley flashing shall be open type.
4. Open valley flashing shall be constructed of metal or type 90 roofing applied in 2 layers, the first layer 18 inches in width and the second 36 inches in width.
5. All valley flashings shall be centered in the valley.
6. When wood shakes, slate, asbestos cement, tile, or shingles are used, they shall have an open type metal flashing.

32-10
(c) **Vertical Surfaces.** Flashings shall be provided wherever vertical surfaces meet a roof, and shall be constructed as follows:

1. On new construction, when the roofs are of rigid asbestos, slate, wood, or asphalt shingles, a metal base flashing and metal counterflashing of at least 28 gauge galvanized metal shall be installed.
2. Base flashing of the step type shall be installed between each course of material.
3. Under clay or concrete shingles, a metal base flashing and counterflashing shall be installed on all roofs.
4. Where the new roof is installed over an existing composition shingle roof, all pipes and vertical projections shall be flashed with plastic cement.
5. A saddle or cricket shall be installed on the upper side of all projections 30 inches or more in width on all sloping roofs.
   A. All saddles or crickets on the upper side of all projections shall be covered with galvanized metal, with soldered joints, or asphalt rolled roofing at least 18 inches wide and equivalent to the type of roofing being applied, nailed over the saddles or crickets and sealed with plastic cement.
   B. Areas where saddles and crickets are not required on the upper side of projections shall be flushed with galvanized metal with a minimum width of 18 inches or asphalt rolled roofing 18 inches wide, equivalent to the type of roofing being applied, and shall be nailed and sealed with plastic cement.

(d) **Vertical Projections.**

1. All projections penetrating the roof deck shall be finished off with a roof jack. The roof jack shall provide a 4 inch flange on the deck and 6 inches of pipes.
2. Pitch pans shall be used with all objects setting on the top of completed roofs but not penetrating the roof deck, with a 4 inch flange and 2 inches in depth.

**SECTION 3210. EQUIPMENT ON ROOFS.**

(a) Mechanical equipment placed, replaced, or reset over roofing shall be supported by curbs or legs which shall be flashed to the roofing and made watertight. Mechanical equipment shall include, by way of example, and not limitation, heating, cooling, refrigeration, ventilating, fans, blowers and similar types of equipment.

(b) **Flat Roofs.** Roofs having a pitch of less than 2 inches rise in a 12 inch run, mechanical equipment shall be supported on a square or rectangular platform which shall be sheathed over solid and covered with metal of at least 26 gauge and surrounded by curbs. All seams and mitre corners of the metal on the platform shall be riveted and soldered so as to be watertight. The platform shall be a minimum of 9 inches above the finished roof or, the units may be set on legs when the following is adhered to:

1. Units in which the largest horizontal dimension does not exceed 4 feet, shall provide a clearance of at least 18 inches from the bottom of the unit to the finished roof.
2. Units in which the largest horizontal dimension does not exceed 4 feet to 8 feet, shall provide a clearance of at least 36 inches from the
bottom of the unit to the finished roof.

3. Units in which the largest horizontal dimension is in excess of 8 feet shall provide a clearance of at least 4 feet from the bottom of the unit to the finished roof.

(c) **Sloped Roofs.** On roofs having a pitch of more than 2 inch rise in a 12 inch run, mechanical equipment may be set on legs which provide a minimum of 11 inches clearance between the equipment frame and the finished roof.

(d) **Piping, Conduits, Etc.** Except where they vertically penetrate the roof, all ducts, piping or conduits shall provide a minimum of 12 inches above the surface of the finished roof and shall be supported on metal stands installed in pitch pans no more than 10 feet between stands.

**SECTION 3211. ROOF DRAINAGE.**

(a) **General.** All roofs or other enclosed structures shall be provided with drains or gutters and downspouts sufficient to drain the roof deck. All downspouts shall discharge upon concrete blocks at least 12 inches in width by 36 inches in length.

**EXCEPTION:** On structures and greenhouses, when the roof extends at least 3 feet horizontally beyond the building wall, and the wall is at least 10 feet from adjacent property lines, shall not be required to have gutters and downspouts except when the roof drains into a sidewalk or pedestrian way.

(b) **Roof Drains.** Except when roofs are sloped to drain to the roof perimeter, interior drains shall be installed, and shall be sized to convey the water to the storm drainage system. See Chapter 50.

(c) **Flashing.** Flashing for interior roof drains shall be one of the following:

1. A minimum of 2 X 2 feet, 4 pound lead sheet or lead-copper coated sheet, set on completed felts in flashing cement.

2. The metal shall be turned a minimum of 1/2 inch into a drain sump and plied with two plies of Type 15 felt.

3. A two component drain system. The membrane flashing shall be polyvinylchloride sheet measuring 22 inches in its overall length, and factory-attached to the underside of the strainer flange. The membrane flashing shall be applied on top of the completed felt, shall extend a minimum of 7 inches from the outside diameter of the drain throat, shall be set into hot asphalt or roofing cement, and plied in with two plies of Type 15 felt.

(d) **Overflow Drains, Scuppers, and Downspouts.** When roof drains are installed, overflow drains having the same capacity as the roof drains shall be installed with the inlet flow line located 2 inches above the low point of the roof; or overflow scuppers having three times the capacity of the roof drains may be installed in adjacent parapet walls, with the inlet flow line located 2 inches above the low point of the adjacent roof, and having a minimum opening height of 4 inches.

(e) **Concealed Piping.** Roof drains and overflow drains, when concealed within the construction of the building, shall be installed in accordance with Chapter 50.

(f) **Discharge Water.** Water shall not be discharged from any conductor pipes onto any public sidewalk, but shall be conducted underneath the walk to the gutter or street.
(g) Gutters and Downspouts.

1. Gutters shall be installed so that the line of the slope of the roof intersects the inside face of the gutter. Gutters shall slope to drain.
2. Hangers shall be the same material as the gutters and installed level with the gutter.
3. Maximum spacing of hangers shall be as follows:
   - Stainless steel gutter: 60 inches on centers.
   - Galvanized steel gutters: 36 inches on centers.
   - Copper, aluminum, or zinc-copper alloy gutters: 24 inches on centers.
4. Gutters shall be anchored to the roof deck.
5. All joints shall be soldered or riveted and sealed with an approved sealant.
6. Gutter backs shall extend beneath roof covering a minimum of one inch, or be provided with a drip edge one inch beneath the roof covering and extending down a minimum of 2 inches into the gutter trough.
7. Downspouts shall be anchored to the building by supporting straps not more than 8 feet on centers, and be of the same material as the gutter.

SECTION 3212. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asphalt Roofing Surfaced with Powdered Talc or Mica. D224-68.</td>
</tr>
<tr>
<td></td>
<td>Asphalt Shingles Surfaced with Mineral Granules. D225-70.</td>
</tr>
<tr>
<td></td>
<td>Asphalt Saturated Roofing Felt for Use in Waterproofing and in Constructing Built-Up Roofs. D227-70.</td>
</tr>
<tr>
<td></td>
<td>Coal-Tar Saturated Roofing Felt for Use in Waterproofing and in Construction of Built-Up Roofs. D227-70.</td>
</tr>
<tr>
<td></td>
<td>Asphalt Roll Roofing Surfaced with Mineral Granules. D249-73.</td>
</tr>
<tr>
<td></td>
<td>Asphalt Saturated Asbestos Felts for Use in Waterproofing and in Constructing Built-Up Roofs. D250-70.</td>
</tr>
<tr>
<td></td>
<td>Definition of Terms Relating to Bituminous and other Organic Materials for Roofing, Waterproofing and Related Building or Industrial Uses. D1079-73.</td>
</tr>
<tr>
<td></td>
<td>Asphalt-Base Emulsions for Use as Protective Coatings for Built-Up Roofs. D1227-70.</td>
</tr>
</tbody>
</table>
Woven Glass Fabrics Treated for Use in Waterproofing and Roofing. D1668-73.
ASTM
Asphalt-Impregnated Glass Fiber Mat (Felt). D2178-74.
Asphalt-Based Aluminum Roof Coatings. D2824-69.
Class A Asphalt Shingles Surfaced with Mineral Granules. D3018-72.
Coated Asphalt Felt for Use in Construction of Built-Up Roofs. D3158-72T.
Slate Shingles. C406-70.
Roofing Asphalt. D312-71.
UL
Roof Coverings. 55A-70.
Roofing and Shingles, Class C Asphalt Organic Felt Sheet. 55B-70.
RCS HSB
ICBO
Roofing Tile Standards. 32-12-73.
SMACC
ARMA

LEGEND

ORGANIZATION

ASTM
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

UL
Underwriter's Laboratories
207 E. Ohio Street
Chicago, Ill. 60606

RCS HSB
Red Cedar Shingle and Handsplit Shake Bureau
5510 White Building
Seattle, Washington

ICBO
International Conference of Building Officials
(Uniform Building Code)
5560 So. Workmen Mill Road
Whittier, California 90601

SMACC
Sheet Metal and Air Conditioning Contractors National Association, Inc.
107 Center Street
Elgin, Ill.
**SECTION 3213. TABLES.**

**TABLE NO. 32-A**

**FASTENERS**

<table>
<thead>
<tr>
<th>No.</th>
<th>Fastener Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Roofing Nail</td>
<td>Annular Thread 11 Gauge 3/8&quot; Diam. Head</td>
</tr>
<tr>
<td>2.</td>
<td>Roofing Nail</td>
<td>Spiral Thread 11 Gauge 3/8&quot; Diam. Head</td>
</tr>
<tr>
<td>3.</td>
<td>Squared Cap Nail</td>
<td>Annular Thread 1&quot; Diameter</td>
</tr>
<tr>
<td>4.</td>
<td>Squared Cap Nail</td>
<td>Spiral Thread 1&quot; Diameter</td>
</tr>
<tr>
<td>5.</td>
<td>Gypsum Roofing Nail</td>
<td>1&quot; Diameter Cap</td>
</tr>
<tr>
<td>6.</td>
<td>Shingle Cut Nail</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Capped Vinyl Nail</td>
<td>1&quot; Cap</td>
</tr>
<tr>
<td>8.</td>
<td>Tube-Loc Nail</td>
<td>1&quot; Diameter Cap</td>
</tr>
<tr>
<td>9.</td>
<td>Loc-Nail</td>
<td>1 3/16&quot; Cap</td>
</tr>
<tr>
<td>10.</td>
<td>Do-All-Loc Nail</td>
<td>1 3/16&quot; Cap</td>
</tr>
<tr>
<td>11.</td>
<td>Riv-Nail</td>
<td>1&quot; Cap</td>
</tr>
<tr>
<td>12.</td>
<td>Insulation Clips</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Zonotite or Mark III</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Nail-Tite-Type A</td>
<td>1 1/4&quot; Diam. Cup</td>
</tr>
<tr>
<td>15.</td>
<td>Roofing Staple</td>
<td>for power driven application only</td>
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</tbody>
</table>

32-15
<table>
<thead>
<tr>
<th>Wood</th>
<th>DECKS</th>
<th>Fastener Recommendation</th>
<th>Length of Fastener</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boards</td>
<td>2-4</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>Plywood</td>
<td>1-3</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Structural Wood Fiber</td>
<td>7</td>
<td>1 1/2&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>1&quot;</td>
</tr>
<tr>
<td>Poured Gypsum</td>
<td>Nail-Tite Type A*</td>
<td>1 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Precast Gypsum</td>
<td>6</td>
<td>1 1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>Precast Nailable Concrete</td>
<td>5 &amp; 6</td>
<td>1 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Precast Lightweight Concrete</td>
<td>5-6</td>
<td>1 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Poured Lightweight Insulating Concrete (Min. 1:4 Mix)</td>
<td>Nail-Tite Type A* and 6</td>
<td>1 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Fiberboard Roof Insulation (1&quot; Thick Min. to 2&quot; Max.) Over Wood Boards</td>
<td>2-4</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Fiberboard Roof Insulation (1&quot; Thick Min. to 2&quot; Max.) Over Metal Roof Deck</td>
<td>11</td>
<td>1/2&quot; longer than 1&quot;, 1 1/4&quot;, or 2&quot; R.I.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>Driven past locking tongue</td>
</tr>
<tr>
<td>Built-Up Roofing over Fiberboard Roof Insulation (1&quot; Thick Min. to 2&quot; Max.)</td>
<td>8</td>
<td>1&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>1 1/4&quot;</td>
</tr>
</tbody>
</table>

* Deck Manufacturer’s Approved Recommendations.

** Must penetrate into deck at least 1/4 inches but not protrude through underside of deck.

**TABLE NO. 32-B**

**MAXIMUM WEATHER EXPOSURE**

<table>
<thead>
<tr>
<th>WOOD SHINGLES</th>
<th>Slope of Roof</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3&quot; to less than 4&quot; in 12&quot;</td>
</tr>
<tr>
<td>Grade Length</td>
<td></td>
</tr>
<tr>
<td>No. 1 16-inch</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>No. 2 16-inch</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>No. 3 16-inch</td>
<td>3&quot;</td>
</tr>
<tr>
<td>No. 1 18-inch</td>
<td>4 1/4&quot;</td>
</tr>
<tr>
<td>No. 2 18-inch</td>
<td>4&quot;</td>
</tr>
<tr>
<td>No. 3 18-inch</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>No. 1 24-inch</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>No. 2 24-inch</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>No. 3 24-inch</td>
<td>5&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TAPERED WOOD SHAKES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18-inch</td>
<td>7 1/4&quot;</td>
</tr>
<tr>
<td>24-inch</td>
<td>10&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRAIGHT-SPLIT WOOD SHAKES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18-inch</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>24-inch</td>
<td>7 1/4&quot;</td>
</tr>
</tbody>
</table>
CHAPTER 33

STAIRS, EXITS AND OCCUPANT LOADS

SECTION 3301. GENERAL.

(a) **Purpose.** In addition to the other requirements of this Building Code, this Chapter shall govern and determine the occupant loads and exit facilities of buildings, structures, or any portion thereof.

(b) **Scope.** Every building, structure, or portion thereof shall be provided with exits as required by this Chapter. Where there is a conflict between a general requirement and a specific requirement for an individual occupancy, the specific requirement shall govern.

(c) **Definitions.** For purposes of this Chapter, certain terms are defined as follows:

1. **Balcony, Exterior Exit.** A landing or porch projecting from the wall of a building and serving as a required means of egress.

2. **Corridor.** A horizontal space dedicated to providing pedestrian communication within a building.

3. **Corridor, Dead End.** A corridor which provides only one means of egress.

4. **Corridor, Private.** A corridor other than a public corridor.

5. **Corridor, Public.** A corridor open to general use, or used by more than one tenant.

6. **Exit.** A continuous and unobstructed means of egress to a public way, including intervening doors, doorways, corridors, exterior exit balconies, ramps, stairways, horizontal exits, exit passageways, exit courts and yards.

7. **Exit Court.** A yard or court which provides egress to a public way.

8. **Exit, Horizontal.** A means of passage from one building into another building, or from one section of a building into another section of the same building through a separation wall. See Section 3307.

9. **Exit Passageway.** An enclosed means of egress connecting a required exit or exit court with a public way.

10. **Exit, Vertical.** A means of egress between two or more floors or levels, including exterior stairways, fire escapes, ramps, and interior stairways.

11. **Floor Area.** See Chapter 4.

12. **Occupant Load.** The total number of persons permitted to occupy a building or portion thereof at any one time.

13. **Panic Hardware.** A bar which extends across at least one-half of the width of each door leaf, which will open the door when subjected to pressure.

14. **Public Way.** Any parcel of land unobstructed from the ground to the sky and at least 10 feet in width, dedicated to the free passage of the public.

15. **Stairway.** See Chapter 4.

16. **Stairway, Exit.** One or more flights of stairs and the necessary landings, platforms, handrails, and guardrails connecting them to
form a continuous and uninterrupted passage from one floor to another.

17. **Stairway, Private.** A stairway serving one adjacent floor only, for one tenant only, and not serving as a required exit.

18. **Stairway, Spiral.** A stairway which provides a circular form in its plan view, with uniform sector shaped treads attached to and radiating about a supporting column. The effective tread shall be delineated by the nosing radius line exterior arc (center line of railing), and the overlap radius line (nosing line of tread above). Effective tread dimension shall be taken along a line perpendicular to the center line of the tread.

19. **Stairway, Winder.** A tread of a stair which, because of the arrangement of the stair, does not have a uniform horizontal dimension measured from riser to riser at each tread.

(d) **Determination of Occupant Load.** The occupant load permitted in any building or portion thereof shall be determined by dividing the floor area assigned to that use by the square foot per occupant set forth in Table No. 33-A. When the number of square feet per occupant is not given for a particular occupancy, it shall be determined by the occupancy which it most nearly resembles. In determining the occupant load, all portions of the building shall be presumed to be occupied at the same time, except as permitted by the Department.

**EXCEPTIONS:**

1. The occupant load of an area which provides fixed seats shall be determined by the number of fixed seats installed. Aisles serving fixed seats, and not used for other purposes, shall not be considered as adding to the occupant load.

2. Accessory use areas which ordinarily are used primarily by persons that occupy the main areas of an occupancy shall be provided with exits as though they were completely occupied, but their occupant load need not be included in computing the total number of occupants for the story or building.

(e) **Posting of Occupant Load.** Rooms in a Group A or B occupancy and dining or drinking establishment in a Group F occupancy which provide an occupant load of more than fifty shall have the capacity of the room posted in a conspicuous place. The wording of the sign shall be as determined by the Department.

(f) **Overcrowding.** The number of occupants of any building or portion thereof shall not exceed the permitted posted capacity.

(g) **Benches, Pews, and Booths.** When benches or pews are used, the number of seats shall be based on one person for each 18 inches of length of the benches or pews. When booths are used in drinking or dining areas, the number of seats shall be based on one person for each 24 inches or major portion thereof, of the length of the booths.

(h) **Mixed Occupancies.** The maximum occupant load of a building containing mixed occupancies shall be determined by adding the number of occupants of each occupancy as specified in Table 33-A.

(i) **Mixed Occupancy Exit Requirements.** For determining exit requirements for a building or portion thereof which is used for more than one occupancy, the capacity shall be determined by the occupant load for the largest number of persons.
(j) Exit Obstruction. Obstructions shall not be placed in the required width of an exit, except those projections permitted by this Chapter.

(k) Heating Equipment and Incinerator Rooms. Boiler or furnace rooms containing an incinerator, liquefied petroleum gas, or liquid fueled equipment, shall be provided with at least two means of egress. All interior openings shall be protected as set forth in Table 33-B. See Chapter 49 for Machinery Room Exits.

(l) Changes in Elevation. Changes in elevation of less than 12 inches along an exit shall be made by means of a ramp.

   EXCEPTION: Group I and J occupancies and along aisles adjoining seating areas.

(m) Exit Ramp Requirements. Every building housing Group A, B-1, B-2, B-3, B-4, C-1, C-2, D-1, D-2, F-1, F-2, H-1, or H-2 occupancies shall provide one means of exit from the first floor for the handicapped confined to wheel chairs, unless otherwise approved by the Department.

SECTION 3302. EXITS REQUIRED.

(a) Determination of the Number of Exits Required. Buildings or floors, including basements, cellars, or occupied roofs, shall provide two means of exit. Portions or areas of building shall provide means of exit as indicated in Table 33-A.

   EXCEPTION: In Groups H-3 and I occupancies, floors above the first story and basements, cellars, or occupied roofs, which provide for an occupant load of less than ten, need only provide at least one exit.

(b) Mezzanines. Each mezzanine used for other than storage purposes, if greater than 2,000 square feet in area or if more than 60 feet in any dimension, shall provide at least 2 stairways to the adjacent floor below.

(c) Special Requirements for All Occupancies. See Section 3315 through 3323, and Chapters 12 and 49.

(d) Stage Exits. See Chapter 39.

(e) Three Exits Required. Every story or portion thereof which provides for an occupant load of 500 to 999 shall have at least three exits.

(f) Four Exits Required. Every story or portion thereof which provides for an occupant load of 1,000 or more shall have at least four exits.

(g) Multiple Story Exit Determination. The number of exits required from any story of a building shall be determined by using the occupant load of that story plus the percentages of the occupant loads of floors which exit through the level under consideration as follows:

   1. Fifty percent of the occupant load in the first adjacent story above and the first adjacent story below when the story below exits through the level under consideration.

   2. Twenty-five percent of the occupant load in the story immediately above and below the first adjacent story.

(h) Final Exiting. The maximum number of exits required for any story shall be maintained until egress is provided from the building.

(i) Motion Picture Projection Room Exits. Every projection room shall be provided with at least one exit, or as otherwise required by Table 33-A. The door opening shall be at least 30 inches in width and at least 6 feet 6 inches in height. Entrances to a projection room shall be protected by a
self-closing assembly having a 3/4-hour fire-resistive rating. The doors shall open outward and lead to exits as required by this Chapter.

(j) **Width.** The total width of exits in feet shall be at least the total occupant load served divided by 50. The width of exits shall be divided approximately equally among the separate exits. The total exit width required from any story shall be determined by using the occupant load of that story, plus the percentage of the occupant loads of floors which exit through the level under consideration as follows:

1. Fifty percent of the occupant load in the first adjacent story above, and the first adjacent story below when a story below exits through the level under consideration.

3. The maximum exit width required from any story of a building shall be maintained until egress is provided from the building.

(k) **Arrangement of Exits.** When more than one exit is required from a portion of a building or story, at least 2 of the exits shall be remote from each other and so arranged and constructed to minimize any possibility that both may become blocked by any one fire or other emergency condition. Means of egress shall be arranged so that, from any room door, exits will be accessible in at least 2 different directions except as permitted in Section 3304. Minimum travel distance between exit doors shall be 25 feet for a building or story.

(l) **Distance to Exits.** The maximum travel distance in any occupied space to at least one exit, measured in accordance with the following requirements, shall not exceed the limits specified for individual occupancies. See Sections 3315 to 3324. Means of egress shall be so arranged that there are no dead end pockets, hallways, corridors, passageways, or courts whose depth exceeds the dead-end corridor regulations of this Chapter. Exit distance and length of dead-end corridors shall be measured from the most remote point on the floor or dead-end corridor along the shortest travel distance to the center of the exterior door, horizontal exit, or exit enclosure.

(m) **Exit Through Adjoining or Accessory Areas.** Exits from a room may open into an adjoining or intervening room or area, provided the adjoining room is accessory to the area served and provides a direct means of egress to an exit corridor, exit stairway, exterior exit, horizontal exit, exterior exit balcony, or exit passageway.

**EXCEPTION:** Exits shall not pass through kitchens, storerooms, rest rooms, closets, heating or mechanical rooms, or spaces used for similar purposes. In Group H-3 and I occupancies, exits may pass through kitchens.

Foyers, lobbies and reception rooms constructed as required for corridors shall not be construed as intervening rooms.

**SECTION 3303. EXIT DOORS.**

(a) **General.** This Section shall apply to every exit door serving an area having an occupant load of more than 10, or serving hazardous rooms or areas. Buildings or structures used for human occupancy shall have at least one exit door which meets the requirements of Sub-Section (d). Sub-Sections (h) and (i) shall apply to all doors, regardless of occupant load.

(b) **Swing.** All doors shall swing in the direction of exit travel when serving
any hazardous area, or when serving an occupant load of 30 or more. Double-acting doors shall not be used as exits serving an occupant load of more than 100, used as a part of a fire assembly, nor equipped with panic hardware. A double-acting door shall be provided with a view panel of at least 200 square inches.

(c) **Type of Lock or Latch.** Exit doors shall be openable from the inside without the use of a key or any special knowledge or effort.

**EXCEPTION:** This requirement shall not apply to exterior exit doors in a Group F or G occupancy if there is a readily visible, durable sign on or adjacent to the door, stating "THIS DOOR TO REMAIN UNLOCKED DURING BUSINESS HOURS." The sign shall be in letters not less than 1 inch high on a contrasting background. The locking device shall be a type that will be readily distinguishable as locked. The use of this Exception may be revoked at any time by the Department for cause.

Manually operated bolts are prohibited. When exit doors are used in pairs, and approved automatic flush bolts are used, the door leaf having the automatic flush bolts shall have no door knob or surface mounted hardware. The unlatching of any leaf shall not require more than one operation.

(d) **Width and Height.** Every required exit doorway shall permit the installation of a door at least 3 feet in width and at least 6 feet 8 inches in height. Exit doors shall be capable of opening 90 degrees and shall be so mounted that the clear width of the exitway is at least 34 inches. In computing the exit width required by Section 3302 (j), the net dimension of the exitway shall be used.

(e) **Door Leaf Width.** No leaf of an exit door shall exceed 4 feet in width.

(f) **Special Doors.** Revolving, sliding, overhead, or power-operated doors shall not be used as a required exit.

(g) **Egress from Door.** Every exit door required by this Section shall give immediate access to an approved means of egress from the building.

(h) **Change in Floor Level at Doors.** Regardless of occupant load, there shall be a level floor or landing on each side of a door. When doors open over landings, the landing shall extend 2 feet beyond the edge of the door leaf when in an open position.

**EXCEPTION:** In Group I occupancies, and within individual units of Group H occupancies, a door may open on the top step of a flight of stairs or on an exterior landing, provided the door does not swing over the top step or exterior landing, and the landing is not more than 7 1/2 inches below the floor level.

(i) **Door Identification and Marking.** Exit doors shall be marked to be readily distinguishable from the adjacent construction. Glass doors shall conform to the requirements of Chapter 54.

(j) **Public Way.** Doors shall not swing into the public way.

**SECTION 3304. CORRIDORS AND EXIT BALCONIES.**

(a) **General.** This Section shall apply to every public corridor serving as a required exit. For purposes of this Section, the term corridor shall also include exterior exit balconies and covered or enclosed exit passageways, including walkways, tunnels and malls.

1. Foyers, lobbies and reception rooms meeting the construction re-
quirement of corridors as specified in this Section may be considered as corridors.

2. Partitions, rails, counters, and similar space dividers less than 6 feet in height above the floor shall not be construed to form corridors.

(b) **Width.** Corridors shall be at least 44 inches in width. For special requirements for Groups C and D occupancies, see Sections 3317 and 3318.

(c) **Height.** Corridors shall provide a clear height of at least 7 feet, measured to the lowest projection from the ceiling.

(d) **Projections.** The required width of corridors shall be unobstructed. For purposes of this Chapter, a door, when fully opened, shall be perpendicular to the opening.

**EXCEPTIONS:**

1. Trim and handrails shall not reduce the required width by more than a total of 7 inches.

2. Exit doors may swing into the corridor a minimum of 1 foot when the corridor exceeds 6 feet in width. The required width of the corridor shall not be decreased by the projection into the corridor.

3. Doors may swing into a corridor from rooms that are infrequently used, and provided with a lock; such as janitors, telephone, and electrical closets.

(e) **Access to Exits.** When more than one exit is required, exits shall be arranged so that it is possible to go in either direction from any point in a corridor to a separate exit, except for dead-end corridors permitted by this Section.

(f) **Dead-End.** Corridors in all occupancy Groups may have dead-ends not to exceed 20 feet in length. Dead-end corridors permitted by this Section shall comply with the following requirements:

   A. All doors opening onto a dead-end corridor shall be protected by a labeled fire assembly which provides a fire-resistive rating of at least 45 minutes. These doors, except in Group H occupancies shall also be provided with an approved self-closing device to maintain the door in a closed position.

   B. Branch corridors shall not be permitted from a dead-end corridor.

   **EXCEPTION:** Except in Groups C and D occupancies, when the entire building is provided with automatic fire extinguishing system, the dead-end corridor may be extended to a total length of 50 feet.

(g) **Construction.** Walls of public corridors shall be of at least one-hour fire-resistive construction and the ceilings shall be at least that required for a one-hour fire-resistive floor or roof system. The long side of an exterior exit balcony shall be at least 50 percent open, with the open area distributed to prevent the accumulation of smoke or toxic gases. Exterior exit balconies shall be of noncombustible construction, except that in Type III and Type V buildings not exceeding two stories in height, the balconies may be of wood at least 2 inches in nominal thickness.

**EXCEPTIONS:**

1. One-story buildings housing Group G occupancies.

2. When the entire building and/or floor is provided with an automatic fire extinguishing system throughout.

(h) **Openings.** When corridor walls are required to be one-hour fire-resis-
tive construction, every interior door opening shall be protected as set forth in Table No. 33-B. Other interior openings, except ventilation louvers equipped with automatic fire dampers, shall be 1/4 inch fixed wire glass set in metal frames. The total area of all openings, other than doors, in any portion of an interior corridor shall not exceed 25 percent of the area of the corridor wall of the room which it is separating from the corridor.

**EXCEPTIONS:**
1. Protection of openings at interior walls of exterior exit balconies.
2. When the building or floor is protected with an automatic fire extinguishing system throughout, openings in corridor walls need not provide a fire-resistant rating.

(i) **Location of Property.** Exterior exit balconies shall not be located in an area where openings are required to be protected due to location on the property.

**SECTION 3305. STAIRWAYS.**

(a) **General.** Every stairway serving any building or portion thereof shall conform to the requirements of this Section.

**EXCEPTION:** In buildings less than 4 stories in height, stairs or ladders used only to attend equipment or access to an unoccupied roof are exempt from the requirements of this Section. Ladders shall extend a minimum of 2 feet above the floor, roof, parapet, or landing.

(b) **Width.** Stairways serving an occupant load of more than 50 shall be at least 44 inches in width. Stairways serving an occupant load of 50 or less shall be at least 36 inches in width. Private stairways serving an occupant load of less than 10 shall be at least 30 inches in width. Trim and handrails shall not reduce the required width by more than 3 1/2 inches on each side. See Section 3317 for stair width requirements in Group C occupancies.

(c) **Rise and Run.** The rise of every step in a stairway shall not exceed 7 1/2 inches, and the run shall be at least 10 inches. Except as provided under Sub-Sections (d) and (e), the maximum variations in the height of risers and the width of treads in any one flight shall be 1/4 inch.

**EXCEPTION:** Private stairways serving an occupant load of less than 10 and stairways to unoccupied roofs may be constructed with an 8 inch maximum rise and 9 inch minimum run.

(d) **Winding Stairways.** Winders may be used in private stairways of Group H and I occupancies if the required tread width is provided at a point 12 inches from the side of the stairway where the treads are narrower. In no case shall the width of run be less than 6 inches at any point. All risers in one flight between landings shall have identical dimensions within 1/4 inch tolerance.

(e) **Circular Stairways.** Circular stairways may be used as an exit, provided the minimum width or run is not less than 10 inches at a point 12 inches from the side of the stairway where the treads are narrower. All risers in any one flight between landings shall have identical dimensions within a 1/4 inch tolerance.

(f) **Spiral Stairways.** For purposes of this Chapter, spiral stairways shall
be permitted only as private stairways, and shall be permitted in all occupancies.
1. The tread of spiral stairways shall provide an exterior arc cord of at least 10 inches, and a minimum effective tread dimension of 6 inches, measured 11 inches from the exterior arc. For limited access purposes, the tread shall provide an exterior arc cord of at least 8 1/2 inches, and a minimum effective tread of 5 inches, measured 9 inches from the exterior arc. The angle of stairway rise shall be between 30 and 50 degrees, measured at the exterior arc.
2. The stair shall be designed, constructed, and installed to carry a live load of 5 times the live load required.
3. The vertical clearance shall be a minimum of 6 feet 6 inches.

(g) Landings. Every landing shall have a dimension measured in the direction of travel equal to the width of the stairway. The dimension need not exceed 5 feet when the stair has a straight run. Landings, when provided, shall not be reduced in width by more than 3 1/2 inches by a door when fully opened. See Section 3303 (h).
1. The vertical distance between landings shall not exceed 12 feet, 6 inches.
2. On all floors above the first floor, a space at least 25 inches by 42 inches shall be provided for one wheel chair in each stairway enclosure as an area of refuge for handicapped persons confined to wheelchairs where exits usable by the handicapped persons are not provided. This refuge area shall be required only in buildings with elevators to upper floors.

(h) Basement and Cellar Stairways. When a basement or cellar stairway and a stairway to an upper story terminate in the same exit enclosure, a barrier shall be provided to prevent persons from continuing into the basement or cellar. See Section 3308 (e). Directional exit lights shall be provided as set forth in Section 3312 (b).

(i) Handrails. Stairways shall have handrails on each side. In addition, every stairway required to be more than 88 inches in width shall be provided with at least one intermediate handrail for each 88 inches of required width. Intermediate handrails shall be spaced approximately equal within the entire width of the stairway.
1. Handrails shall be placed not less than 30 inches, or more than 34 inches above the nosing of the treads. Handrails shall be continuous the full length of the stairs and except or private stairways, at least one handrail shall extend at least 6 inches beyond the top and bottom risers, with the ends returned or terminating in posts or safety terminals.
2. Handrails projecting from a wall shall provide a space of at least 1 1/2 inches between the wall and the handrail.

EXCEPTION:
1. Stairways 44 inches or less in width and stairways serving one individual dwelling unit in Group H or I occupancies may have one handrail, except that stairways open on one or both sides shall have handrails provided on the open side or sides.
2. Stairways serving one individual dwelling unit in Group H
or I occupancies having less than four risers need not have handrails.

(j) Guardrails. See Chapter 17.

(k) Exterior Stairway Protection. Openings in the exterior wall below or within 10 feet, measured horizontally, of an exterior stairway serving a building in excess of two stories in height, shall be protected by a self-closing fire assembly having a three-quarter hour fire-resistive rating.

EXCEPTION: Openings may be unprotected when two separated exterior stairways serve and exterior exit balcony.

(l) Interior Stairways. Interior stairways shall be constructed as specified in Chapters 17 through 22 of this Building Code. In occupancies other than I, J, and individual units of Group H occupancies, when stairs or ramps are not required to be enclosed and usable space is provided under these stairs or ramps, an automatic fire extinguishing system shall be installed as required by Chapter 38. The space shall be enclosed as required for one-hour fire-resistive construction.

(m) Exterior Stairways. Exterior stairways shall be constructed of noncombustible material, except that on Type III buildings not exceeding two stories in height, and on Type V buildings, stairs may be constructed of wood at least 2 inches in thickness. Exterior stairways shall not project into yards where protection of openings is required. See Section 3304 (l) for Exit Balcony requirements. When enclosed usable space is provided under stairs, the walls and soffits of the enclosed space shall be protected on the enclosed side as required for one-hour fire-resistive construction.

(n) Stairway to Roof. In every building four or more stories in height, one stairway shall extend to the roof surface, unless the roof has a slope greater than 4 in 12. Openings onto the roof shall have hinged doors.

(o) Escalators. Escalators shall not be considered as a required exit.

(p) Headroom. Every required stairway shall have a headroom clearance of at least seven feet. Clearances shall be measured vertically from a plane parallel and tangent to the stairway tread nosing to the soffit above all points.

(q) Obstructions. There shall be no obstructions in a stairway.

SECTION 3306. RAMPS.

(a) General. Ramps used as exits shall conform to the provisions of this Section.

(b) Width. The width of ramps shall be the same as required for stairways.

(c) Slope. The maximum pitch of a ramp shall not exceed one vertical to 12 horizontal from the first floor to grade in all Group A through H occupancies. The slope of all other exit ramps shall not exceed one vertical to 8 horizontal.

(d) Landings. Ramps having slopes greater than one vertical to 15 horizontal shall have landings at the top and bottom. At least one intermediate landing shall be provided for each 5 feet of rise. Landings shall have a dimension of at least 5 feet, measured in the direction of ramp run. Doors in any position shall not reduce the landing dimension to less than 42 inches nor the required width by more than 3 1/2 inches.

(e) Handrails. Handrails shall be provided on at least one side of every ramp, at least 32 inches in height, measured from the surface of the ramp. Handrails shall extend one foot beyond the top and bottom of the
ramp. Intermediate handrails shall not be required.

(f) **Construction.** The enclosures for ramps shall be constructed as required for stairways.

(g) **Surface.** The surface of ramps shall be roughened or shall be of nonslip materials.

(h) **Vehicle Exit Facilities.** See Chapter 17.

SECTION 3307. HORIZONTAL EXIT.

(a) **Used as a Required Exit.** When conforming to the provisions of this Chapter, a horizontal exit may be considered as a required exit.

(b) **Openings.** All openings in a wall which provides a horizontal exit shall be protected by a fire assembly having a fire-resistive rating of at least one-hour. The fire assembly shall be self-closing as required in Chapter 43.

(c) **Discharge Areas.** A horizontal exit shall lead into a floor area having a capacity for an occupant load of at least the occupant load served by this exit. The capacity shall be determined by allowing 3 square feet of net clear floor area per occupant and 20 square feet per nonambulatory occupant. The area in which the horizontal exit leads shall be provided with exits other than additional horizontal exits.

SECTION 3308. EXIT ENCLOSURES.

(a) **General.** Every interior stairway, ramp, or escalator shall be enclosed as specified in this Section.

**EXCEPTIONS:**

1. In other than Group D occupancies, an enclosure shall not be required for a stairway, ramp, or escalator serving only one adjacent floor, and not connected with corridors or stairways serving other floors.

2. Stairways in Group I occupancies and stairways within individual apartments in a Group H occupancy, need not be enclosed.

3. An enclosure shall not be required for escalators if an automatic fire sprinkler system is installed in accordance with the provisions of Chapter 38.

4. The enclosure for private stairways need not be provided when the stairway is provided with an automatic fire sprinkler system installed in accordance with the provisions of Chapter 38 and the stairway does not inter-connect with more than one adjacent floor.

(b) **Enclosure Construction.** Enclosure walls shall be constructed of at least two-hour fire-resistive construction in Type I and II building and shall be of at least one-hour fire-resistive construction elsewhere.

(c) **Openings Into Enclosures.** There shall be no openings into exit enclosures except doorways and openings in exterior walls. All doors in an exit enclosure shall be protected by a fire assembly having a fire-resistive rating of at least one-hour where one-hour enclosure construction is permitted and one-and-one-half-hours where two-hour enclosure construction is required. Doors shall be self-closing or shall close automatically when actuated by means of products of combustion detectors. See Table 33-B. There shall be no enclosed useable space under stair-
ways in an exit enclosure. In all buildings having floors used for human occupancy located more than 75 feet above the lowest level of Fire Department vehicle access, and housing a Group C, D, F-2, H-1 and H-2 occupancy, the exit stairway doors shall be openable from the stairway side at levels not exceeding 5 floors.

(d) **Extent of Closure.** Stairway and ramp enclosures shall include landings and parts of floors connecting stairway flights and shall also include a corridor on the ground floor leading from the stairway to the exterior of the building. Enclosed corridors or passageways shall not be required from unenclosed stairways. Every opening into the corridor shall comply with the requirements of Section 3308 (c).

**EXCEPTIONS.**

1. Exits may discharge through street floor lobbies or corridors with unprotected openings provided the required exit width is free and unobstructed and the entire street floor is protected with an automatic fire-extinguishing system.

2. Where one remote exit leads directly to the outside with all openings protected as per Section 3308 (c), a maximum of 50 percent of the exits may discharge into a lobby provided the lobby is protected with an automatic fire sprinkler system, and all unprotected openings are provided with a row of sprinkler heads on the accessory use side.

(e) **Barrier.** A stairway in an exit enclosure shall not continue below the grade level exit unless a door is provided at the ground floor level to prevent persons from accidentally continuing into the basement. The door shall swing in the direction of exit from the lower level. See Section 3303 for door requirements.

**EXCEPTION:** A barrier shall not be required for a building with only one story and basement.

**SECTION 3309. SMOKEPROOF ENCLOSURES.** Deleted.

**SECTION 3310. EXIT COURTS.**

(a) **General.** Every exit court shall discharge into a public way or exit passage.

(b) **Width.** Exit court minimum widths shall be determined in accordance with the provisions of Section 3302, based on the tributary occupant load. The required width shall be unobstructed except for projections permitted in corridors in Section 3304. Where the width is reduced from any cause, the reduction shall be effected gradually by a guardrail at least 3 feet in height and making an angle of not more than 30 degrees with the axis of the exit court.

(c) **Number of Exits.** Every exit court shall be provided with exits as determined by Section 3302.

(d) **Openings.** All openings into an exit court less than 10 feet wide shall be protected by fire assemblies having not less than a three-fourths-hour fire-protection rating.

**EXCEPTION:** Openings more than 10 feet above the floor of the exit court may be unprotected.

**SECTION 3311. EXIT PASSAGEWAYS.**

(a) **Construction.** The walls of exit passageways shall be without openings
other than required exits, and shall have walls, floors, and ceilings of the same fire-resistive rating required for the walls, floors, and ceilings of the building served, with a minimum of one-hour fire-resistive construction. Exit openings throughout the enclosing walls of exit passageway shall be protected by fire assemblies having a three-fourths-hour fire protection rating.

(b) **Detailed Requirements.** Exit passageways shall have width, height, and other construction requirements as required for corridors in Section 3304.

**SECTION 3312. EXIT SIGNS AND ILLUMINATION.**

(a) **Exit Illumination.** Exit areas shall be illuminated at all times the building is occupied, with light having an intensity of at least one foot candle at floor level.

**EXCEPTION:** Group I, J and H-3 occupancies.

Exit illumination shall be provided from separate circuits or separate sources of power (but not necessarily separate from exit signs) when there are required for exit sign illumination. See Chapter 53 for additional requirements.

(b) **Exit Signs.** An illuminated exit sign, with white letters at least 5 inches high on a green background shall be provided from all areas serving the occupant load specified in this sub-section. The letters of the sign shall be lighted with 2 electric lamps of not less than 15 watts each. In addition, in interior stairways, an exit sign shall be provided at the floor level leading directly to the exterior. An exit sign shall be provided at every required exit doorway in Groups A through H occupancies with an occupant load of more than 30, and shall clearly indicate the direction of egress.

**EXCEPTION:** Main exterior exit doors which are clearly identifiable as exits need not have exit signs.

(c) **Power Sources.** See Chapter 53.

(d) **Standby Source.** In addition to the requirements of Chapter 53, the following Occupancies shall be required to provide a standby power source separate from the Public power supply: (See Chapter 53 for wiring methods).

1. Groups A, B, and F Occupancies with an occupant load of 300 or more, except churches.
2. Group H-1 and H-2 Occupancies with an occupant load of 100 or more.
3. See Chapter 53 for Group D Occupancies.
4. See Chapter 38 for High Rise Building Requirements.

**SECTION 3313. AISLES.**

(a) **General.** Every portion of a building in which fixed seats are installed shall be provided with aisles leading to an exit.

(b) **Width.** Every aisle shall be not less than 3 feet wide if serving only one side, and not less than 3 feet 6 inches if serving both sides. The minimum width shall be measured at the point farthest from an exit cross aisle, or foyer, and shall be increased by 1 1/2 inches for each 5 feet in length toward the exit, cross aisle, or foyer. With continental seating,
as specified in Section 3314 (a), the side aisle shall be not less than 44 inches in width.

c) **Distances to Nearest Exit.** In areas occupied by seats, and in Groups A and B occupancies without seats, the line of travel to an exit door by an aisle shall be not more than 150 feet. Except as permitted in Sections 3315 and 3316.

d) **Aisle Spacing.** With standard seating, as specified in Section 3314 (a), aisles shall be located so that there will be not more than 6 intervening seats between any seat and the nearest aisle. With continental seating, as specified in Section 3314 (a), the number of intervening seats may be increased to 29 where exit doors are provided along side aisle in the proportion of one pair of exit doors for each five rows of seats. The exit doors shall provide a minimum clear width of 66 inches.

(e) **Cross Aisles.** Aisles shall terminate in a cross aisle, foyer, or exit. The width of the cross aisle shall be at least the sum of the required width of the widest aisle plus 50 percent of the total required width of the remaining aisles leading thereto. Dead-end aisles shall not exceed 20 feet in Groups A, B, and C occupancies.

(f) **Vomitories.** Vomitories connecting the foyer or main exit with the cross aisles shall have a total width of at least the sum of the required width of the widest aisle leading thereto plus 50 percent of the total required width of the remaining aisles leading thereto.

(g) **Slope.** The slope portion of aisles shall not exceed 1 foot in 8 feet.

**SECTION 3314. SEATS.**

(a) **Seat Spacing.** With standard seating, the spacing of rows of seats shall provide a space of at least 12 inches from the back of one seat to the front of the most forward projection of the seat assembly immediately behind it, measured horizontally between vertical planes. With continental seating, the spacing of rows of seats shall provide a clear width measured horizontally as follows:

- 18 inches clear for rows of 18 seats or less.
- 20 inches clear for rows of 35 seats or less.
- 21 inches clear for rows of 45 seats or less.
- 22 inches clear for rows of 46 seats or more.

Automatic or self-rising seats shall be measured in the seat-up position; other seats shall be measured in the seat-down position.

(b) **Bleacher Seats.** Seats used in grandstands, bleachers and reviewing stands shall conform to Section 3324.

**SECTION 3315. EXITS: GROUP A OCCUPANCIES.**

(a) **Main Exit.** Every Group A occupancy shall be provided with a main exit. The main exit shall be of width to accommodate one-half of the total occupant load, but shall be at least the total required width of all aisles, exit passageways, and stairways leading thereto, and shall connect to a stairway or ramp leading to a public way.

(b) **Side Exits.** Every auditorium, of a Group A occupancy shall be provided with exits on each side. The exits on each side of the auditorium shall be of width to accommodate one-third of the total occupant load served. Side exits shall open directly to a public way or into an exit court, exit stairway, exterior stairway, or exit passageway leading to a public
way. Side exits shall be accessible from a cross aisle.

(c) **Balcony Exits.** Every balcony having an occupant load of more than 10 shall be provided with a minimum of 2 exits. Balcony exits shall open directly into a stairway or ramp. When there is more than one balcony, exits shall open into an exterior or enclosed stairway or ramp. Balcony exits shall be accessible from a cross aisle. The number and distribution of exits shall be as specified in this Chapter.

(d) **Panic Hardware.** All exit doors specified in Sections (a), (b) and (c) herein shall not be provided with a latch or lock other than panic hardware.

(e) **Aisles.** See Section 3313.

(f) **Maximum Travel Distance.** Exits shall be so arranged so that the total length of travel from any point to an exit shall not exceed 150 feet.

**EXCEPTION:** When the building is protected throughout by an automatic fire sprinkler system, the distance may be increased to 200 feet.

**SECTION 3316. EXITS: GROUP B OCCUPANCIES.**

(a) **Group B, Division 1, 2 and 3.** Group B, Divisions 1 and 2 shall have exits as required by Section 3315. In Group B, Division 3 occupancies having an occupant load of more than 100, exit doors shall not be provided with a latch or lock other than panic hardware.

**EXCEPTION:** Panic hardware shall not be required on exit doors in churches with an occupancy load of less than 300.

(b) **Group B, Division 4.** In Group B, Division 4 occupancies having an occupant load of more than 100, exit doors shall not be provided with a latch or lock other than panic hardware. Panic hardware may be waived on gates surrounding stadiums when the gates are under constant intermediate supervision while the public is present, and provided dispersal areas are located between the stadium and fence. The required dispersal area shall be located at least 50 feet from the stadium.

(c) **Skating Rinks.** Skating rinks shall be located at or near the adjacent ground level, and exits shall be by means of ramps.

(d) **Maximum Travel Distance.** Exits shall be arranged so that the total length of travel from any point to an exit shall not exceed 150 feet.

**EXCEPTION:** When the building is protected throughout by an automatic fire extinguishing system, the distance may be increased to 200 feet.

**SECTION 3317. EXITS: GROUP C OCCUPANCIES.**

(a) **Definitions.** For the purpose of this Section, certain terms are defined as follows:

**ROOM.** A room is a space or area bounded by any obstruction to an exit passage which encloses more than 80 percent of the area. In computing the unobstructed perimeter, openings less than 3 feet clear width and less than 6 feet 8 inches high shall not be considered.

**INTERIOR ROOM.** A room whose only means of egress is through an adjoining or intervening room which is not an exit corridor.

(b) **Maximum Travel Distance.** Exits shall be arranged to conform to the following:

1. No point in a room in a building shall be more than 75 feet from an
exit corridor, enclosed stairway, or exterior of the building.

EXCEPTION: In buildings not more than two stories in height, an increase to 90 feet shall be permitted when the building is protected throughout with detectors of products of combustion other than heat. When a building is protected throughout by an automatic fire sprinkler system, the distance may be increased to 110 feet.

2. No point in a building without an automatic fire-sprinkler system shall be more than 150 feet measure along the line of travel, from exit door, horizontal exit, exit passageway, or enclosed stairway. In buildings not more than two stories in height, protected throughout with detectors of products of combustion other than heat, the distance may be increased to 175 feet. In a building protected throughout with an automatic fire sprinkler system, the distance may be increased to 200 feet.

(c) **Exits Through Adjoining Rooms.** Interior rooms may exit through adjoining or intervening rooms, provided the total distance of travel through rooms to an exit corridor does not exceed that specified in Subsection (b) 1, and provides a direct, and unobstructed means of travel. The routes of exit travel shall not pass through kitchens, storerooms, rest rooms, closets, laboratories using hazardous materials, industrial shops, or similar spaces. Foyers and lobbies constructed as required for exit corridors shall not be construed as adjoining or intervening rooms. Where the only means of exit from a room, detectors of products of combustion other than heat shall be installed in the area of the common atmosphere through which the exit must pass. See Chapter 38.

(d) **Corridors and Exterior Exit Balconies.** The width of a corridor in a Group C, Division 1 occupancy shall be the width required by Section 3302, plus 2 feet; but no corridor shall be less than 6 feet wide.

EXCEPTION: When the number of occupants served is less than 100, the corridor may be 44 inches wide.

Corridor walls shall be of at least one-hour fire-resistive construction, with openings protected as required in Section 3304 (h).

EXCEPTION: When each room used for instruction has at least one exit door directly to the exterior at ground level, and when rooms used for assembly purposes have at least one-half of the required exits directly to the exterior at ground level, one-hour fire-resistant construction of corridor walls and ceilings shall not be required.

There shall be no change in elevation of less than 2 feet in a corridor or exterior balcony unless ramps are used.

(e) **Exit Serving Auditoriums in Group C, Division 1 Occupancy.** An exit serving both an auditorium and other rooms need provide only for the capacity of whichever requires the greater width if the auditorium is not used simultaneously with the other rooms.

(f) **Stairs.** Each floor above or below the ground level shall have at least two exit stairs. The required exit width shall be equally divided between the stairs. Stairs serving an occupant load of more than 100 shall be at least 5 feet in clear width.

(g) **Basement of Cellar Rooms.** Exit stairways from a cellar or basement
shall open directly to the exterior of the building without entering the first floor corridor.

(h) **Panic Hardware.** Exit doors from rooms having an occupant load of more than 50, and from corridors, shall not be provided with a latch or lock other than panic hardware.

(i) **Fences and Gates.** School grounds may have fencing and gates equipped with locks, provided dispersal areas are available for persons between buildings and fences. Gates shall not be permitted across corridors or passageways leading to dispersal areas unless they comply with exit requirements. See Section 3324 for exits from dispersal areas.

(j) **Arrangement and Access of Exits.** See Section 3302 (m).

**SECTION 3318. EXITS: GROUP D OCCUPANCIES.**

(a) **Patient Room Exits.** Every patient room in a Group D occupancy shall have access to at least 2 means of egress from the building without passage through intervening rooms other than corridors, or lobbies or accessory rooms. Required exterior exit doors shall open in the direction of exit travel.

(b) **Minimum Size of Exits.** Every exit opening through which patients are transported in wheelchairs, stretchers, or beds shall provide a clear width of at least 44 inches. There shall be no projections within the 44-inch clear width.

(c) **Corridors.** The minimum clear width of a corridor shall be 44 inches, except that corridors serving any area housing nonambulatory persons shall be at least 8 feet in width. There shall be no change of elevation in a corridor serving nonambulatory persons unless ramps are used. In Group D, Division 1 occupancies such as jails, prisons, reformatories and similar buildings with open-barred cells forming corridor walls, the corridor and cell doors need not be fire resistive.

(d) **Basement Exits.** One exit accessible to every room below grade shall lead directly to the exterior at grade level.

(e) **Ramps.** See Section 3306.

(f) **Hardware.** Exit doors serving an occupant load of more than 50 shall not be provided with a latch or lock other than panic hardware. Patient room doors shall be openable from either side without the use of keys.

**EXCEPTION:** No requirements of this Chapter shall be construed to prohibit the construction of cell blocks in jails, or prevent the use of any locks or safety devices where it is necessary to forcibly restrain the inmates.

(g) **Locking Devices.** In buildings housing occupancies in which the personal liberties of inmates or patients are restrained within the building, the exterior doors may be fastened with locks, provided that room doors shall not be fastened by other means than doorknobs or similar devices which can be opened readily from the corridor side without the use of keys or any special knowledge or effort.

(h) **Maximum Travel Distance.** Exits shall be arranged so that the total length of travel from any point to an exit shall not exceed 150 feet.

**EXCEPTION:** When the building is protected throughout by an automatic fire sprinkler system, the distance may be increased to 200 feet.
SECTION 3319. EXITS: GROUP E OCCUPANCIES.

(a) **Number of Exits.** Every portion of a Group E occupancy having a floor area of 200 square feet or more shall be served by at least two exits.

(b) **Maximum Travel Distance:** Exits shall be arranged to conform to the following:
   1. In Divisions 1 and 2, no part of any room shall be more than 75 feet from an exit. In divisions 3, 4, and 5, no part of any room shall be more than 150 feet from an exit.

   **EXCEPTION:** In a one-story Group E-5 occupancy, the exit travel distance may be increased to 400 feet if the building is equipped throughout with an automatic fire extinguishing system.

(c) **Corridor Doors.** Doors leading to a corridor of fire-resistive construction shall have a minimum three-fourths hour fire protection rating, shall have not more than 100 square inches of wired glass set in steel frames, shall be maintained self-closing or automatic closing as required by Table 33-B, and shall open in the direction of exit travel.

SECTION 3320. EXITS: GROUP F OCCUPANCIES.

(a) **Special Exit Requirements.** At least 1/2 of the required exits shall be located to be reached without going through checkout stands. In no case shall check-out stands or associated railings or barriers obstruct exits or required aisles or approaches.

(b) **Arrangement and Access of Exits.** See Section 3302 for the number and arrangement of exits.

(c) **Maximum Travel Distance.** Exits shall be arranged so that the total length of travel from any point to an exit shall not exceed 150 feet.

   **EXCEPTION:** When the building is protected throughout by an automatic fire-sprinkler system, the distance may be increased to 200 feet.

SECTION 3321. EXITS: GROUP G OCCUPANCIES.

(a) **Arrangement of Exits.** See Section 3302 (k).

(b) **Maximum Travel Distance.** Exits shall be arranged so that the total length of travel from any point to an exit shall not exceed 150 feet.

   **EXCEPTIONS:**
   1. When the building is protected throughout by an automatic fire-sprinkler system, the distance may be increased to 200 feet. See Chapter 38.
   2. In open parking garages, the distance may be increased to 200 feet.

SECTION 3322. EXITS: GROUP H OCCUPANCIES.

(a) **Arrangement of Exits.** See Section 3302 (k).

(b) **Maximum Travel Distance.** Exits shall be arranged so that the total length of an individual living unit shall not exceed 50 feet or traverse more than one flight of stairs. The entrance door to any unit shall be within 100 feet of an exit or 150 feet when the entire building is protected by an automatic fire sprinkler system.

SECTION 3323. EXITS: GROUP I AND J OCCUPANCIES.
(a) **Emergency Exits.** Sleeping rooms shall have at least one openable window or exterior door approved for emergency exit or rescue.

(b) **Stair Width.** See Section 3305 (b).

(c) **Stair Rise and Run.** See Section 3305 (c).

(d) **Stair Handrails.** See Section 3305 (i).

(e) **Stair Headroom.** Every required stairway shall have a headroom clearance of at least 6 feet 6 inches. Clearances shall be established by measuring vertically from a plane parallel and tangent to the stairway tread nosing to the soffit above.

(f) **Door Width and Height.** See Section 3303 (a) and (d).

(g) **Change in Floor Level at Doors.** See Section 3303 (h).

**SECTION 3324. REVIEWING STANDS, GRANDSTANDS AND BLEACHERS.**

(a) In addition to the requirements of Section 3316, reviewing stands, grandstands, and bleachers shall conform to the provisions of this Section.

(b) **Definitions.** For the purpose of this Section, certain terms are defined as follows:

**BLEACHERS.** Bleachers are seating facilities without backrests in which less than 3 square feet per person is assigned in computing the occupant load.

**DISPERSEAL AREA.** A dispersal area is an area which will accommodate a number of persons equal to the total capacity of the stand and building which it serves in a manner that persons within the area are at least 50 feet from the stand or building. Dispersal areas are based upon an area of not less than 3 square feet per person.

**FOOTBOARD.** Footboards are those parts of a raised seating facility, other than an aisle or cross-aisle, upon which the occupant of the stands walks to reach a seat, or upon which he may rest his feet.

**GRANDSTANDS.** Grandstands are seating facilities wherein an area of 3 square feet or more is provided for each person and where rows of seats are on an increasing height level by means of a terraced arrangement for placement of seats.

**PERMANENT.** Permanent stands are seating facilities which remain at a location for more than 90 days.

**REVIEWING STANDS.** Reviewing stands are elevated platforms accommodating not more than 50 persons.

(c) **Height of Grandstands and Bleachers.** Grandstands or bleachers employing combustible members in the structural frame shall be limited to 11 rows or 9 feet in height.

(d) **Design Requirements.** See Chapter 23.

(e) **Row Spacing.** There shall be a clear space of at least 12 inches between the back or backrest of each seat and the front of the seat immediately behind it, measured horizontally. The minimum spacing of rows of seats, measured from back to back shall be:

1. Twenty-two inches for seats without backrests.
2. Thirty inches for seats with backrests.
3. Thirty-two inches for fixed or movable chair seating.

(f) **Aisles.**
1. **Aisles Required.** Aisles shall be provided in all seating facilities, except that aisles may be omitted when all of the following conditions exist:
   A. Seats are without backrests.
   B. The rise from row-to-row does not exceed 12 inches per row.
   C. The number of rows does not exceed 11 in height.
   D. The top seating board is not over 10 feet above grade.
   E. The first seating board is not more than 20 inches above grade.

2. **Width.** Aisles serving seats on both sides shall have a minimum width of 42 inches. When serving seats on only one side, the aisle shall have a minimum width of 36 inches.

   (g) **Cross-Aisle and Vomitories.** Cross-aisles and vomitories shall be at least 54 inches in clear width and shall extend to an exit, enclosed stairway, or exterior ramp.

   (h) **Stairs and Ramps.** Stairs and ramps shall have a maximum rise and run as provided in Section 3305 (c) and Section 3306. Those within the seating area, and which serve as aisles perpendicular to the rows of seats shall have a rise not greater than 8 inches.

   (i) **Guardrails.** Perimeter guardrails or enclosing walls shall be provided for all portions of elevated seating facilities more than 30 inches above the horizontal level. Construction and design of guardrails shall comply with Chapters 17 and 23.

   **EXCEPTION:** The minimum guardrail height shall be 30 inches and a minimum of 36 inches in height at the end of an aisle or at the front of steps. Guardrails need not meet the 9 inch maximum spacing specified in Chapter 17; however, a mid-rail shall be installed.

   (j) **Toeboards.** A 4-inch high vertical barrier shall be installed along the edge of walking surface wherever guardrails are required.

   (k) **Footboards.** Footboards shall be provided for all rows of seats above the third row, or beginning at a point where the seating planks is more than 2 feet above grade. When the same platform is used for both seating and footrests, footboards will not be required, provided each level or platform is at least 24 inches wide.

   (l) **Special Requirements: Grandstands and Bleachers.**

       1. **Grandstands and Bleachers Within Buildings.** Grandstands within a building shall comply with the applicable Sections of this Chapter.

       **EXCEPTION:** When seats are without backrests, there may be a maximum of nine seats between any seat and an aisle.

       2. **Open-Air Grandstands and Bleachers.**

       A. **Number of Seats Between Aisles.** The number of seats between any seat and an aisle shall not be greater than twenty when the seats have backrests.

       B. **Dead Ends.** Dead ends in vertical aisles shall not exceed a depth of sixteen rows for permanent grandstands and twenty-six rows for temporary grandstands.

       C. **Distance to Exit.** The line of travel from any seat to dispersal area, exit ramp, enclosed stairway, or vomitory shall not be more than 200 feet. When seats have no backrests, the distance may be measured by direct line.
D. **Dispersal Area.** Each dispersal area shall have a minimum of two exits. There shall be a minimum of three exits when more than 6000 persons are to be accommodated in a dispersal area, and a minimum of four exits when more than 9000 persons are to be accommodated. The aggregate clear width of exits from a dispersal area shall be determined on the basis of not less than one exit unit of 22 inches for each 500 persons to be accommodated, but no exit shall be less than 44 inches in width.

E. **Exits Required.** Two exits shall be provided from every grandstand which accommodates more than 300 persons. Three exits shall be provided from every grandstand which accommodates more than 1000 persons.

F. **Determination of Exit Width.** The total width of exits in feet shall be at least the total occupant load served divided by 150 when exiting by stairs, or divided by 200 when exiting by ramps, corridors, tunnels, or vomitories. No exit shall be less than 42 inches in width.

**SECTION 3325. TABLES.**
<table>
<thead>
<tr>
<th>USE</th>
<th>Rooms</th>
<th>Square Feet per Occupant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 or More</td>
<td>Buildings</td>
</tr>
<tr>
<td></td>
<td>Exits Req.</td>
<td>Floors</td>
</tr>
<tr>
<td></td>
<td>When Occ.</td>
<td>Rooms</td>
</tr>
<tr>
<td></td>
<td>Load Exceeds</td>
<td>Rooms</td>
</tr>
<tr>
<td>Aircraft Hangers (No Repair)</td>
<td>30</td>
<td>500</td>
</tr>
<tr>
<td>Aircraft Hangers (Repair)</td>
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<td>300</td>
</tr>
<tr>
<td>Assembly (Concentrated Use)</td>
<td>50</td>
<td>7</td>
</tr>
<tr>
<td>Auditoriums</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bowling Alleys (Assembly Areas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Churches and Chapels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dance Floors, Halls and Banquet Rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lodge Rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting Rooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewing Stands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theatres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stadiums:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Houses - Gyms (Seating Areas)</td>
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<td>7</td>
</tr>
<tr>
<td>Field Houses - Gyms (Other Areas)</td>
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<tr>
<td>Assembly (Medium Concentrated Use)</td>
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<td>Assembly (Low Concentrated Use)</td>
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<td>Conference Rooms</td>
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<td>Dining Rooms</td>
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</tr>
<tr>
<td>Exhibit Rooms</td>
<td></td>
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<tr>
<td>Lounges</td>
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<tr>
<td>Skating Rinks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Childrens Homes</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>Classrooms</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Dormitories</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Dwellings</td>
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<tr>
<td>Factories</td>
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<tr>
<td>Garages (No Repair)</td>
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<td>300</td>
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<tr>
<td>Garages (Repair)</td>
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<td>150</td>
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<tr>
<td>Greenhouses</td>
<td>30</td>
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<tr>
<td>Group E Occupancies</td>
<td>5</td>
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</tr>
<tr>
<td>Hospitals - Sanitariums</td>
<td>5</td>
<td>80</td>
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<tr>
<td>Homes for the Aged</td>
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<tr>
<td>Nursing Homes</td>
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<td></td>
</tr>
<tr>
<td>Personal Care Boarding Homes</td>
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<td></td>
</tr>
<tr>
<td>Hotels and Apartments</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>Kitchens (Commercial)</td>
<td>30</td>
<td>200</td>
</tr>
<tr>
<td>Libraries and Reading Rooms</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Locker Rooms</td>
<td>30</td>
<td>50</td>
</tr>
</tbody>
</table>

*a Refer to Sections 3315 through 3323 for other specific requirements.*
# TABLE NO. 33-A

**AVAILABLE SQUARE FEET PER OCCUPANT AND EGRESS FACILITIES**

<table>
<thead>
<tr>
<th>USE</th>
<th>Rooms</th>
<th>Square Feet per Occupant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 or More Exits Req.</td>
<td>Buildings Floors Rooms</td>
</tr>
<tr>
<td>Mechanical Equipment Rooms</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>Nurseries for Children (Day Care)</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Office Buildings and Offices</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Row Dwelling Buildings</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>Schools Shops and Vocational Rooms</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Stores - Retail Sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Ground Floor</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Upper Floors</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Swimming Pools (Inside or on Roof of Buildings)</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Tennis Courts (Indoors)</td>
<td>30</td>
<td>500</td>
</tr>
<tr>
<td>Warehouses</td>
<td>15</td>
<td>300</td>
</tr>
<tr>
<td>All Other Occupancies as Approved by the Department</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

*a Refer to Sections 3315 through 3323 for other specific requirements.
### TABLE NO. 33-B

**REQUIREMENTS FOR FIRE RATED DOORS**

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>Exit Doors to Corridors</th>
<th>Doors to Exit Enclosures</th>
<th>Boiler and Furnace Room Doors</th>
<th>Corridors Crossing Area Separation Walls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hour(^{b,c}) Rating</td>
<td>Sq. In.(^{e}) Glazing</td>
<td>Closing Device</td>
<td>Hour(^{d,f}) Rating</td>
</tr>
<tr>
<td>A</td>
<td>(3/4)</td>
<td>720</td>
<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>B</td>
<td>(3/4)</td>
<td>1200</td>
<td>A or B</td>
<td>1 1/2</td>
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<tr>
<td>C-1</td>
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</tr>
<tr>
<td>C-2</td>
<td>(3/4)</td>
<td>1200</td>
<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>D-1</td>
<td>(3/4)</td>
<td>720</td>
<td>A or B(^e)</td>
<td>1 1/2</td>
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<tr>
<td>D-2</td>
<td>(3/4)</td>
<td>1200</td>
<td>A or B(^e)</td>
<td>1 1/2</td>
</tr>
<tr>
<td>E-1</td>
<td>(3/4)</td>
<td>100</td>
<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>E-2</td>
<td>(3/4)</td>
<td>100</td>
<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>E-3</td>
<td>(3/4)</td>
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<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>E-4</td>
<td>(3/4)</td>
<td>100</td>
<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>E-5</td>
<td>(3/4)</td>
<td>100</td>
<td>A or B</td>
<td>1 1/2</td>
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<tr>
<td>F-1</td>
<td>(3/4)</td>
<td>100</td>
<td>A or B</td>
<td>1 1/2</td>
</tr>
<tr>
<td>F-2</td>
<td>(3/4)</td>
<td>1200</td>
<td>A or B(^c)</td>
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</tr>
<tr>
<td>G-1</td>
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<td>1200</td>
<td>C</td>
<td>1 1/2</td>
</tr>
<tr>
<td>G-2</td>
<td>(3/4)</td>
<td>1200</td>
<td>C</td>
<td>1 1/2</td>
</tr>
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<td>(3/4)</td>
<td>1200</td>
<td>C</td>
<td>1 1/2</td>
</tr>
<tr>
<td>H-1</td>
<td>(3/4)</td>
<td>1200</td>
<td>C</td>
<td>1 1/2</td>
</tr>
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<td>H-2</td>
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<tr>
<td>H-3</td>
<td>(3/4)</td>
<td>1200</td>
<td>C</td>
<td>1 1/2</td>
</tr>
</tbody>
</table>
### TABLE NO. 33-B

**REQUIREMENTS FOR FIRE RATED DOORS**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Self-closing.</td>
</tr>
<tr>
<td>B</td>
<td>Automatic-self-closing doors when activated by a magnetic device (See Chapter 43).</td>
</tr>
<tr>
<td>C</td>
<td>None required, except in dead-end corridors.</td>
</tr>
<tr>
<td></td>
<td>For occupancy separations and protection of openings. See Table 5-B.</td>
</tr>
<tr>
<td></td>
<td>Doors, with a minimum thickness of 1 3/4&quot; solid wood may be permitted. Wire glass shall be installed in approved metal frames. (See Chapter 43).</td>
</tr>
<tr>
<td></td>
<td>Except jails, prisons, etc., where open barred cells are provided.</td>
</tr>
<tr>
<td></td>
<td>Less than 5 stories in height, one hour is permitted.</td>
</tr>
<tr>
<td></td>
<td>None required in patient room doors in institutions providing 24 hour supervision.</td>
</tr>
<tr>
<td></td>
<td>Doors rated over one hour shall be provided with a label by a recognized testing laboratory.</td>
</tr>
<tr>
<td></td>
<td>Wire glass (1/4 inch minimum thickness).</td>
</tr>
</tbody>
</table>

**NOTE:** See Chapter 17 for Boiler-Furnace Enclosures
CHAPTER 34
PREFABRICATED CONSTRUCTION

SECTION 3401. GENERAL.
(a) Purpose. The purpose of this Chapter is to regulate materials and establish methods of safe construction where any structure or portion thereof is wholly or partially prefabricated.
(b) Scope. Unless otherwise specifically stated in this Chapter, all prefabricated construction and all materials used therein shall conform to all the requirements of this Building Code. See Chapter 1.
(c) Definition. PREFABRICATED ASSEMBLY. A building or utility unit, the integral parts of which have been fabricated or assembled prior to incorporation in the building.

SECTION 3402. TESTS OF MATERIALS. Every approval of a material not specifically mentioned in this Building Code shall incorporate as a proviso the kind and number of tests to be made during prefabrication.

SECTION 3403. TESTS OF ASSEMBLIES. The Department may require special tests to be made on assemblies to determine their durability and weather resistance.

SECTION 3404. CONNECTIONS. Every device designed to connect prefabricated assemblies shall be capable of developing the strength of the members connected as specified in Chapter 23. The connection device shall be designed as required by other Chapters in the Building Code. Connections between roofs, supporting walls and foundations shall be capable of withstanding an uplift force equal to the requirements contained in Chapter 23.

SECTION 3405. PIPES AND CONDUITS. Structural provisions shall be made for the removal or alteration of any member required for the installation of pipes, conduits, or other equipment.

SECTION 3406. CERTIFICATE AND INSPECTION.
(a) Materials. Materials and the assembly thereof shall be inspected to determine compliance with this Building Code. Every material shall be graded, marked, or labeled where required elsewhere in this Building Code.
(b) Certificate. A certificate of approval shall be furnished with every prefabricated assembly, except where the assembly is readily accessible to inspection at the site. The certificate of approval shall certify that the assembly in question has been inspected and meets all the requirements of this Building Code. When mechanical, electrical, or plumbing equipment is installed so that it cannot be inspected at the site, the certificate of approval shall certify that the equipment complies with the Chapters applying thereto. The certificate of approval shall be made by an approved Agency.
(c) Field Erection. Placement of prefabricated assemblies at the building site shall be inspected by the Department to determine compliance with this Building Code.
(d) Continuous Inspection. If continuous inspection is required for cer-
tain materials where construction takes place on the site, it shall also be required where the same materials are used in prefabricated construction.

EXCEPTION: Continuous inspection shall not be required during prefabrication if the approved agency certifies to the construction and furnishes evidence of compliance.
CHAPTER 35
INSULATION

SECTION 3501. GENERAL. Except as provided for in Chapters 49, 50, 52 and 58, this Chapter shall govern the installation of insulation in all buildings.

(a) Testing and Approval. All insulation, except those which are obvious by their materials as being noncombustible, shall be tested in accordance with ASTM E-84 for flame spread and fuel contributed and ASTM D-2843 for smoke developed. Noncombustible insulation, not obvious by the material, shall be tested in accordance with ASTM E-136. Insulation used as part of a fire resistive assembly shall be Underwriters Laboratories approved and tested in accordance with ASTM E-119.

(b) Type I and II and IV Buildings. Insulation installed in Types I, II and IV buildings shall be noncombustible. Insulation having a flame spread rating less than 25, a fuel contributed rating of less than 50 and a smoke developed rating less than 50 may be installed in completely enclosed cavity walls.

(c) Type III and V Buildings. Insulation installed in Type III, and V buildings shall have a flame spread rating of 25 or less, a fuel contributed rating of less than 50 and a smoke developed rating less than 50. All insulation shall bear the Underwriters Laboratory Label listing the flame spread, fuel contributed and smoke developed. All approved insulation manufacturers shall provide an Underwriters Laboratory follow-up inspection service. Insulation installed in Group I occupancies shall provide a minimum R factor of 13 in the walls and 17 in the ceilings.

(d) Plastic Insulation. Plastic insulation need not meet the requirements of (b) and (c) of this Section if specifically approved by the Department in accordance with Section 111 of this Building Code.

SECTION 3502. ROOF INSULATION. Insulation to be installed in roofs shall conform to the manufacturers instructions and shall be as approved by the Department. When a Class A, B or C roof is required, the insulation shall not deter from its classification.

SECTION 3503. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply.

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<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
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<td>Density of Smoke from the Burning or Decomposition of Plastics. D2843-70</td>
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<td>Surface Burning Characteristics of Building Materials. E84-70</td>
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<td>Noncombustibility of Elementary Materials. E136-73</td>
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ASTM

ORGANIZATION
American Society for Testing Materials
1916 Race Street
Philadelphia, Pa. 19103
CHAPTER 36
PENTHOUSES AND ROOF STRUCTURES

SECTION 3601. PENTHOUSES AND ROOF STRUCTURES.

(a) **Height.** No penthouse or other projection above the roof in structures of other than Type I construction shall exceed 28 feet in height above the roof when used as an enclosure for tanks or for elevators which run to the roof, and in all other cases shall not extend more than 12 feet in height above the roof.

(b) **Area.** The aggregate area of all penthouses and other roof structures shall not exceed 33 1/3 percent of the area of the supporting roof.

(c) **Prohibited Uses.** No penthouse or any other similar projection above the roof shall be used for purposes other than shelter of mechanical equipment or shelter of vertical shaft openings in the roof. Penthouses used for purposes other than permitted by this Section shall conform to the requirements of this Building Code for an additional story.

(d) **Construction.** Roof structures shall be constructed with walls, floors and roof as required for the main portion of the building.

**EXCEPTIONS:**

1. On Type I and II buildings, the exterior walls and roofs of penthouses which are 5 feet or more from an adjacent property line may be of one-hour fire-resistive noncombustible construction.

2. On Type III buildings, walls not less than 5 feet from a property line may be of one-hour fire-resistive noncombustible construction.

3. Enclosures housing only mechanical equipment and located at least 20 feet from adjacent property lines may be of unprotected noncombustible construction.

4. On one-story buildings, unroofed mechanical equipment screens, fences, or similar enclosures may be of combustible construction when located at least 20 feet from adjacent property lines, and when not exceeding 6 feet in height above the roof surface.

SECTION 3602. TOWERS AND SPIRES.

(a) **General.** Towers or spires, when enclosed, shall have exterior walls as required for the building to which they are attached. Towers not enclosed, and which extend more than 75 feet above grade, shall have their framework constructed of structural steel or reinforced concrete. No tower or spire shall occupy more than 1/4 of the street frontage or any building to which it is attached, and in no case shall the base area exceed 1,600 square feet, unless it conforms entirely to the type of construction requirements of the building to which it is attached and is limited in height as a main part of the building. The roof covering of spires shall be fire retardant if required for the main roof of the building to which it is attached. Skeleton towers used as radio masts and placed on the roof of any building, shall be constructed entirely of noncombustible materials when more than 25 feet in height. When placed on existing buildings, the structure shall be checked by an Engineer and a report or
drawings submitted to the Department in order to assure that the building can sustain this additional loading.
CHAPTER 37
CHIMNEYS AND VENTS

SECTION 3701. GENERAL

(a) **Scope.** In addition to the other requirements of this Building Code, this Chapter shall govern the installation, maintenance, repair and approval of all chimneys, vents, and connectors. For additional requirements for incinerators, see Chapter 48.

(b) **Special Engineered Vent System Tables.** Approved vent system tables may be used in determining vent and vent connector sizing.

(c) **Prohibitions:**
   1. The use of a shelf or bracket type chimney is prohibited.
   2. Draft Hoods shall not be used on equipment with power burners or induced draft fans.

(d) **Existing Chimneys.** When inspection reveals that an existing chimney is not safe for the intended application, the chimney shall be rebuilt, replaced, or repaired to conform to the requirements of this Chapter.

(e) **Access.** A cleanout or connector shall be accessible. Crawl spaces shall not be used for this purpose.

(f) **Starting Level and Support.** Only vents and factory-built chimneys may start at any desired level. Vents and factory-built chimneys shall be securely anchored to the building so that they cannot be dislodged in any direction. All runs shall be strapped. Straps shall be at least No. 26 gauge galvanized steel, and shall be installed at intervals of not more than 5 feet and at every change in direction.

(g) **Offsetting Inlets.** Where 2 or more inlets are provided in any vent or chimney, the inlets shall be offset so that no portion of any inlet shall be opposite other inlets.

SECTION 3702. DEFINITIONS. Except as otherwise provided, terms and symbols used in this Chapter shall be defined as follows:

(a) **Appliance Connector.** The pipe used to connect a fuel-fired appliance to a vent or a chimney.

(b) **Chimney.** A chimney is a hollow shaft containing one or more passageways, vertical or nearly so, for conveying products of combustion to the outside atmosphere.

(c) **Chimney, Bracket or Shelf Chimneys.** One which terminates below the ceiling of the area in which they originate.

(d) **Chimney, Factory-Built.** An approved, listed chimney.

(e) **Chimney, Masonry.** A chimney of solid masonry units, brick, stone, hollow masonry units, or reinforced concrete.

(f) **Chimney, Metal.** A single-wall unlisted sheet metal hollow cylinder used for conveying products of combustion.

(g) **Chimney, Residential Appliance Type.** An approved factory-built or masonry chimney suitable for removing products of combustion from residential type appliances of 1000 degrees F. or less measured at the appliance flue outlet.

(h) **Chimney, Low Heat Appliance Type.** A factory-built, masonry, or metal chimney suitable for removing the products of combustion from fuel-burning low-heat appliances producing combustion gases not in ex-
cess of 1000 degrees F. under normal operating conditions but capable of producing combustion gases of 1400 degrees F. during intermittent forced firing for periods up to one hour. All temperatures shall be measured at the appliance flue outlet.

(i) **Chimney, Medium-Heat, Appliance Type.** A factory-built, masonry, or metal chimney suitable for removing the products of combustion from fuel-burning medium-heat appliances producing combustion gases in excess of 2000 degrees F. measured at the appliance flue outlet.

(j) **Chimney, High-Heat Appliance Type.** A factory-built, masonry, or metal chimney suitable for removing the products of combustion from fuel-burning high-heat appliances producing combustion gases in excess of 2000 degrees F. measured at the appliance flue outlet.

(k) **Chimney Liner.** A product of fire clay or other approved material that meets the requirements of ASTM C-27.

(l) **Combustible Material.** (See Chapter 4).

(m) **Draft Hood.** A device attached to or made a part of the vent outlet from an appliance, and designed to:
   1. Insure the ready escape of the products of combustion in the event of no draft, back-draft, or stoppage in the vent beyond the draft hood.
   2. Prevent a backdraft from entering the appliance.
   3. Neutralize the effect of stack section of the flue during operation of the appliance.

(n) **Firebrick.** A refractory brick which meets the requirements of ASTM Standard C-27.

(o) **Listed.** Products published by an approved nationally recognized testing agency.

(p) **Power Induced Draft Fan.** A fan installed in or on a chimney, vent, or the connector to a chimney or vent, to induce a draft at the connected appliance.

(q) **Vent.** A conduit or passageway, for conveying products of combustion to the outside atmosphere.

(r) **Venting System, Manufactured.** A vent, vent connector, and cowl cap assembled to form a continuous open passageway from the appliance to the outside atmosphere for the purpose of removing combustion gases.

1. **Types of Venting Systems.**
   A. **Type B and Type B-W.** A gas venting system consisting of listed vent piping, fittings, and cowl cap listed for use with listed gas appliances with draft hoods.
   B. **Type L.** A venting system consisting of listed vent piping and fittings for use with Type L or with listed appliances.

**SECTION 3703. MASONRY CHIMNEYS.**

(a) **Draft.** Every chimney, vent or venting system shall be capable of producing a draft at the appliance not less than that required for the safe operation of the appliance connected thereto.
   1. Induced draft or forced draft fans may be used to increase insufficient draft. See Chapter 48 for incinerators.
   2. When a fan is used, provisions shall be made to shut off the fuel supply to the appliance in the event of failure of the fan.
   3. When equipment is power-vented, no other atmospheric vented
equipment shall be vented into the same chimney or vent.

(b) **Structural Design Masonry.** Chimneys shall be designed, anchored, supported and reinforced as required in this Chapter and Chapters 23, 24, 26, and 29. Chimneys shall not support any structural load other than their own weight unless designed to act as supporting members. Chimneys in exterior walls of wood-frame buildings shall be anchored laterally at the ceiling line or at each floor line which is more than 6 feet above grade, except when entirely within the framework.

(c) **Walls.** Every masonry chimney shall provide walls of masonry units, brick, stone, reinforced concrete or equivalent solid thickness of hollow masonry, and lined with suitable liners in accordance with the following requirements:

1. **Masonry Chimneys for Residential-Type Appliances.** They shall be constructed with walls at least 4 inches, or stone at least 12 inches thick. A chimney liner shall be provided in accordance with item (d) of this Section.

2. **Masonry Chimneys for Low-Heat Appliances.** They shall be constructed with walls 8 inches thick or stone at least 12 inches thick. A chimney liner shall be provided in accordance with item (d) of this Section.

3. **Masonry Chimneys for Medium-Heat Appliances.** They shall be constructed with walls 8 inches thick, or stone at least 12 inches thick. In addition, shall be lined with at least 4 1/2 inches of firebrick laid in a solid bed of fire clay mortar with solidly filled head, bed, and wall joints. The lining shall commence at least 2 feet below the chimney connector entrance and extend for a distance of at least 25 feet above the chimney connector entrance.

4. **Masonry Chimneys for High-Heat Appliances.** They shall provide exterior walls constructed of solid masonry units or of reinforced concrete of at least 8 inches in thickness. The interior walls shall be of at least 4 1/2 inches firebrick in thickness laid in a solid bed of fire clay mortar with solidly filled head, bed, and wall joints, with a 2-inch air space between the firebrick and the chimney wall.

(d) **Fire Clay Lining.** Fire clay lining shall be 5/8 inch thick extended from a point 8 inches below the lowest inlet, or in the case of fireplaces, from the throat of the fireplace to a point above enclosing masonry walls. Each liner shall be installed ahead of the construction of the chimney, carefully bedded on the lower section in fire clay mortar, with close-fitting joints left smooth on the inside. Firebrick, 2 inches thick, may be used in lieu of fire clay chimney lining as set forth in Table 37-A.

(e) **Area.** Chimney passageways shall not be smaller in area than the vent connection of the appliance attached thereto and at least that as set forth in Table 37-A. Engineering methods approved by the Department may be used to design the system. The effective cross-sectional area of the chimney shall not exceed 4 times the cross-sectional area of the chimney connectors entering chimney.

(f) **Height.** Unless otherwise required in this Chapter, every masonry chimney shall extend at least 3 feet above the highest elevation of any part of a building within 10 feet of the chimney.

(g) **Corbeling.** See Chapter 24.

(h) **Change in Size or Shape.** Changes in the size or shape of a masonry
chimney, where the chimney passes through the roof, shall not be permitted within a distance of 6 inches above or below the roof joist or rafters.

(i) **Separation of Masonry Chimney Passageways.** When more than one passageway is contained in the same chimney, masonry separation at least 4 inches thick, bonded into the masonry wall of the chimney, shall be provided to separate the passageways.

(j) **Inlet Openings.** Every inlet opening in a masonry chimney shall enter its side. Each opening shall be lined with a thimble or sleeve of at least 24 gauge metal.

(k) **Clearance.** Combustible material shall not be placed within 4 inches of the interior chimney liner or masonry walls when built within a structure, or within one inch when the chimney is built entirely outside the structure. For other requirements for fireplaces, see Chapter 48.

(l) **Cleanouts.** An accessible cleanout assembly consisting of a thimble or sleeve with a tight fitting cover shall be provided at least 12 inches below the lowest inlet opening into the chimney.

**SECTION 3704. TYPES OF CHIMNEYS AND VENTS REQUIRED.**
The type of chimney to serve the various classification of appliances shall be as set forth in Tables 37-B and 37-C.

**SECTION 3705. METAL CHIMNEYS.**

(a) **Design.** Metal chimneys shall be listed, or provide a minimum thickness equal to No. 10 U.S. guage steel and shall be designed and constructed as specified in Table 37-F and Chapters 23 and 27.

(b) **Construction.** Unlisted single-wall metal chimneys shall be riveted or welded, and unless structurally self-supporting, shall be guyed, or firmly anchored to, or otherwise supported by the building or structure served thereby.

1. **Lining.** See Table 37-F.
2. **Termination.** Metal chimneys shall terminate as required by Table 37-F.
3. **Clearance.** See Table 37-F.
4. **Foundations.** Metal chimneys shall be supported on properly designed foundations of masonry, reinforced concrete, or other non-combustible material.
5. **Enclosure for Interior Chimneys.** Metal chimneys in other than a one-story building shall be enclosed above the story in which the appliance served is located in a chase of noncombustible construction which provides fire-resistive rating of at least one-hour, if the building is less than 4 stories in height; and not less than 2 hours if the building is 4 stories or more in height. There shall be space on all sides of the chimney accessible for examination and repair. The enclosing walls shall be without openings.

**EXCEPTION:** Inspection openings equipped with an equivalent fire rating may be permitted at each floor level for inspection purposes.

**SECTION 3706. FACTORY-BUILT CHIMNEYS.**

(a) **Factory-Built Chimneys.** Listed chimneys shall be installed in strict
accordance with the terms of their listings and the manufacturer's instructions.

(b) **Multiple Venting in Vertical Shafts.** Factory-built chimneys utilized with pre-fabricated metal fireplaces may be used in a common vertical shaft having the required fire-resistive rating.

**SECTION 3707. USE OF VENTING SYSTEMS.**

(a) **Type B Gas Vents** shall be used only with listed gas appliances with draft hoods and shall not be used for venting the following:

1. Incinerators.
2. Appliances which may be converted to the use of solid or liquid fuels.
3. Appliances listed for use with chimneys only.
4. Any appliance which produces flue products in excess of 550 degrees F. at the inlet of the divertor or draft regulator.

(b) **Type BW Gas Vents.** They shall be used only with vented recessed gas wall furnaces listed for use with these vents.

(c) **Type L Venting System.** They shall be used only with appliances listed for this use.

**SECTION 3708. INSTALLATION REQUIREMENTS FOR VENTS.**

(a) **Termination.** Each vent shall extend above the roof surface through its flashing and shall terminate in an approved listed cap with a venting capacity at least that of the vent. The outlet opening of any vent shall be at least 24 inches from any portion of the building; at least 10 feet from any portion of the building or structure which extends at an angle of more than 45 degrees upward from the horizontal. Also see Table 37-F.

1. Gravity operated vents shall not terminate less than 5 feet in vertical height above the lower skirt of the draft hood of the highest connected appliance.

(b) **Venting System** Draft fans may be used in lieu of natural draft vents for any gas appliance when the appliance is approved for this use. When fans are used with gas appliances requiring venting, controls shall be installed to prevent the flow of gas to the main burner in the event of failure of the fan.

1. The vent terminals of power-equipped gas venting systems shall be located at least 10 feet from any building opening and at least 10 feet above grade when located adjacent to public walkways.

(c) **Venting Through Ventilating Hoods and Exhaust Systems.**

1. **Commercial Appliances.** Ventilating hoods and power exhaust systems may be used to vent gas-burning appliances installed in commercial applications.

2. **Dampers Prohibited.** When automatically operated appliances, such as water heaters, are vented through ventilating hoods, dampers shall not be installed in the ventilating system.

3. **Interlock Controls.** The appliance control system shall be interlocked so as to permit appliance operation only when the power exhaust system is in operation.

(d) **Type B, BW Termination.** A Type BW gas vent, or combination of Type BW and Type B, shall terminate at an elevation at least 12 feet above the bottom of the wall furnace.

(e) **Clearances.** All vents shall be installed with clearances to combustibles.
as specified in this Section, or in accordance with the individual listings.
1. Single-wall metal pipe may be used as a gas vent only, provided it is
installed with minimum clearances from combustible material as
follows:
   A. Appliances without draft hoods: 18 inches.
   B. Boilers and furnaces equipped with listed conversion burners
      and draft hoods: 9 inches.
   C. Listed appliances with draft hoods: 6 inches.
   D. For listed gas-burning appliances with draft hoods, when
      penetrating a combustible wall, an approved thimble, 4 inches
      larger in diameter than the vent, may be used. If there is a run
      of 6 feet or more of vent pipe in the open, between the draft hood
      outlet and the thimble, the thimble may be 2 inches larger in
      diameter than the vent pipe.
   E. Metal pipe vents passing through a wall or roof constructed of
      combustible material, shall be guarded at the point of passage
      as specified for exterior wall by Subsection D; or by metal thim-
      bles at least 2 inches larger in diameter than the pipe packed
      with approved noncombustible insulating material.

(f) **Protection.** Provisions shall be made to prevent mechanical injury to
the vents where subject to damage.

(g) **Support.** All portions of gas vents and chimneys shall be properly sup-
ported for their weight and design. Listed gas vents shall be supported
and spaced in accordance with their listings and the manufacturer’s in-
stuctions.

(h) **Size.** Every gravity vent shall be of a size at least that of the draft hood
collar of the appliance attached. In no case shall the area be less than
the area of a 3 inch diameter pipe. When more than one appliance is
connected into a vent, the vent area shall be at least the area of the
largest vent connector plus 50 percent of the areas of the additional vent
connectors.

   **EXCEPTION:** The size of gravity vents and their connectors shall
not apply when engineered venting methods are approved by the
Department.

(i) **Vent Offsets.** Unless part of an engineered venting system, vents shall
have no more than 2 offsets of not more than 45 degrees from the verti-
cal.
   1. When approved by the Department, a vent may have one offset of
      not more than 60 degrees from the vertical.
   2. Any angle greater than 45 degrees from the vertical is considered
      horizontal.

**SECTION 3709. CHIMNEY CONNECTORS AND VENT CONNECTORS.**

(a) **Materials.** Vent or chimney connectors shall be constructed of metal of
at least the following gauges:

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<tr>
<td><strong>Gauge No.</strong></td>
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<td><strong>Less than 10 inches</strong></td>
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<td><strong>10 to 12 inches</strong></td>
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1. Connectors serving listed appliances with draft hoods may be constructed of Type B, or when the former is not required, it may be constructed of single-wall metal provided it meets the limitations of use specified in this Chapter.

(b) Installation.

1. Inter-connections. 2 or more vent or chimney connectors shall not be joined unless the common connector, the manifold, and the vent or chimney are properly sized to serve the appliances connected. Adequate draft shall be made available to remove all products of combustion to the outdoors. Gas and oil appliances so connected shall be equipped with primary safety controls. Connectors serving gravity-vent type appliances shall not be connected to a chimney, vent, or venting system served by a power exhauster or power burner.

2. Clearance. Single-walled metal connectors shall be installed with clearance to combustibles as indicated in Table 37-D.

3. Size. The connector, for its entire length, shall be not smaller than the flue collar of the appliance.

   EXCEPTION: Unless otherwise recommended by the manufacturer of the appliance, chimney or vent, or part of an engineered venting system as may be approved by the Department.

4. Location. When the connector used for a gas appliance with a draft hood is located in or passes through an attic, crawl space, or other cold area, that portion of the connector shall be of listed Type B vent material.

5. Length. All connectors shall be as short and straight as possible. The appliance shall be located as close as practical to the chimney, gas vent, or venting system. The connector shall not exceed 75 percent of the portion of the chimney or vent above the inlet connection. In no case shall the total horizontal length be greater than 15 feet unless part of an engineered venting system.

6. Passage Through Walls. Connectors for listed gas appliances with draft hoods may pass through walls or partitions constructed of combustible material if made of listed Type B, or Type L material, and installed with not less than listed clearances to combustible material. Connectors shall be exposed to view throughout their length. Connectors serving low, medium, or high-heat appliances as classified in Table 37-B shall not pass through walls or partitions, but shall be located in the same space as the appliance and shall be visible throughout their entire length.

7. Resistance. Connectors shall be installed so as to avoid sharp turns or other construction features which would create excessive resistance to the flow of combustion gases. Devices which will obstruct the free flow of combustion gases shall not be installed in a connector, chimney or vent. This shall not be construed to prohibit the use
of devices specifically listed for installation in a connector, such as draft regulators and safety controls.

8. **Joints.** Chimney and vent connectors shall be securely supported, and joints fastened with sheet metal screws, rivets, or welds. All runs shall be strapped. Straps shall be at least No. 26 gauge galvanized steel, and shall be installed at intervals of not more than 5 feet, and at every change in direction.

9. **Connection.** A connector to a masonry chimney shall extend through the wall to the inner face of the liner but not beyond. A thimble shall be used to facilitate removal of the connector for cleaning. The thimble shall be permanently cemented in place with high temperature cement. See Section 3703(k). Chimneys or vents shall not have connector openings in each story of a building, unless provision is made for completely closing the openings with devices made of noncombustible materials whenever their use is discontinued.

10. **Fireplace.** A connector shall not be connected to a chimney serving a fireplace unless the fireplace opening or the chimney which vents the fireplace is permanently sealed below the connection, and a cleanout provided as per Section 3703(m).

11. **Draft Regulators.** A draft regulator shall be installed in the connector serving a liquid fuel-burning appliance unless the appliance is approved for use without the regulator. A draft regulator may be installed in the connector serving a listed gas incinerator when recommended by the incinerator manufacturer. These draft regulators shall be installed in accordance with the installation instructions accompanying the incinerator. A draft regulator, furnished as part of a listed gas appliance shall be installed in the connector serving the appliance. A draft regulator, when used, shall be installed in the same room or enclosure as the appliance so that no difference in pressure between air in the vicinity of the regulator and the combustion air supply will exist.

12. **Rise.** Every vent connector which is a part of a gravity-type venting system shall have a continuous rise of at least 1/4 inch per foot of length, measured from the appliance vent collar to the vent.

**SECTION 3710. SPECIAL VENTING ARRANGEMENTS.** Listed appliances which provide a sealed combustion chamber and which are so constructed and installed that all air for combustion is derived from outside the building and all flue gases are discharged to the outside atmosphere shall be considered as properly vented when installed in accordance with their listing and manufacturer's instructions. Venting requirements as set forth in this Chapter shall not apply. For other requirements, See Chapters 51 and 52.

**SECTION 3711. DRYER VENTS.**

(a) **Vents for Domestic Clothes Dryers (Type I).**

1. A clothes dryer vent shall not be connected into any vent connector, gas vent or chimney serving other equipment. Dryer vents shall not terminate in a crawl space, attic, or other similar concealed space.

2. Clothes dryer vents shall be constructed of galvanized steel (minimum gauge No. 26), or aluminum (minimum gauge No. 24). All joints and seams shall be tight fitting with a minimum of 3 sheet metal screws (not to exceed 1/4 inch in length) or blind rivets. Rivets
shall not be installed at the vent connection to the dryer. This joint shall provided with metal screws. All joints shall be lapped in the direction of the air flow. The use of duct tape on vents is prohibited.

3. The size of clothes dryer vents shall be at least the size specified by the manufacturer. The length of the vent shall not exceed the manufacturer’s recommendations.

4. Clothes dryers shall be vented independently. All vents shall discharge to the outside atmosphere. A minimum of 12 inches shall be provided from vent discharge opening to any door, window or from any opening into the structure.

5. Clothes dryer vent discharge openings shall be provided with a back draft damper.

6. The use of flexible ducts or vibration isolation connectors on gas fired clothes dryer vents is prohibited.

(b) **Vents for Commercial Clothes Dryers (Type II)**

1. A clothes dryer vent shall not be connected into any vent connector, gas vent, or chimney serving other equipment. Dryer vents shall not terminate in a crawl space, attic or other similar concealed space.

2. Vents for commercial clothes dryers shall be constructed of not less than No. 24 gauge galvanized sheet steel.

3. Commercial type clothes dryers shall be equipped or installed with lint controlling devices.

4. Vents from commercial clothes dryers shall have a clearance of at least 6 inches to combustible material.

5. All joints and seams shall be tight fitting with a minimum of 3 sheet metal screws (not to exceed 1/4 inch in length) or 3 blind rivets. Rivets shall not be installed at the vent connection to the dryer but shall be provided with metal screws. All joints shall be lapped in the direction of the air flow. The use of duct tape on vents is prohibited.

6. The use of flexible ducts or vibration isolation connectors on commercial dryer vents is prohibited. The use of slip sleeves to eliminate vibration in exhaust ducts shall be permitted. Slip sleeves, if used, shall provide a minimum length of 12 inches.

7. The size of commercial clothes dryer vents shall be at least the size specified by the manufacturer. The length of the vent shall not exceed the manufacturer’s recommendations.

8. All clothes dryers shall be vented independently. All vents shall discharge to the outside atmosphere.

**EXCEPTION:** Engineered systems.

9. Dryer vent discharge openings shall not be located within 10 feet of openings into the building.

10. All dryer vent openings shall be provided with a U bend or discharge earthward to be weather-proof. Screens shall not be used on dryer vent discharge duct openings. Vent openings shall be located a minimum of 3 feet above the roof surface. Back draft dampers may be used at exhaust discharge openings.
SECTION 3712. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply.

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<td>Ground Fire Clay as a Mortar for Laying Up</td>
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</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td></td>
<td>1430 Broadway</td>
</tr>
<tr>
<td></td>
<td>New York, New York 10018</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td></td>
<td>470 Atlantic Avenue</td>
</tr>
<tr>
<td></td>
<td>Boston, Mass. 02210</td>
</tr>
</tbody>
</table>

SECTION 3713. TABLES.

TABLE NO. 37-A
MINIMUM PASSAGE AREAS FOR MASONRY CHIMNEYS

<table>
<thead>
<tr>
<th>Type of Masonry Chimney</th>
<th>MINIMUM CROSS SECTIONAL AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Round</td>
</tr>
<tr>
<td>Residential\textsuperscript{a}</td>
<td>50 Sq. In.</td>
</tr>
<tr>
<td>Fireplace\textsuperscript{b}</td>
<td>1/12 of opening</td>
</tr>
<tr>
<td>Low Heat</td>
<td>50 Sq. In.</td>
</tr>
<tr>
<td></td>
<td>57 Sq. In.</td>
</tr>
<tr>
<td></td>
<td>135 Sq. In.</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Areas for medium and high-heat chimneys shall be determined using accepted engineering methods and as approved by the Department.

\textsuperscript{b} Where fireplaces open on more than one side, the fireplace opening shall be measured along the greatest dimension.
### TABLE NO. 37-B

**CHIMNEY SELECTION CHART**

**TYPES OF APPLIANCES TO BE USED WITH EACH TYPE CHIMNEY**

(See Table 37-C for gas appliances)

<table>
<thead>
<tr>
<th>COLUMN I</th>
<th>COLUMN II</th>
<th>COLUMN III</th>
<th>COLUMN IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimneys for Residential Appliances</td>
<td>Chimneys for Low Heat Appliances</td>
<td>Chimneys for Medium Heat Appliances</td>
<td>Chimneys for High Heat Appliances</td>
</tr>
<tr>
<td>1. Factory Built (Residential)</td>
<td>1. Factory Built (low heat)</td>
<td>1. Factory Built (medium heat)</td>
<td>1. Masonry (high heat type)</td>
</tr>
<tr>
<td>3. Metal (smokestack)</td>
<td>3. Metal (smokestack)</td>
<td>3. Metal (smokestack)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appliances such as:</th>
<th>Columns I and II, and</th>
<th>Columns I, II and III, and</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ranges</td>
<td>Appliances such as:</td>
<td>Appliances such as:</td>
<td></td>
</tr>
<tr>
<td>2. Warm-air furnaces</td>
<td>1. Alabaster gypsum kilns</td>
<td>1. Bessemer retorts and cupolas</td>
<td></td>
</tr>
<tr>
<td>5. Low pressure steam boilers (not over 15 p.s.i.g.)</td>
<td>4. Cold stirring furnaces</td>
<td>4. Bone calcining furnaces</td>
<td></td>
</tr>
<tr>
<td>*6. Domestic incinerators</td>
<td>5. Feed, fertilizer and pulp driers</td>
<td>5. Brass furnaces</td>
<td></td>
</tr>
<tr>
<td>8. Unit heaters</td>
<td>7. Gas producers</td>
<td>7. Cement brick, tile and ceramic kilns</td>
<td></td>
</tr>
<tr>
<td>11. Hot air furnaces</td>
<td>13. Steam boilers operating at not over 50 p.s.i.g.</td>
<td>13. Pot-arches</td>
<td></td>
</tr>
<tr>
<td>13. Rosin melting furnaces</td>
<td>15. Wood distilling furnaces</td>
<td>15. Regenerative furnaces</td>
<td></td>
</tr>
<tr>
<td>14. Steam boilers operating at not over 50 p.s.i.g.</td>
<td>16. Wood-gas retorts</td>
<td>16. Reverberatory furnaces</td>
<td></td>
</tr>
<tr>
<td>15. Sulphur furnaces</td>
<td>17. Incinerators (Commercial and industrial)</td>
<td>17. Stacks, carburetor or super-heating furnaces</td>
<td></td>
</tr>
<tr>
<td>16. Type and lead furnaces</td>
<td>18. Crematories</td>
<td>18. Vitreous enameling ovens</td>
<td></td>
</tr>
<tr>
<td>17. Wood kilns and impregnators</td>
<td></td>
<td>19. Wood carbonizing furnaces</td>
<td></td>
</tr>
<tr>
<td>18. Zinc amalgamating furnaces</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* May be used to vent Domestic Incinerators in Group I Occupancies if constructed of 4 inch brick, with tile liner and does not leak flue gas, provided the incinerator is listed.
### TABLE NO. 37-C

**VENTING SYSTEM SELECTION CHART**
(Type of venting system)

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type B Gas Round</td>
<td>Type BW Gas</td>
<td>Type L</td>
<td>Metal Pipe (Single wall)</td>
</tr>
<tr>
<td>All listed gas appliances with draft hoods such as:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Central furnaces</td>
<td></td>
<td>1. Low temperature flue gas appliances listed for use with Type L venting systems</td>
<td>1. Exterior domestic incinerator installations only</td>
</tr>
<tr>
<td>2. Heating boilers</td>
<td></td>
<td>2. Gas appliances shown in Column I</td>
<td>2. Residential and low-heat appliances</td>
</tr>
<tr>
<td>3. Ranges and ovens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Recessed wall furnaces (above wall section)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Room and unit heaters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Water heaters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Duct Type Unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Horizontal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE NO. 37-D

#### CONNECTOR CLEARANCE

<table>
<thead>
<tr>
<th>DESCRIPTION OF APPLIANCE</th>
<th>MINIMUM CLEARANCES (Inches) a, b</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RESIDENTIAL APPLIANCES</strong></td>
<td></td>
</tr>
<tr>
<td>Column I (Table 37-B)</td>
<td></td>
</tr>
<tr>
<td>Gas appliances without draft hoods</td>
<td>18</td>
</tr>
<tr>
<td>Electric, gas and oil incinerators</td>
<td>18</td>
</tr>
<tr>
<td>Oil and solid-fuel appliances</td>
<td>18</td>
</tr>
<tr>
<td>Unlisted gas appliance with draft hoods</td>
<td>9</td>
</tr>
<tr>
<td>Boilers and furnaces with listed burner and draft hood</td>
<td>6</td>
</tr>
<tr>
<td><strong>COMMERCIAL-INDUSTRIAL APPLIANCES</strong></td>
<td></td>
</tr>
<tr>
<td>Low-heat Appliances. Column II (Table 37-B)</td>
<td></td>
</tr>
<tr>
<td>Gas, oil, and solid-fuel boilers, furnaces and water heaters</td>
<td>18</td>
</tr>
<tr>
<td>Ranges, restaurant type</td>
<td>18</td>
</tr>
<tr>
<td>Oil unit heaters</td>
<td>18</td>
</tr>
<tr>
<td>Unlisted gas unit heaters</td>
<td>18</td>
</tr>
<tr>
<td>Listed gas unit heaters with draft hoods</td>
<td>6</td>
</tr>
<tr>
<td>Other low-heat industrial appliances</td>
<td>18</td>
</tr>
<tr>
<td>Medium-heat Appliances. Column III (Table 37-B)</td>
<td></td>
</tr>
<tr>
<td>All gas, oil, and solid-fuel appliances</td>
<td>36</td>
</tr>
</tbody>
</table>

a These clearances apply except if the listing of an appliance specifies different clearances in which case the listed clearance takes precedent.
b If listed Type B or Type L vent material is used, the clearance may be in accordance with the vent-material listing.

### TABLE NO. 37-E

#### INSULATING CASTABLE LINING FOR METAL INCINERATOR STACKS

<table>
<thead>
<tr>
<th>Stack diameter</th>
<th>Lining thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 thru 14&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>15 thru 20&quot;</td>
<td>2 1/2&quot;</td>
</tr>
<tr>
<td>21 thru 30&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>Over 30&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Building Heating and Industrial type Low-Heat Appliances (1000°F, operating - 1400°F, Temp. Maximum)</td>
<td>Mfgs Std 10 ga.</td>
</tr>
<tr>
<td>Medium-Heat Industrial Type Appliances (2000°F, Maximum)</td>
<td>Mfgs Std 10 ga.</td>
</tr>
<tr>
<td>High-Heat Industrial Type Appliances (Over 2000°F)</td>
<td>Mfgs Std 10 ga.</td>
</tr>
<tr>
<td>Residential Type Incinerators</td>
<td>Mfgs Std 10 ga.</td>
</tr>
<tr>
<td>Commercial or industrial Type Incinerators</td>
<td>Mfgs Std 10 ga.</td>
</tr>
</tbody>
</table>

⁴ See Table 37-B for types of appliances to be used with each type of chimney.

⁵ Lining shall extend from bottom to top of chimney.

⁶ Lining shall extend from 24 inches below connector to 24 feet above.

⁷ Clearance shall be as specified by the design engineer, shall have sufficient clearance from buildings and structures to avoid overheating combustible materials (maximum 160°F).

⁸ Firebrick in fire clay mortar or equal.
CHAPTER 38
FIRE PROTECTION SYSTEMS

SECTION 3801. GENERAL.
(a) Scope. The provisions of this chapter shall govern the design, installation, repair, operation, and maintenance of fire protection systems in all Group A through I Occupancies. See Chapter 31 (Rehabilitation).
(b) Systems Not Required. Where fire protection systems are not required by this Building Code but are installed, the installation shall meet all the requirements of this Chapter except that a central station system connection need not be provided and the installation may be designed for and limited to those areas approved by the Department and the Fire Department. The Fire Department shall be notified prior to disconnecting a non-required system. When a non-required system is disconnected, all external appurtenances including heads, pull stations, valves, outlets and fire department connections shall be removed.
(c) Fire Protection System Shut-Off. When a fire protection system is interrupted for repairs or other necessary reasons, the owner and tenant shall advise the Fire Department prior to disconnection, and shall diligently prosecute the restoration of the system. The Fire Department shall be notified when the system is reactivated and returned to service.
(d) Threads. All threads provided for fire department connections, hose outlets, or other threads to be used for the connection of fire hose shall comply with Fire Department specifications.
(e) Signs. A sign shall be provided on the door of the entrance to the room housing the fire sprinkler and standpipe controls. The sign shall be red in color and at least 4 inches in height, with contrasting letters at least 1 1/4 inches in height, and shall read “Fire Valves.”
(f) Annunciation of Fire Protection Equipment. The method of establishing interconnection, activation and annunciation of system alarms shall be determined in conjunction with the Department and the Fire Department.
(g) Special Extinguishing Systems. A special extinguishing system may be installed in lieu of, or in addition to, a required system when approved by the Department and the Fire Department.
(h) Material and Equipment. All materials and equipment used in a fire protection system shall be approved in accordance with the requirements of this Building Code and the Standards listed in Section 3817.
(i) Corrosion Protection. All underground piping shall be adequately protected from corrosion. Galvanized and black pipe and fittings shall be provided with approved coverings.
(j) Maintenance. The owner and tenant of every building or structure shall be responsible for the care and maintenance of all fire protection systems.
(k) Drawings. Installation drawings, prepared to scale and showing detailed design of the fire protection system shall be submitted to and approved by the Department and the Fire Department prior to issuance of a Permit. See Chapter 3.
SECTION 3802. DEFINITIONS. For purposes of this Chapter, certain terms are defined as follows:

**Approved - Approval.** See Chapter 4.

**Approved Extinguishing Agents.** As approved by the Department and the Fire Department.

**Automatic Detection Device.** An individual device or combination of devices designed to detect flame, heat, smoke, or combustion gases resulting from a fire and to automatically operate electrical signaling contacts. Detectors shall be classified as one of the following:

1. **Products of Combustion.** A device designed to detect one or more products of combustion. These products may consist of gases, ions, water vapor, or invisible smoke particles.

2. **Photo-electric Type.** A device designed to detect an abnormal density of visible smoke particles only, either by obscuration of a projected light path or reflection of light from the visible smoke particles onto a light-sensitive element.

3. **Flame Type.** A device designed to detect flames, either in the infra-red or ultra-violet regions.

4. **Thermostatic Type.** An integral assembly of heat-responsive elements and non-coded electrical contacts which function automatically under conditions of increase in air temperature.

5. **Central Station System.** An approved system of electrically supervised circuits employing a connection between signalling devices at the protected premises and signal receiving equipment at the Fire Alarm Headquarters or other location approved by the Fire Department.

6. **Fire Alarm System.** An approved integrally supervised system consisting of manual stations which will actuate audible and visual alarm signals throughout the building or structure and an annunciator at an approved location.

7. **Fire Detection System.** An approved integrally supervised system of automatic detection devices connected to operate an audible and visual alarm system throughout the building or structure and an annunciator at an approved location.

8. **Fire Protection System.** Includes fire sprinkler systems, fire alarm systems, fire detection systems, standpipe systems, special extinguishing systems, water supplies, and other extinguishing agents suitable for the specific purpose for which they are designed and installed.

9. **Fire Sprinkler System.** An approved arrangement of open or closed fire sprinkler heads, automatically or manually operated, attached to piping containing an approved extinguishing agent.

10. **Grade.** See Chapter 4.

11. **Partial System.** A system designed to protect a portion of or less than an entire floor area.

12. **Pre-signal System.** A fire alarm or detection system which, when activated, will immediately transmit a signal to an approved central station and transmit a local alarm to pre-determined locations on the protected premises.

13. **Special Extinguishing System.** An approved fire extinguish-
14. **Standpipe System.** An approved system of wet or dry piping and all required appurtenances.

**SECTION 3803. FIRE SPRINKLER SYSTEMS.**

(a) **Where Required.** Fire sprinkler systems shall be installed and maintained in full operating condition as specified in this Chapter and the Standards herein in the following locations:

1. In every story, cellar, and basement of all buildings when the floor area exceeds 1500 square feet, except Group I Occupancies.

**EXCEPTION:** Sprinkler systems shall not be required when at least 20 square feet of window opening is provided in each 50 linear feet, or fraction thereof, of exterior wall in each story, cellar, or basement. These windows shall be provided on at least 2 sides of the building.

A. When the side of a building is less than 50 feet in length, the required window area may be in proportion to the actual length. Minimum window dimensions shall be maintained.

B. The required window opening shall be a glazed surface at least 30 inches clear in its smallest dimension.

C. Doors may be included as required openings if provided with the minimum glazing requirements.

D. Required window openings shall not be approved if fully covered or filled with:
   1. Glass in excess of 1/4 inch thickness.
   2. Safety glass, glass block, or louvers.
   3. Plastics not approved by the Department and Fire Department.
   4. Metal bars or mesh exceeding 1/4 inch in any cross section dimension.

E. Windows located below grade shall be provided with areaways which provide enclosing walls or masonry, concrete, or metal extending 4 inches above grade and 4 inches below the bottom of the window. The bottom of the areaway shall provide a masonry, concrete or gravel floor. The inside dimensions of the areaway shall be at least 6 feet in length, 4 feet in width, and not more than 4 feet in depth. The areaway shall extend the full length of the window when the window is longer than 6 feet.

2. When any portion of a basement or cellar is more than 50 feet from required openings, the entire basement or cellar shall be provided with an approved fire sprinkler system.

3. When any portion of a story is more than 75 feet from required window openings, the entire story shall be provided with an approved fire sprinkler system.

4. Throughout open parking garages and storage garages which exceed 75 feet in height above grade.

5. In all buildings or structures housing Group E Occupancies.

**EXCEPTIONS:**

1. In Group E-3 and E-4 Occupancies less than 2500 square
feet in area, not over one story in height, entirely above
grade, and with the required window openings.
2. Aircraft storage hangars.
6. Stages of any size at the following locations:
A. The proscenium arch, by providing a line of open type fire
sprinklers installed on the stage side and immediately back of
the proscenium arch or curtain, not more than 5 feet above the
arch and spaced not more than 6 feet on centers. The system
shall be controlled by manually operated quick opening valves
located on each side of the proscenium opening, not more than 5
feet above the stage floor.
B. Under the gridiron.
C. Under the stage floor.
D. In tie and fly galleries.
E. In areas adjacent to a stage, without limitation, such as: dressing
rooms, store rooms, property rooms, carpenter shops, paint
shops, and passageways.
7. Under platform floors containing usable space beneath.
8. Spray painting rooms, booths, and any area where painting, brush-
ing, dipping, or mixing of flammable materials is regularly con-
ducted.
9. Rooms or areas used for incineration, trash and laundry collection
areas, and at the top of all chutes, and in chutes at alternate floors in
all buildings which require standpipes. These systems shall provide
separate O S & Y control valves.
10. In all existing buildings or structures where a fire hazard is deter-
mined to exist. See Chapter 1.
11. Underground tunnels used as passageways which exceed 6 feet in
width or height and are more than 10 feet in length. Overhead passageways more than 65 feet above grade and which exceed 6 feet
in width or height and are more than 10 feet in length.
12. Unenclosed vertical openings between floors, where permitted by
other Sections of this Building Code.
A. Fire sprinklers shall be provided around the perimeter of the
opening.
B. Fire sprinklers shall be provided in all ceiling surfaces directly
above and parallel to each escalator or stair flight, and at the
ceiling above the vertical opening required for the escalator or
stair.
13. Dead end corridors except as permitted in Chapter 33.
14. Enclosed usable space under stairs.
15. In high rise buildings. See Section 3816.
(b) Partial Fire Sprinkler Systems. A maximum of 10 fire sprinkler
heads in a building or structure may be supplied from the domestic water
system, provided the water supply and pressure is adequate to operate
the fire sprinklers. See Standards.
(c) Signs. Legible signs, tags, or labels are required on all valves. Instructions for care and maintenance of the valve shall be attached to the riser
or mounted on the wall adjacent to it.
(d) Water Supply. See Section 3808.
(e) **Draft Stops and Draft Curtains for Sprinklered Buildings.** See Chapter 32.

(f) **Valves.** Automatic fire sprinkler system valves shall be electrically monitored or secured with a chain and padlock which will lock the valve in an open (operating) position.

### SECTION 3804. FIRE SPRINKLER ALARMS.

(a) **Connection and Location.** Approved audible horn and visual light devices shall be connected to every fire sprinkler system. The devices shall be located on the exterior of the building at least 10 feet above grade and within 25 feet of and visible from the fire department connection. When more than one building is supplied by a yard main, the alarm devices shall be located on the exterior of each building.

(b) **Additional Alarms.** Additional horn or light type devices shall be within hearing and seeing distance of all sprinklered areas within the building and in other areas as required by the Department and the Fire Department.

(c) **Not Required.** Alarms and alarm attachments shall not be required for partial fire sprinkler systems supplied from the domestic water system. See Section 3803 (b).

### SECTION 3805. FIRE DEPARTMENT CONNECTIONS.** See Section 3807 for temporary standpipes.

(a) **Required.** All fire sprinkler and standpipe systems shall be provided with at least one 2-way fire department connection. Each inlet of the fire department connection shall be 2 1/2 inch diameter. The pipe from the system to the fire department connection shall not be smaller than 4 inch diameter. Single fire department connections may be installed on a 3 inch or smaller riser when approved by the Department and the Fire Department.

(b) **Connections.** Fire department connections shall be arranged so that the use of any one connection will serve all the fire sprinklers and standpipes within the building. Unless otherwise approved by the Department and Fire Department.

(c) **Location.** Fire department connections shall be located and be visible on a street front in a location approved by the Department and the Fire Department. Connections shall be located so that ready access can be made by the Fire Department. Obstructions such as fences, bushes, trees, walls, or any other object, shall not be permitted.

(d) **Height.** Fire department connections shall not be less than 1 foot 6 inches and not more than 3 feet 6 inches in elevation above the ground level to the center line of the inlets.

(e) **Projection.** When the fire department connection would project beyond the property line or into the public way, flush type fire department connections shall be provided.

(f) **Hose Threads.** Hose threads shall meet Fire Departmnt specifications.

(g) **Fittings.** Fire department inlet connections shall be installed with check valves, ball drip valves, and plugs with chains and caps.

(h) **Signs.** A metal sign with raised letters at least one inch in height shall be mounted on all fire department connections serving fire sprinklers and standpipes. The sign shall read “Automatic Sprinklers” or “Standpipe”.
SECTION 3806. STANDPIPE SYSTEMS.

(a) **When Required.** Wet standpipes shall be installed in all buildings or structures 4 or more stories in height above grade and shall be installed and maintained in full operating condition as specified in this Chapter and the Standards.

**EXCEPTION:** Open parking garages may have dry standpipes in lieu of wet standpipes. The standpipes shall conform to all the requirements of wet standpipes, except water supply.

(b) **Location.** Outlets shall be located in a public corridor within 10 feet of the opening of a required stairway, on all floor levels, or as approved by the Department and the Fire Department. In no case shall the outlet be located in a stairway.

**EXCEPTION:** Where the maximum distance from the required standpipe outlets is exceeded and a horizontal fire separation is provided in a corridor, a standpipe and the required outlets shall be provided on each side of the separation. The standpipe outlets shall not be located more than 10 feet from either side of the fire separation.

(c) **Distance.** The maximum distance from a required standpipe outlet to any point in the building or structure shall not exceed 100 feet in the line of travel.

(d) **Size.**

1. Buildings, or portions thereof, having 4 or more stories above grade, shall be equipped with one or more 4 inch standpipes extending from the lowest portion of the building to a height 5 feet above the finished floor of the topmost story.

2. Buildings, or portions thereof, having 7 or more stories above grade shall be equipped with one or more 6 inch standpipes extending from the lowest portion of the building to the topmost outlet. At least one 2-way roof manifold with 2 1/2 inch hose valves, with caps and chains, connected to a standpipe, shall be provided on each building rooftop. The main control valve on a roof manifold shall be located in a heated area and equipped with an automatic drain. These valves shall be accessible from the outside, within 3 feet of the manifold, and shall be plainly marked.

(e) **Extinguishers and Hose.** A 2 1/2 gallon approved water-air pressure type extinguisher, or other extinguisher approved by the Fire Department, shall be provided at each standpipe outlet location at each floor level. Hose shall not be required for standpipes.

(f) **Material.** Wet standpipes shall be constructed of standard weight wrought iron, steel, or Type L hard-drawn copper as approved by the Department. Copper pipe and fittings shall be joined with a low temperature brazing alloy. Dry standpipes shall be constructed of steel. All pipe, fittings, and valves shall be extra heavy pattern when the working pressure will exceed 175 pounds per square inch.

(g) **Capacity.** Standpipes shall be capable of discharging a minimum of 500 gallons per minute for the first standpipe and 250 gallons per minute for each additional standpipe, the total supply not to exceed 2500 gallons per minute, for a period of at least 30 minutes. The supply shall be sufficient to maintain a minimum residual pressure of 65 pounds per square inch at the topmost outlet of each standpipe with 500 gallons per minute flowing.
(h) **Outlets.** At each floor level a 2 1/2 inch hose valve with cap and chain and a 1 1/2 inch hose valve with cap and chain shall be connected to each standpipe. Outlets shall be at least 3 feet and not more than 6 feet above finished floor. The valves shall be readily accessible and plainly identified.

(i) **Valves.** All main control valves of a standpipe shall be electrically monitored or secured with a chain and padlock which will lock the valve in an open (operating) position.

(j) **Water Supply.** See Section 3808.

(k) **Standpipes in Sprinklered Buildings.** In fully sprinklered buildings, a separate standpipe riser and the 1 1/2 inch hose outlet may be omitted. The sprinkler water supply riser may be used for the standpipe. The maximum distance from required standpipe outlets to any portion of the building or structure shall not exceed 200 feet in the line of travel. All other requirements for standpipes shall apply.

**SECTION 3807. STANDPIPES FOR BUILDINGS UNDER CONSTRUCTION OR DEMOLITION.**

(a) **General.** Wet or dry standpipes shall be provided for all buildings under construction which exceed 3 stories above grade, and shall comply with all the requirements of Section 3806. Standpipes shall be available for use when construction reaches the third floor level, and remain in service until the permanent installation is completed and in service.

(b) **Height.** The standpipe and outlets shall be operable on all floors below the top floor of construction.

(c) **Fire Department Connections.** At the street level there shall be provided, for each temporary or permanent standpipe installation, one or more two-way fire department inlet connections. Fire department inlet connections shall be prominently marked and readily accessible at all times. See Section 3805.

(d) **Standpipes for Buildings Under Demolition.** When a building is being demolished, and a standpipe is existing within the building, the standpipe shall be maintained in an operable condition so as to be available for use by the Fire Department. The standpipe shall be demolished with the building, but in no case shall the standpipe be inoperable more than one floor below the top remaining floor of the structure.

**SECTION 3808. WATER SUPPLY AND OTHER EXTINGUISHING AGENTS.**

(a) **Required.** Fire sprinkler systems and wet standpipes shall be provided with at least one reliable water supply. Other types of extinguishing agents permitted by this Building Code shall supply the extinguishing material in quantities adequate to perform the function intended.

(b) **Insufficient Pressure.** When the city water pressure is insufficient to produce the required volume and pressure required in this Chapter and Standards, a booster pump system shall be installed and maintained in operating condition at all times.

(c) **Booster Pumps.** Booster pumps shall be of an approved type, and shall have a rated capacity sufficient to produce and maintain the required volumes and pressures. Booster pumps shall be equipped with a controller which will provide both automatic and manual operation. Booster
pumps taking suction from a street water main shall be installed in a bypass. Electric wiring to the pump motor shall be on a separate circuit and connected to the emergency system. See Chapter 53. Booster pumps shall be installed in a separate noncombustible room, boiler room or pump house of at least one hour fire-resistant construction. Room doors shall be equipped with a self closing device and shall be rated 3/4 hour fire resistive.

(d) **Combined Water Supply.** Where both sprinklers and standpipes are installed, they shall have a common water main as their combined source of supply. The connection shall not be made to any City water main of less than 4 inch diameter. The common water supply for both standpipes and sprinkler systems shall be at least the largest connection required for either.

(e) **Combination Domestic Water Supply.** A fire sprinkler system may be connected to the domestic water supply system provided the supply system is of adequate pressure, capacity, and size for the combined fire sprinkler system and domestic water needs. An OS&Y gatevalve and check valve shall be installed in the sprinkler supply line.

(f) **Size.** The water supply for complete or partial fire sprinkler systems shall be sized in accordance with NFPA Pamphlet No. 13, for the quantity of heads provided. See Standards, Section 3817.

(g) **Standpipes.**
1. Standpipes shall be connected to a street water main at least equal to the size of the largest standpipe within the building. The size of the water service at the base of the standpipe risers shall be at least the size of the largest standpipe.
2. The required water supply shall be connected to the base of each standpipe. Where more than one standpipe is required, all standpipes shall be interconnected at their base. An approved shutoff valve shall be installed at the base of each standpipe.

**SECTION 3809. FIRE DETECTION SYSTEMS.**

(a) **Where Required.** A complete fire detection system shall be required and maintained in all new and existing C and D occupancies, and all new F-1, B-2 and B-3 occupancies which provides for the serving of malt or alcoholic beverages.

**EXCEPTIONS:**
1. Group C-2 occupancies with 20 or less occupants and Group D-2 occupancies with 10 or less occupants, provided these occupancies are protected with approved single station products of combustion detectors wired to a 115 volt AC unswitched electric power source.
2. Group C-1 occupancies with more than 20 and less than 50 occupants, shall be provided with a complete fire detection system, and need not be connected to a central station.

(b) **Not Required.** A fire detection system may be installed in lieu of a fire sprinkler system, when approved by both the Department and the Fire Department. When a fire sprinkler system is installed in a building or area where a fire detection system was originally required, the detector system need not be provided when approved by both the Department and the Fire Department.
(c) **Manual Pull Stations.** Manual pull stations, conforming to the requirements of Section 3811, shall be installed in conjunction with fire detection systems.

**EXCEPTION:** Manual pull stations need not be installed in new Group F-1 or B-3 occupancies with an occupant load of less than 150, which provides for the serving of malt or alcoholic beverages.

(d) **Power Supply.** Electric power supply shall be provided from the building emergency system. See Chapter 53.

(e) **Detailed Requirements.** Fire detection systems shall be of an approved type, shall be electrically supervised, and shall comply with the following:

1. Wiring shall conform to the requirements of Chapter 53 and NFPA Pamphlets as listed in the Standards. See Section 3817.
2. Audible alarms of approved horn type shall be provided. In addition, visual alarms shall be provided where required by other portions of this Chapter.

**EXCEPTION:** In Group D occupancies, chimes may be installed in lieu of horns when approved by the Department and Fire Department. When chimes are installed, visual alarms shall also be provided.

A. Visual and audible alarms shall be provided in occupancies housing the hard of hearing as approved by the Department and the Fire Department.

B. Horns or chimes shall be located to be heard above all other sounds by the occupants in occupied spaces in the building.

C. The operation of any detection device shall cause all audible and visual alarms to operate.

3. Fire detection systems shall incorporate products of combustion type detectors in routes of egress and storage rooms opening into routes of egress. Products of combustion type detectors shall be installed in operating rooms, X-ray rooms, delivery rooms, cardiac and intensive care rooms and patient sleeping rooms. Other spaces shall be provided with detectors approved for the particular application.

**EXCEPTION:** Fire protection systems in all Group F-1, B-2, and B-3 occupancies which provides for the serving of malt or alcoholic beverages shall incorporate approved thermal rate of rise type detectors in routes of egress and all other areas.

A. Fire detecting devices shall be installed to comply with the lineal or square footage allowances specified, based on Standards 3817.

4. A presignal system may be installed in Group D occupancies. Presignal systems shall not be installed in other occupancies, unless approved by the Department and the Fire Department. All presignal systems shall be connected to an approved central station system.

A. When a presignal system is installed, 24 hour personnel supervision shall be provided at locations approved by the Fire Department.

5. The master keys for manual pull stations, and for the master fire alarm panel, shall be located within the elevator fire control key cabinet or other location approved by the Department and the Fire Department.
6. Each floor shall be zoned separately. If the floor area exceeds 20,000 square feet, additional zoning shall be provided. In no case shall the length of any zone exceed 200 feet in any direction.
   A. Zoning indicator panels and controls shall be in a location approved by the Department and the Fire Department. Annunciators shall lock in until the system is reset.

7. All systems shall be tested semi-annually.
   A. Accurate logs shall be maintained on the premises indicating box numbers, location and type of devices tested. Any defect, modification, or repair shall be recorded in the log. Logs shall be made available to the Fire Dept.

SECTION 3810. SINGLE STATION DETECTING DEVICES.

(a) Single Station Detecting Devices. Approved single station products of combustion detectors shall be installed in the following Occupancies and areas:
   1. New C-2 and D-2 Occupancies as provided for in Section 3809 (a).

(b) Location. Location of detectors in C-2 and D-2 occupancies shall be in the corridor or central area approved by the Department and Fire Department. Detector(s) in H-1 occupancies shall be located in each room utilized for sleeping purposes. Detector(s) in H-2, H-3 and I occupancies shall be located in the corridor or central area of the unit adjacent to the sleeping area, as approved by the Department and Fire Department.

(c) Power Supply. Detectors required by this Section shall be wired to a 115 volt AC unswitched electric power source and when activated shall initiate an audible alarm.

   EXCEPTION: Battery powered detectors shall be permitted in existing Group I Occupancies, and no Permit shall be required for such installation. (See Chapter 1 for 50 percent requirement.)

SECTION 3811. FIRE ALARM SYSTEMS.

(a) Where Required. A fire alarm system shall be required, installed, and maintained in all new and existing Group A, B, C, D, and H Occupancies and in all new Group F-2 Occupancies.

   EXCEPTIONS:
   1. F-2 and H Occupancies of 4 stories or less above grade.
   2. Churches.
   3. Group C-2 Occupancies with 20 or less occupants.
   4. Group C-1 Occupancies of more than 20 occupants and less than 50 shall be provided with a complete fire alarm system that need not be connected to an approved central station system.
   5. Group B-3 with an occupant load of 150 or less and B-4 Occupancies.

(b) Approval. Manual pull stations shall be approved for the particular application and shall be used for fire protective signaling purposes only. Alarm boxes shall be painted red.

(c) Location and Signs. Manual pull stations shall be located in each corridor of each story, basement, or ellar so that from each corridor door no more than 100 feet will be traversed in order to reach a manual station. Stations shall be located as near as possible, but not more than 5 feet
from each stair exit. The height of the boxes shall be not less than 4 1/2 feet, and not more than 6 feet above the floor. When corridors are not provided, manual stations shall be located so that no point in the building is more than 100 feet from a station. When a stage is provided, a manual pull station shall be located adjacent to the lighting control panel. Manual pull stations shall be located at or near each exit from the building.

Where a Central Station is not required, an engraved plaque with letters no smaller than 1/4 inch in height, shall be provided within 4 inches of the pull station. The plaque shall state “AFTER PULLING ALARM - PHONE 911, this is a local alarm only.”

**EXCEPTION:** In Group C Occupancies, manual pull stations may be located in areas under supervision of persons in authority as approved by the Department and the Fire Department.

(d) **Coding.** Coded stations shall be coded in conformance with the Standards as listed in Section 3817.

(e) **Power Supply.** Electric power supply shall be provided from the building emergency system. See Chapter 53.

(f) **Detailed Requirements.** Fire alarm systems shall be of an approved type, shall be electrically supervised, and shall comply with the following:

1. All wiring shall conform to the requirements of Chapter 53 and NFPA Pamphlets listed in the Standards. See Section 3817.

2. Audible alarms of approved horn type shall be provided.
   A. Visual and audible alarms shall be provided in occupancies housing the hard of hearing as approved by the Department and the Fire Department.
   B. Horns shall be located to be heard above all other sounds by the occupants in occupied spaces in the building.
   C. The operation of any signal initiating device shall cause all audible and visual alarms to operate.

3. A presignal system may be installed in Group D Occupancies. Presignal systems shall not be installed in other occupancies unless approved by the Department and the Fire Department. All presignal systems shall be connected to an approved central station system.
   A. When a presignal system is installed, 24 hour personnel supervision shall be provided at locations approved by the Fire Department.

4. The master keys for the stairway doors, manual pull stations and for the master fire alarm panel shall be located within the elevator fire control key cabinet or other location approved by the Department and the Fire Department.

5. Each floor shall be zoned separately. If the floor area exceeds 20,000 square feet, additional zoning shall be provided. In no case shall the length of any zone exceed 200 feet in any direction.
   A. Zoning indicator panels and controls shall be located as approved by the Department and the Fire Department. Annunciators shall lock in until the system is reset.

6. All systems shall be tested semi-annually.
   A. Accurate logs shall be maintained on the premises indicating
box numbers, location and type of devices tested. Any defect, modification or repair shall be recorded in the log. Logs shall be made available to the Fire Department.

SECTION 3812. SPECIAL EXTINGUISHING SYSTEMS.

(a) Where Required. An approved special extinguishing system shall be installed and maintained in range hoods, connecting duct systems, and special hazards such as deep fat fryers, ranges, griddles and broilers used in conjunction with frying and cooking operations in food preparation centers within any Group A through H Occupancies.

EXCEPTIONS:
A. New or existing restaurants in one story buildings with an occupant load of less than 50.
B. Churches, schools, and noncommercial installations when the food preparation center is used less than 8 hours per week.
C. Dwelling units.

1. General Requirements. All systems shall comply with the following:
A. A manual station controlling the actuation of the extinguishing system shall be located in the path of egress from the cooking area and a minimum of 10 feet from the range hood, unless otherwise approved by the Department and the Fire Department. Manual stations shall be securely mounted at an approved location not less than 4 1/2 feet or more than 6 feet above the floor.
B. Extinguishing systems required by this Section shall provide both automatic and manual actuation.
C. System nozzles shall be accessible for cleaning and replacement.
D. Operating instructions shall be posted at the manual station.
E. When a fire alarm system is required by other Sections of this Building Code, the special extinguishing system shall be connected to the central station system.
F. Containers for the extinguishing agent shall not be subject to weather conditions affecting proper operation, physical damage, chemical, or other damage, or exposure to fire or explosion occurring in the hazard area.
G. Upon activation of the extinguishing system, a valve shall shut off the gas pilot and burners and electric power supplying the cooking equipment. Fan operation and fire damper installation and control shall be in accordance with the Standards governing the particular system. See Section 3817.
H. A visual indicator shall signify the readiness of the extinguishing system.
I. Approved portable fire extinguishers shall be installed and maintained as required by the Fire Code.
J. The system shall be maintained in full operating capacity as required by this Building Code and shall be serviced at least once every 6 months. A record of the service company and dates of service shall be posted and available for inspection.
SECTION 3813. SERVICE STATIONS INSIDE BUILDINGS.
Prohibited. See Chapter 10 and Fire Code.

SECTION 3814. FIRE HYDRANTS. See Fire Code.

SECTION 3815. CENTRAL STATIONS.

(a) Central Stations Required. Required fire protection systems shall be connected to an approved central station system. When approved by the Fire Department, the fire protection system may be connected to the City alarm signalling system.

EXCEPTIONS:
1. C-2, E, and I Occupancies.
2. Special extinguishing systems unless otherwise required. See Section 3812 (a) E.
3. Standpipes.
4. F-2 and H Occupancies when 4 stories or less above grade.
5. Churches.
6. F-1 occupancies not including those serving malt or alcoholic beverages.

(b) Responsibility. It shall be the responsibility of the owner and tenant of a building or structure to provide and maintain the required central station connection.

SECTION 3816. SPECIAL REQUIREMENTS FOR HIGH RISE BUILDINGS.

Scope. In addition to the other requirements of this Building Code, this Section shall apply to all buildings, having any portion of a story used for human occupancy, more than 75 feet above the lowest level of Fire Department vehicle access, and housing Groups C, D, F-2, H-1, and H-2 Occupancies.

(b) Fire Sprinkler System.
1. Required. Automatic fire sprinklers installed in accordance with the requirements of this Chapter shall be provided throughout all C, D, F-2, H-1 and H-2 Occupancies.

EXCEPTIONS: An approved product of combustion detection system complying with the requirements of this Chapter may be installed in lieu of sprinklers:
A. In Group C Occupancies in classrooms.
B. In Group D Occupancies; in hospital corridors, patient rooms, computer rooms, x-ray rooms, operating rooms, recovery rooms, nurseries, and specialized diagnostic and treatment rooms.
C. In the individual dwelling units of Group H-1 and H-2 Occupancies.

2. Valves. Automatic sprinkler valves required by this Section shall be electrically monitored.

(c) Fire Detection Systems. Approved duct detectors shall be installed in accordance with the requirements of Chapter 52. The actuation of any detector shall activate the fire alarm system.

d) Communication Systems. A communication system shall be provided, and shall function as follows:
1. A voice communication system designed to be clearly heard by all occupants of the building and operated from the Operations Center. The detection system and fire alarm system shall activate the voice communication system. It shall provide one way communication or a selective or general basis to the following locations:
   A. Elevators.
   B. Elevator lobbies.
   C. Public corridors.
   D. Exit stairways.
   E. Rooms exceeding 2,500 square feet.
   F. Apartment dwelling units.
   G. Hotel and motel guest rooms.

2. A fire department communication system designed to provide two-way communication between the Operations Center and the following locations:
   A. Elevators.
   B. Manual pull stations.
   The communication system shall be designed and installed so that damage to any station will not affect the operation of the remainder of the system. The system shall be continuously electrically supervised.

3. When approved by the Department and Fire Department, the Fire Department communication may be combined with voice communication system.

4. The communication systems shall be continuously electrically supervised. Design of the communication systems shall be such the speakers on any one floor shall be connected to an alternate speaker cable system so that damage or loss of any one speaker, amplifier, or pre-amplifier will not cause the failure of more than one-half of the communication systems on a given floor. The speaker cable system shall be routed in a minimum of 2 separate vertical risers remotely located from each other.

(e) Operations Center. An Operations Center shall be provided in a location approved by the Department and Fire Department, and shall contain the following:
   1. The communication system panel.
   2. Fire alarm and detection system annunciator and panel.
   3. Elevator controls and status indicators.
   4. Air handling system controls and status indicators.
   5. Sprinkler valve and water flow indicators.
   6. Standby power controls.
   7. A telephone.
   8. A diagramatic set of building floor plans.
   The Operations Center shall be contained in a room separated from the remainder of the building by a 2-hour fire resistive separation, and shall be directly accessible from the exterior of the building.

(f) Standby Power System. A permanently installed standby power generating system conforming to the requirements of Chapter 53 shall be provided. System supervision and controls shall be provided at the Operations Center. An on-site fuel supply sufficient for at least 2 hours
operation at full load shall be maintained. Systems required by this Section shall be automatically transferable to the standby power system. The standby power requirements shall be sufficient to provide for the following:
1. Fire alarm and detection system.
2. Exit and emergency lighting.
3. Fire pumps.
4. Mechanical ventilation required by Chapter 52.
5. Emergency elevators.
6. Communication system.
See Chapter 53.

SECTION 3817. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

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<tr>
<th>ORGANIZATION</th>
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<tr>
<td></td>
<td>Dry Chemical Systems, Pamphlet 17, 1975.</td>
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<td>Water Tanks, Pamphlet 22, 1974.</td>
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<td>Supervision of Valves, Pamphlet 26, 1958.</td>
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<td>Central Station Signaling Systems, Pamphlet 71, 1974.</td>
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Public Fire Service Communications, Pamphlet 73, 1975.
Aircraft Hangars, Pamphlet 409, 1975.

ORGANIZATION
National Fire Protection Association
470 Atlantic Avenue
Boston, Mass. 02210
CHAPTER 39
STAGES AND PLATFORMS

SECTION 3901. SCOPE In addition to the other requirements of this Building Code, this Chapter shall govern the requirements for stages and platforms.

SECTION 3902. STAGES AND PLATFORMS DEFINED. See Chapter 4.

SECTION 3903. GRIDIRONS. Gridirons, fly galleries, and pinrails shall be constructed of noncombustible materials, but protection of steel and iron members may be omitted. Gridirons and fly galleries shall be designed to support the live loads as indicated in Chapter 23.

(a) Each loft block well shall be designed to support 250 pounds per lineal foot, and the head block well shall be designed to support the aggregate weight of all the loft block wells served. The head block well shall be provided with a strongback or lateral brace to offset torque.

(b) The main counterweight sheave beam shall be designed to support a horizontal and vertical uniformly distributed live load, sufficient to accommodate the weight imposed by the total number of loft blocks in the gridiron. The sheave blocks shall be designed to accommodate the maximum load of the loft blocks served with a safety factor of 5.

SECTION 3904. ROOMS ACCESSORY TO STAGES. Rooms accessory to a stage shall be separated from each other and from the stage by at least a one-hour noncombustible fire separation.

SECTION 3905. PROSCENIUM WALLS.

(a) Construction. Stages shall be completely separated from the auditorium by a proscenium wall of at least one-hour noncombustible construction. The proscenium wall shall extend to the underside of the roof deck over the auditorium.

(b) Openings. All openings, other than proscenium openings, shall be protected with fire dampers as required in Chapter 52.

SECTION 3906. STAGE FLOORS.

(a) Construction. All portions of stage floors shall be built in accordance with the requirements of this Building Code, and shall be constructed of materials no less fire resistant than the building or structure housing the stage, and in no case shall the construction be less than one-hour fire-resistive noncombustible construction. Wood coverings may be installed, providing such wood covering shall be of at least 2 inch nominal thickness. Where wood sleepers are used for the laying of wood floors, the space between the floor slab and the underside of the wood covering shall be filled with noncombustible material or firestopped, so that there will be no open spaces under the flooring which will exceed 100 square feet in area. See Chapter 38 for fire sprinklers under stages.

(b) Openings. Openings through stage floors shall be equipped with tight-fitting trap doors of wood at least 2 inches in nominal thickness.
SECTION 3907. PLATFORMS.

(a) Construction. Walls and ceilings of an enclosed platform in an assembly room shall be of at least one-hour fire-resistive construction. See Chapter 38 for fire sprinklers under platforms.

(b) Accessory Rooms. Rooms accessory to a platform shall be separated from each other by at least a one-hour fire-resistive separation.

SECTION 3908. STAGE EXITS. At least one continuous exit, not less than 36 inches in width, shall be provided from each side of the stage, opening directly or by means of a passageway to a street or exit court.

(a) An exit stair at least 2 feet 6 inches wide, shall be provided for egress from each fly gallery.

(b) Each group or vertical tier of dressing rooms shall be provided with at least 2 means of egress, and each shall be at least 2 feet 6 inches in width.

(c) Stairs required in this Section need not be enclosed.

(d) Stairs shall be constructed as specified in Chapter 33.

SECTION 3909. SWITCHBOARD. A noncombustible protecting hood shall be provided over the full length of the stage switchboard.

SECTION 3910. FLAME-RETARDING REQUIREMENTS. Combustible scenery, drops, props, decorations, or other combustible effects shall not be placed or utilized on any stage or enclosed platform, unless the materials have been treated with a fire-retardant solution. All materials shall be maintained in a nonflammable condition as approved by the Fire Department. See Chapter 42.

SECTION 3911. FIRE PROTECTION SYSTEMS. Fire protection systems shall be installed as required in Chapter 38.
CHAPTER 40
FILM PROJECTION ROOMS OR BOOTHS

SECTION 4001. REQUIREMENTS.

(a) General. In addition to the other requirements of this Building Code, this Chapter shall govern the requirements for motion picture film projection rooms or booths.

(b) Scope. The provisions of this Chapter shall apply only where ribbon type motion picture film 16 mm or larger, is used or is intended to be used. See Chapter 53 for electrical requirements.

(c) Projection Room Required. Every motion picture projector using ribbon type film as set forth in this Chapter, together with all electrical devices, rheostats and equipment located in any Group A, B, and C occupancy, shall be enclosed in a projection room of a size which will permit the operator access to all parts of the projector.

SECTION 4002. CONSTRUCTION.

(a) General. Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located, but not less than one-hour construction. Openings need not be fire rated.

(b) Floor Area Assignment. The room shall have a floor area of at least 80 square feet for a single projector, and at least 40 square feet for each additional projector. Each motion picture projector, floodlight, spotlight, or similar piece of equipment shall have a clear working space at least 30 inches by 30 inches on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors.

SECTION 4003. EXITS. See Chapter 33.

SECTION 4004. VENTILATION. See Chapter 52.

SECTION 4005. SANITARY FACILITIES. Sanitary facilities shall be required in all projection rooms or booths, except those located in churches or schools.

SECTION 4006. FLAMMABLE FILM.

(a) Prohibition. The use or storage of flammable film (for example nitrocellulose) in new and existing Group A through H occupancy buildings is prohibited.

(b) Sign. There shall be posted within the projection room or booth a conspicuous sign with one-inch block letters stating “SAFETY FILM ONLY PERMITTED IN THIS ROOM”.

SECTION 4007. PROJECTION PORTS AND OPENINGS.

(a) Openings. The aggregate of openings of projection equipment shall not exceed 25 percent of the area of the walls between the projection room and the auditorium. All openings shall be provided with glass, so as to completely close the opening.
CHAPTER 41
DOMESTIC APPLIANCES

SECTION 4101. GENERAL.
(a) Scope. In addition to the other requirements of this Building Code, this Chapter shall govern the installation, repair and replacement of domestic appliances as herein defined.

b) Water Supply Connection. All connections made to a potable water supply system, including water bypasses for water conditioning appliances, for purposes of installing, altering, repairing, or replacing appliances, as herein defined, shall conform to the provisions of this Chapter and, where applicable, with Chapter 50 of this Building Code.

SECTION 4102. DEFINITIONS.
(a) General. The following words, phrases, terms and their derivatives shall be interpreted as set forth in this Section.

1. **Air Break (drainage system)**. A piping arrangement in which a drain from an appliance discharges indirectly into a plumbing fixture at a point above the flood level rim of the fixture.

2. **Air Gap (drainage system)**. The unobstructed vertical distance through the free atmosphere between the domestic appliance waste pipe outlet and the flood level rim of the receptacle into which it is discharging.

3. **Air Gap (water distribution system)**. The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to the domestic appliance and the flood level rim of the receptacle.

4. **Anchors**. See Supports.

5. **Approved**. See Chapter 4.

6. **Backflow**. The flow of water or other liquids, mixtures, or substances into the distributing piping system of potable water from any source other than its intended source. Back-siphonage is one type of backflow.

7. **Backflow Preventor**. A backflow preventor is a device or means to prevent backflow.

   A. **Atmospheric Type (Vacuum Breaker--Atmospheric)**. A device designed for installation in a water line, without any control valves downstream, to close against its inlet seat and introduce air into its outlet side when water ceases to flow through it.

   B. **Pressure Type (Vacuum Breaker--Pressure)**. A device designed for installation in a water line, to close against its inlet seat and introduce air into its outlet side when inlet water pressure drops below the outlet water pressure.

   C. **Reduced Pressure Zone Type**. An assembly of differential valves and check valves including an automatically opened spillage port to the atmosphere.

8. **Back-Siphonage**. The flowing back of used, contaminated, or polluted water from a plumbing fixture or other sources into a potable water supply pipe due to a negative pressure in the pipe.
9. **Closed System.** A system which is designed so that the expansion of the water due to temperature changes cannot be accommodated by reverse flow in the water supply system.

10. **Connection to Water Supply System.** This shall not be construed to include connections to existing faucets.

11. **Domestic Appliances.** Shall mean any and all apparatus and equipment where the same is connected to a potable water supply system, and which is not connected to a drainage system, or is only indirectly connected to a drainage system as herein defined, and shall include the following:
   A. Clothes washing machines whose capacity does not exceed 20 pounds.
   B. Dishwashing machines used in dwelling units only.
   C. Evaporative coolers of the window and free standing type only.
   D. Humidifiers of the freestanding type only.
   E. Ice making machines used in dwelling units only.
   F. Water conditioning appliances which are provided with a maximum capacity of 120,000 grains. These appliances shall not be directly connected to closed steam or hot water heating systems.
   G. Water heaters not in excess of 100 MBH. This term shall not include the gas piping, gas venting, or electrical wiring of the appliance connection.
   H. This definition of Domestic Appliances shall, for the purpose of repair and replacement, include garbage disposal units directly connected to the drainage system.

12. **Drainage System.** A drainage system means, and includes, all piping within public or private premises which conveys sewage, storm water, or other liquid waste, and includes the building sewer.

13. **Effective Opening.** The effective opening is the minimum cross-sectional area at the point of water-supply discharge, measured or expressed in terms of: (1) the diameter of a circle, or (2) if the opening is not circular, the diameter of a circle or equivalent cross-area.

14. **Flood Level.** The flood level in reference to an appliance or fixture means the level at which water begins to overflow from the top or rim of the appliance or fixture.

15. **Flood Level Rim.** The flood level rim is the top edge of the receptacle from which water overflows.

16. **Ice Makers.** Shall mean any type of refrigeration which is connected to the water supply for the purpose of making ice.

17. **Indirect Waste Pipe.** A waste pipe which does not connect directly with a drainage system, but which discharges into the drainage system through an air break or air gap, into a trap, plumbing fixture, receptor, interceptor, or other approved point of disposal.

18. **Repair or Replacement.** Shall include the repair or replacement of domestic appliances as defined in this Chapter. In addition, repair or replacement shall include garbage disposal units and dishwashers where they are connected directly to the sanitary sewer system, including the necessary replacement of tail pipes and traps. This shall not be construed to include the providing of additional openings into, or the relocation of, existing openings to another location in the sanitary drainage system.
19. **Receptor.** A plumbing fixture which is intended to receive the discharge from indirect waste piping, is directly connected to the drainage system, and is properly trapped and vented, and which is installed as provided for in Chapter 50.

20. **Sump.** A sump is a tank or pit which receives the discharge from drains, or other wastes, located below the normal grade of the gravity system, and which must be emptied by mechanical means.

21. **Supports, Hangers and Anchors.** Supports, hangers and anchors are devices for securing pipes, appurtenances and devices to walls, ceilings, or floors.

22. **Used.** Used, when applied to material, or equipment, means removed from previous installations.

23. **Vacuum breaker.** See Backflow Preventor.

24. **Water Conditioning Appliances.** The term water conditioning appliances shall include equipment which is not connected to a drainage system, or is only indirectly connected to a drainage system, and which is designed to soften or otherwise treat water bypasses.

25. **Water Distributing Pipes.** A water distributing pipe in a building is a pipe which conveys water from the water service pipe to the domestic appliances, plumbing fixture branch or other plumbing outlets.

26. **Water Service Pipe.** Water service pipe is the pipe from the water main, or other source of water supply, to the building served.

27. **Water Heaters.** The term water heater shall include those which provide a Btu input capacity not to exceed 100 MBH and is not used primarily for building heating purposes.

28. **Water Supply System.** The water supply system of a building consists of the water distributing pipes, and the necessary connecting pipes, fittings, control valves, and all appurtenances on a particular premises.

**SECTION 4103. GENERAL REQUIREMENTS.**

(a) **Installation.** All appliances shall be installed in a manner to afford access for cleaning, repair, and replacement.

(b) **Vertical Pipe Supports.** Vertical piping shall be secured at sufficiently close intervals to keep the pipe alignment and carry weight of the pipe and contents, but in no case less than at every story height.

(c) **Hangers and Anchors.** Hangers and anchors shall be metal of sufficient strength to support the pipe and its contents, and shall be attached to the building construction.

(d) **Openings.** Openings through walls, floors, and ceilings shall be filled with incombustible materials.

**SECTION 4104. JOINTS AND CONNECTIONS.**

(a) **Watertight.** All joints and connections shall be made watertight.

(b) **Threaded Joints.** All burrs shall be removed. Pipe ends shall be reamed out to the size of the bore, and all chips shall be removed. Pipe joint cement shall be permitted on male threads only.

(c) **Soldered or Brazed Joints.** Soldered or brazed joints for tubing shall
be made with approved fittings. The tubing shall be expanded with a proper flaring tool.

(d) **Flared Joints.** All flared joints for soft-copper water tubing shall be made with approved fittings. The tubing shall be expanded with a proper flaring tool.

(e) **Slip Joints.** Slip joints shall not be concealed.

(f) **Ground Joints.** Ground joints brass connections which allow adjustment of tubing, but provide a rigid joint when made-up, shall be considered as slip joints.

**SECTION 4105. AIR GAPS, AIR BREAKS AND PREVENTORS.**

(a) **Protection of Water Supply.** All appliances, except water heaters and water conditioning appliances, shall be supplied with water through an air gap or air break, or shall be provided with a backflow preventor conforming to the following:

1. **Air Gap.** The minimum required air gap shall be measured vertically from the end of the faucets, spout, or supply pipe, down to the flood level rim of the fixtures or vessel.
   A. The minimum required air gap shall be twice the diameter of the effective opening.

2. **Backflow Preventor.** Atmospheric type backflow preventors, where required, shall be installed between the control valve and the appliance, so the preventor will not be subjected to water pressure except the back pressure incidental to water flowing to the appliance.
   A. Backflow preventors shall be constructed of corrosion-resistant material of design and proportions which will not deteriorate or deform under reasonable service conditions.

3. **Air Break.** The water discharge from a portable appliance into a plumbing fixture may be through an air break.

**SECTION 4106. WASTE OUTLETS.**

(a) **General.** Waste from appliances shall be discharged into open plumbing fixture or receptor, properly trapped, vented and connected to the drainage system, or if located below the building drain, as defined in Chapter 50, such appliances may discharge to a sump. Discharge from devices, other than plumbing fixtures, supplied with potable water through an air gap or an approved vacuum breaker, or discharge from devices producing condensate and not subject to a vacuum, at times which could cause back-siphonage, may discharge through an air break. Clear water waste may also discharge to an approved dry well or to other approved points of disposal.

(b) **Prohibited Waste.** Toxic, corrosive, flammable, or explosive substance, or other liquid, vapor, gas, or substance of any kind harmful to the drainage system, shall not be discharged into a plumbing fixture.

(c) **Standpipe for Clothes Washing Machines.** A standpipe may be used as a receptor when installed as provided for in Chapter 50.

**SECTION 4107. WATER SUPPLY AND DISTRIBUTION.**

(a) **Protection Against Freezing.** All piping, tanks, appliances, and devices, where subject to freezing temperatures, shall be effectively protected.
(c) **Water Pipes, Tubing and Fitting.** Water supply and discharge piping used for appliances shall consist of brass, copper, lead, cast iron, wrought iron, open-hearth iron, or steel, or NSF approved plastic pipe, with appropriate approved fittings; provided, however, approved type flexible connections, with a shutoff valve ahead of such connections, shall be permitted for use as water supply and flexible discharge piping shall be permitted, also, for appliances which are portable or subject to vibration. All threaded ferrous pipe and fittings shall be galvanized (zinc-coated), or cement lined.

(c) **Drainage of Water Pipes.** All water supply pipes for appliances shall be graded or pitched to permit the entire system, or parts thereof, to be drained.

(d) **Sizing Water Piping.** Water supply pipes for appliances shall be not less in size than the water connection of such units, provided washing machines require not less than 1/2 inch lines, and that the pressure at the appliance connection be not less than 8 psig flowing pressure.

**SECTION 4108. TEMPERATURE-PRESSURE RELIEF VALVES.**

(a) **General.** Approved combination temperature-pressure relief valves or separate temperature and pressure relief valves, shall be installed on closed water systems. Combination temperature-pressure, or individual temperature relief valves, shall be of the thermostatic self-closing type. The pressure side of the valve shall be set to relieve at a maximum of 165 pounds per square inch (psi). The temperature side of the valve shall be set to relieve at a maximum of 210 degrees Fahrenheit, and shall be capable of discharging sufficient hot water to prevent any further rise in temperature within the water heater. All temperature relief valves shall provide a relief capacity equal to, or greater than, the rated Btu input of the water heater.

(b) **Outlet Waste.** The outlet of temperature and pressure relief valve shall not be connected to the drainage system as a direct waste. The discharge pipe from temperature and pressure relief valves shall be piped to drain into a receptor, sump, open fixture, or other disposal location as approved by the Department.

(c) **Location.** Thermostatic self-closing type combination temperature pressure relief valves shall be placed within 6 inches of the top of the tank, or directly above the tank on the hot water side, and in no case more than 3 inches away from the tank. Required vacuum-relief valves shall be placed as close to the tank as possible. There shall be no check valve or shut-off valve between a relief valve and the heater or tank for which it is installed.

**SECTION 4109. USED MATERIALS AND WATER HEATERS.**

(a) **Approval.** Used materials and water heaters shall not be permitted unless approved by the Department.

(b) **Potable-Water Piping Material.** Material that has been used for other than potable-water supply shall not be used for pipe, tubing, or fittings in a potable-water supply system.
SECTION 4110. MATERIALS. All materials, appliances and heaters shall be approved and used in accordance with the limitations imposed throughout this Building Code, and shall meet established technical standards of quality and strength necessary to produce reasonable, safe, and sanitary installations.

SECTION 4111. STANDARDS. Unless provided for in other portions of this Building Code, the Standards Section of Chapter 50 shall apply.
CHAPTER 42
INTERIOR WALL AND CEILING FINISH

SECTION 4201. GENERAL. Interior wall and ceiling finish shall mean interior wainscoting, paneling, or other finish applied structurally or for decoration, acoustical correction, surface insulation, or similar purposes. Requirements for finishes shall not apply to trim, defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames, nor to materials which are less than 1/28 inch in thickness cemented to the surface of walls or ceilings, if these materials have flame-spread characteristics no greater than paper of this thickness cemented to a noncombustible backing.

SECTION 4202. TESTING AND CLASSIFICATION OF MATERIALS.
(a) Testing. Tests shall be made by an approved testing agency to establish flame-spread characteristics and to show that materials, when cemented or otherwise fastened in place, will not readily become detached when subjected to room temperatures of 300 degrees Fahrenheit for 25 minutes. Flame-spread characteristics shall be determined by one of the following methods:
1. The “Tunnel Test”, as setforth in ASTM-E-84.
2. Any other recognized method of test procedure for determining the flame-spread characteristics of finish materials that will give comparable results to those specified in Method No. 1 herein.
(b) Classification. The classes of materials, based upon their flame-spread characteristics under the Tunnel Test, shall be as set forth in Table No. 42-A. The smoke density shall be no greater than 450 when tested in accordance with ASTM-E-84 in the manner intended for use. The products of combustion shall be no more toxic than the burning if untreated wood under similar conditions.

SECTION 4203. APPLICATION OF CONTROLLED INTERIOR FINISH.
(a) General. Interior finish materials applied to walls and ceilings shall be tested as specified in Section 4202, and regulated for purposes of limiting flame-spread by the following provisions:
1. When walls and ceilings are required by any provision in this Building Code to be of fire-resistive or noncombustible construction, the finish material of any class shall be applied directly against such fire-resistive construction or to furring strips not exceeding 1 1/2 inches thick applied directly against such surfaces. The intervening spaces between such furring strips shall be filled with inorganic or Class I material, or shall be firestopped not to exceed 8 feet in any direction.
2. Where walls and ceilings are required to be of fire-resistive or noncombustible construction, and walls are set out or ceilings are dropped distance greater than specified in Paragraph (1) of this Section, Class I finish materials shall be used, except where the finish materials are protected on both sides by automatic fire extinguishing systems, or are attached to a noncombustible backing or to furring strips installed as specified in Paragraph (1). The hangers and
assembly members of such dropped ceilings that are below the main ceiling line shall be of noncombustible materials, except that in Types III and V construction fire-retardant wood may be used. The construction of each set out wall shall be of fire-resistive construction as required elsewhere in this Building Code. See Chapter 25.

3. Wall and ceiling finish materials of all classes permitted in this Chapter may be installed directly against the wood decking or planking of Heavy-Timber Construction, or to wood furring strips applied directly to the wood decking or planking, installed or fire-stopped as specified in Paragraph (1).

4. All interior wall or ceiling finish, other than Class I material which is less than 1/4 inch thick, shall be applied directly against a noncombustible backing, unless the qualifying tests were made with the material suspended from the noncombustible backing.

SECTION 4204. FINISHES BASED ON OCCUPANCY. The minimum flame-spread classification of interior finish, determined by tests, shall be based on use or occupancy as set forth in Table No. 42-B.

EXCEPTIONS:

1. Except in Group D occupancy and in enclosed vertical exitways Class III may be used in other exitways and rooms as wainscoting extending not more than 48 inches above the floor, and for tack and bulletin boards covering not more than 5 percent of the gross wall area of the room.

2. Where approved full fire extinguishing system protection is provided, the flame-spread classification rating may be reduced one classification, but in no case shall materials having a classification greater than Class III be used.

3. The exposed faces of Type III-H.T. structural members and Type III-H.T. decking and planking where otherwise permissible under this Building Code, are excluded from flame-spread requirements.

SECTION 4205. DRAPERIES, BLINDS, CARPETS, AND DECORATIONS. Draperies, blinds, tapestries and decorations of all types in buildings housing Group A through D occupancies, shall be required to be of an approved flameproof or noncombustible material. Carpeting to be installed on the walls or ceilings of Group A through H occupancies shall provide a flame-spread not to exceed 25 and smoke developed not to exceed 50. In addition, the attachment of the carpeting to walls or ceilings shall not rely on adhesives, but shall be installed with mechanical fastenings as approved by the Department prior to installation.

SECTION 4206. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
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<tbody>
<tr>
<td>NFPA</td>
<td>Standards for Flameproofed Textiles, Pamphlet 701-74.</td>
</tr>
<tr>
<td>ASTM</td>
<td>Surface Burning Characteristics of Building Materials, E-84-70.</td>
</tr>
<tr>
<td></td>
<td>Methods of Test for Flammability of Treated Paper and Paperboard. D777-65.</td>
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**LEGEND**

**NFPA**
National Fire Protection Association
470 Atlantic Avenue
Boston, Mass. 03310

**ASTM**
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

**ORGANIZATION**

**SECTION 4207. TABLES.** Flame-spread classification and minimum interior finish classification shall conform to Tables 42-A and 42-B.

**TABLE NO. 42-A**

**FLAME-SPREAD CLASSIFICATION**

<table>
<thead>
<tr>
<th>CLASS. NO.</th>
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<tr>
<td>I</td>
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<tr>
<td>II</td>
<td>26.75</td>
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<tr>
<td>III</td>
<td>76.200</td>
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**TABLE NO. 42-B**

**MINIMUM INTERIOR FINISH CLASSIFICATION**

<table>
<thead>
<tr>
<th>Occupancy Group</th>
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<th>Other Exitways</th>
<th>Rooms or Areas</th>
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<td>A</td>
<td>I</td>
<td>I</td>
<td>III</td>
</tr>
<tr>
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<td>III</td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>J</td>
<td>No Restrictions</td>
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</tbody>
</table>

*a Flame-Spread provisions are not applicable to kitchens and bathrooms of Group I Occupancies.*
CHAPTER 43
FIRE RESISTIVE STANDARDS

SECTION 4301. GENERAL. This Chapter shall govern the fire-resistive materials and the requirements for fire-resistive construction specified in this Building Code.

SECTION 4302. FIRE RESISTIVE MATERIALS.
(a) General. Materials used for fire-resistive purposes shall be limited to those specified in this Chapter unless accepted under the provisions of Section 4302(b), and shall conform to the Standards of this Chapter.
(b) Tests. For the purpose of determining the degree of fire resistance, the materials of construction listed in this Chapter and the Standards shall be assumed to have the fire resistance ratings indicated. Other materials of construction tested in accordance with ASTM Standard E-119 shall be rated for fire resistance according to the results of this test, provided that they also meet the requirements of Section 111 of this Building Code.
(c) Concrete. Normal weight concrete shall be made with aggregates conforming to ASTM Standard C33 producing structural concrete having a density exceeding 115 pounds per cubic foot. Lightweight concrete shall be made with aggregates conforming to ASTM Standard C330 producing structural concrete having a density of 115 pounds per cubic foot or less.

SECTION 4303. PROTECTION OF STRUCTURAL MEMBERS.
(a) General. Structural members having the fire resistance set forth in Table 43-A or in the Standards shall be assumed to have the fire resistive ratings indicated therein.
(b) Protective Coverings.
1. Thickness of Protection. The thickness of fire-resistive materials required for protection of structural members shall not be less than set forth in Table 43-A or the Standards, except as modified in this Section. The figures shown shall be the net thickness of the protecting materials, and shall not include any hollow space back of the protection.
2. Unit Masonry Protection. Unit masonry protection for metal columns shall have metal ties embedded in transverse joints spaced not more than 16 inches on center. Soffit tile protecting beam and girder flanges shall be secured to the flange with metal ties. Metal ties shall have a minimum cross section area equal to No. 8 wire gage.
3. Reinforcement for Cast-In-Place Concrete Column Protection. Cast-in-place concrete protection for steel columns shall be reinforced at the edges of the members with wire ties not less than .18 inch in diameter wound spirally around the columns on a pitch of not more than 8 inches or by equivalent reinforcement.
4. Embedment of Pipes. Conduits and pipes shall not be embedded in the required fire protection of structural members.
5. Column Jacketing. Fire-resistive covering on columns shall be protected from damage due to moving vehicles, the handling of merchandise or other means.
6. Ceiling Protection. When a ceiling forms the protective membrane for fire-resistive assemblies, the construction and their supporting horizontal structural members need not be individually fire protected except where the members support directly applied loads from more than one floor or roof. The required fire resistance shall be at least that required for individual protection of members. Ceilings shall form continuous fire-resistive membranes, but may have openings for metal plumbing pipes, ducts and electrical outlet boxes provided the areas of the openings through the ceiling are no more than 100 square inches for any 100 square feet of ceiling area. Duct openings shall be protected by fire dampers.

**EXCEPTION:** Larger openings than permitted herein may be installed where the openings and the assemblies in which they are utilized conforms to the testing requirements of Section 4301(b).

Individual electrical outlet boxes shall be of steel, and not greater than 16 square inches in area.

7. Plaster Application. Plaster protective coatings may be applied with the finish coat omitted when they comply with the design mix and thickness requirements of Table 43-A, 43-B, 43-C and the Standards.

(c) Protected Members.

1. **Attached Metal Members.** The edges of lugs, brackets, rivets and boltheads attached to structural members may extend to within 1 inch of the surface of the fire protection.

2. **Reinforcing.** Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties shall not project more than 1/2 inch into the protection.

3. **Studs and Joists.** Studs and joists are not required to have individual protection when part of an assembly that has a fire-resistive rating.

4. **Bonded Prestressed Concrete Tendons.** For members having a single tendon or more than one tendon installed with equal concrete cover measured from the nearest surface, the cover shall be at least that specified in Table 43-A. For members having multiple tendons installed with variable concrete cover, the average tendon cover shall be at least that specified in Table 43-A provided:

   A. The clearance from each tendon to the nearest exposed surface is used to determine the average cover.

   B. In no case shall the clear cover for individual tendons be less than one-half of that specified in Table 43-A. A minimum cover of 3/4 inch for slabs and 1 inch for beams shall be required for concrete of any type aggregate.

   C. For the purpose of establishing a fire-resistive rating, tendons having a clear covering at least that specified in Table 43-A shall not contribute more than 50 percent of the required ultimate moment capacity for members less than 350 square inches in cross sectional area and 65 percent for larger members. For structural design purposes, however, tendons having a reduced cover are assumed to be fully effective.
(d) Fire Protection Omitted. Fire protection may be omitted from the bottom flange of lintels spanning not over 6 feet, and shelf angles, or plates which are not a part of the structural frame.

SECTION 4304. HEAVY TIMBER CONSTRUCTION. Wood members conforming to the requirements of Chapter 20 for heavy timber construction shall be assumed to have an equivalent fire resistance rating of one hour.

SECTION 4305. FIRE RETARDANT TREATED WOOD. Lumber or plywood impregnated with chemicals, when tested in accordance with ASTM E-84 for a period of 30 minutes, shall have a flame spread not over 25. Materials exposed to the weather shall maintain this fire retardant classification when tested in accordance with the rain and weather tests of UL Standard Secification 790. All materials shall bear the label of an approved testing laboratory showing the fire performance rating and, if intended for exterior use, shall be identified to show suitability for exposure to the weather.

SECTION 4306. WALLS AND PARTITIONS.
(a) General. Fire-resistive walls and partitions shall be assumed to have the fire resistance ratings specified in Table 43-B and the Standards.
(b) Combustible Members. Combustible members framed into a wall shall be protected at their ends by at least one-half the required fire-resistive thickness of the wall. See Chapter 25 for fire stopping requirements.
(c) Exterior Walls. In fire-resistive exterior wall construction, the fire-resistive rating shall be maintained for walls enclosing attic areas.

SECTION 4307. FLOOR-CEILING AND ROOF-CEILING ASSEMBLIES.
(a) General. Fire-resistive floor-ceiling and roof-ceiling assemblies shall be assumed to have the fire resistance ratings specified in Table 43-C and the Standards.
(b) Floors. Fire-resistive floors shall be continuous, and all openings shall be enclosed as specified in Chapter 17.

EXCEPTIONS:
1. Metal Pipes, conduits and electrical outlets may be installed within or through fire-resistive floor systems, provided the installations do not impair the required fire resistance of the assembly.
2. The provisions of this Section shall not apply when the openings conform to the testing requirements of Section 4301(b).
(c) Roofs. Fire-resistive roofs may have the same openings permitted for floors, and may contain other openings permitted by this Building Code. See Chapters 54 and 60 for skylight construction.
(d) Unusable Space Above or Below. In one hour fire-resistive construction, the ceiling may be omitted above unusable space and flooring may be omitted below unusable space.
(e) Ceiling Protection. When a ceiling approved for one hour fire-resistive construction is provided below concrete slabs or concrete structural members not required to be protected by the ceiling, the required thickness of the slab and the fire protection of structural members may be
reduced 1/2 inch; but in no case shall the slab thickness be less than 2 inches and the fire protection of structural members less than 3/4 inch.

(f) Ceiling Panels. When lay-in ceiling panels are used as part of fire-resistive floor-ceiling or roof-ceiling assemblies, wire clips or other devices shall be installed to prevent upward displacement of of the panels. Clips and devices shall be maintained in place at all times.

(g) Draft Stops. See Chapter 32.

SECTION 4308. FIRE ASSEMBLIES FOR THE PROTECTION OF OPENINGS.

(a) General. When required by this Building Code for the fire protection of openings, fire assemblies shall meet the requirements of this Chapter.

(b) Definitions.

1. Fire Assembly is the assembly of a fire door, fire window or fire damper including all required hardware, anchorage, frames and sills. Fire dampers shall be fabricated and installed in accordance with the requirements of Chapter 52.

2. Automatic Closing Fire Assembly is a fire assembly which may remain in an open position, and will close automatically if activated by a device detecting products of combustion other than heat.

3. Self Closing Fire Assembly is a fire assembly maintained in a normally closed position, and is equipped with a device to insure closing and latching after having been open for use.

(c) Closing Devices. Type A closing devices shall be self closing door closers without hold open mechanisms. Type B closing devices shall be electromagnetic door holders in combination with Type A closing devices. All devices shall bear the label of an approved testing laboratory.

(d) Identification of Fire Assemblies. All fire assemblies having fire protection ratings of 3 hours, 1-1/2 hours, 1 hour and 3/4 hour shall bear a label or other identification showing the fire resistive rating. The label or identification shall be issued by an approved testing agency having a service for inspection of materials and workmanship at the factory.

EXCEPTION: A 1-3/4 inches thick solid core wood door shall be acceptable as meeting the requirements for a 3/4 hour fire-resistive door.

(e) Fire-Resistive Test. The fire-resistive rating of all types of required fire assemblies shall be determined in accordance with ASTM Standard E 152.

(f) Hardware. Each fire assembly required to have a 3 hour fire-resistive rating shall be automatic closing as defined in Section 4308. Each fire assembly required to have a 1-1/2 hours, one hour or 3/4 hour fire resistive rating shall be automatic closing or self closing as defined in Section 4308.

EXCEPTION: Exit doors may have closing devices as specified in Chapter 33. Devices detecting products of combustion other than heat used in automatic fire assemblies shall be installed on each side of the wall opening at the top of the door opening, and at the ceiling when the ceiling is more than 3 feet above the opening. Devices detecting products of combustion shall be approved prior to installation and shall
be maintained in operating condition at all times.

(g) **Glazed Openings in Fire Doors.** Glazed openings shall not be permitted in fire doors required to have a 3 hour fire-resistant rating. The area of glazed openings in fire doors required to have 1-1/2 hours or one hour fire-resistant ratings shall not exceed 100 square inches per door. The area of glazed openings in fire doors required to have a 3/4 hour fire-resistant rating shall not exceed 1296 square inches per light, with no dimension exceeding 54 inches. One or more lights may be provided.

(h) **Glazed Openings In Fire Windows.** Windows required to have a 3/4 hour fire-resistant rating shall not exceed 84 square feet in total area with no dimension exceeding 12 feet. The area of individual lights shall not exceed 1296 square inches with no dimension exceeding 54 inches. Fire window frames shall bear the classification marking of an approved testing laboratory.

(i) **Glazing.** Glazing in required fire assemblies shall be wired glass at least 1/4 inch thick, reinforced with 24 gauge or heavier wire embedded in the glass and spaced not to exceed one inch in one or more directions. Wired glass shall be installed with glazing angles or wire clips. When wire clips are used, one shall be installed in each mounting hole.

(j) **Installation.** All fire assemblies shall be installed in accordance with the Standards of this Chapter.

**SECTION 4309. ROOF COVERINGS.** Fire retardant roof coverings shall be as specified in Chapter 32.

**SECTION 4310. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

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<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
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<tr>
<td>ASTM</td>
<td>Spec. for Gypsum Plasters, C28 - 68.</td>
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<td>Spec. for Concrete Aggregates, C33 - 74.</td>
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<td>Spec. for Gypsum Wallboard C36 - 73.</td>
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<td>Sampling and Testing Concrete Masonry Units, C140 - 70.</td>
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<td>Spec. for Light weight Aggregates for Structural Concrete, C330 - 69.</td>
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<td>Fire Tests of Door Assemblies, E152 -73.</td>
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<td>FM</td>
<td>Approval Guide - 76.</td>
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<td>NFPA</td>
<td>Fire Doors and Windows, No. 80 - 76.</td>
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<td>UL</td>
<td>Fire Resistance Index, Building Materials Directory - 76.</td>
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**LEGEND**

| ORGANIZATION | |
|--------------| American Society for Testing Materials |
| ASTM         | 1916 Race Street |
|              | Philadelphia, Pa. 19103 |

43-5
SECTION 4311. TABLES.
<table>
<thead>
<tr>
<th>Structural parts to be protected</th>
<th>Item</th>
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<th>Minimum thickness in inches for fire resistive rating</th>
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<td>Normal weight and light weight concrete</td>
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<td>2</td>
<td>Brick of clay, shale or concrete</td>
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</tr>
<tr>
<td></td>
<td>3</td>
<td>Clay tile or concrete block</td>
<td>4 4 2 2</td>
</tr>
<tr>
<td>Steel beams and girders</td>
<td>4</td>
<td>Normal weight or lightweight concrete</td>
<td>2 2 1 1</td>
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<td>4 4 2 2</td>
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<td>6</td>
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<td>Bonded pretensioned reinforcement in prestressed concrete</td>
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<td>Restrainted members</td>
<td>Beams and girders less than 12&quot; wide 2 1 1/4 1 3/4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beams and girders 12&quot; or wider 2 1 1/4 1/2 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slabs 1 1/4 1 3/4 3/4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Normal weight concrete</td>
<td>Beams and girders less than 12&quot; wide 4 1/2 2 1 1/4 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unrestrained members</td>
<td>Beams and girders 12&quot; or wider 3 2 1/2 1/2 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slabs 2 1 1/4 1 1/2</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Lightweight concrete</td>
<td>Beams and girders less than 12&quot; wide 2 1 1/2 1 1/4 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Restrainted members</td>
<td>Beams and girders 12&quot; or wider 1 3/4 1 1/4 1 1/4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slabs 1 3/4 3/4 3/4</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Lightweight concrete</td>
<td>Beams and girders less than 12&quot; wide 3 1/2 2 1 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unrestrained members</td>
<td>Beams and girders 12&quot; or wider 2 1/4 2 1 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slabs 1 1/2 1 1/4 3/4</td>
</tr>
<tr>
<td>Reinforcement in concrete columns, beams, girders and trusses</td>
<td>13</td>
<td>Normal weight concrete</td>
<td>2 1 1/2 1 1/2</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Lightweight concrete</td>
<td>1 1/2 1 1/2 1 1/2</td>
</tr>
<tr>
<td>Reinforcement in concrete joists placed monolithically with slab</td>
<td>15</td>
<td>Normal weight concrete</td>
<td>1 3/4 1 3/4 1</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Lightweight concrete</td>
<td>1 1/4 1 1/4 1 3/4</td>
</tr>
<tr>
<td>Reinforcement in concrete floor and roof slabs</td>
<td>17</td>
<td>Normal weight concrete</td>
<td>1 1 1 3/4</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Lightweight concrete</td>
<td>1 1 1 3/4</td>
</tr>
<tr>
<td>Material</td>
<td>Item Number</td>
<td>Construction</td>
<td>Minimum Finished Thickness Face-to-Face (In Inches)</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 hr.</td>
</tr>
<tr>
<td>Brick of Clay or Shale</td>
<td>1</td>
<td>Solid units at least 75 percent solid</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Solid units plastered each side with (\frac{1}{4})&quot; gypsum or portland cement plaster</td>
<td>4 (\frac{3}{4})</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Hollow brick units at least 71 percent solid</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Hollow brick units at least 71 percent solid, plastered each side with (\frac{1}{4})&quot; gypsum or portland cement plaster</td>
<td>8 (\frac{3}{4})</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Hollow cavity wall consisting of two 4&quot; nominal clay brick units with air space between</td>
<td>10</td>
</tr>
<tr>
<td>Hollow Clay Tile</td>
<td>6</td>
<td>Units at least 45 percent solid</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Units at least 45 percent solid, plastered each side with (\frac{1}{4})&quot; gypsum plaster</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Two cells in wall thickness, units at least 40 percent solid</td>
<td>8</td>
</tr>
<tr>
<td>Combination of clay brick and load-bearing hollow clay tile</td>
<td>9</td>
<td>4&quot; brick and 8&quot; tile</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>4&quot; brick and 4&quot; tile</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>4&quot; brick and 4&quot; tile, plastered on the tile side with (\frac{1}{4})&quot; gypsum plaster</td>
<td>8 (\frac{1}{2})</td>
</tr>
<tr>
<td>Concrete masonry units</td>
<td>12</td>
<td>Lightweight concrete</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Normal weight concrete</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Horizontal reinforcement not less than 0.25 percent and vertical reinforcement not less than 0.15 percent. (Three-fourths as much for welded wire fabric)</td>
<td>Light-weight concrete 5 (\frac{1}{2}) (\frac{1}{2}) (\frac{3}{12}) (\frac{2}{12}) Normal weight concrete 6 (\frac{1}{2}) 5 (\frac{1}{2}) 4 (\frac{1}{2}) 3 (\frac{1}{2})</td>
</tr>
<tr>
<td>Hollow (studless) Gypsum wallboard partition non-bearing</td>
<td>15</td>
<td>One full-length layer of (\frac{1}{4})&quot; Type &quot;X&quot; gypsum wallboard attached to both sides of wood or metal top and bottom runners laminated to each side of 1&quot; x 6&quot; full length gypsum coreboard ribs spaced 24&quot; on center with approved laminating compound. Ribs centered at vertical joints of face plies and joints staggered 24&quot; in opposing faces.</td>
<td>2 (\frac{1}{4})</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1&quot; regular gypsum &quot;V&quot; edge full-length base layer attached to both sides of 1 (\frac{1}{2})&quot; wood or metal runners. Face layer of (\frac{1}{2})&quot; regular full length gypsum wallboard laminated to base layer with approved laminating compound.</td>
<td>4 (\frac{1}{8})</td>
</tr>
<tr>
<td>Noncombustible studs - non-bearing partitions</td>
<td>17</td>
<td>3 (\frac{1}{4})&quot; No. 16 gauge approved nailable studs spaced 24&quot; on center. (\frac{1}{4})&quot; neat gypsum wood fibered plaster each side over (\frac{1}{4})&quot; rib metal lath nailed to studs at 8&quot; on center.</td>
<td>5 (\frac{3}{8})</td>
</tr>
<tr>
<td>Material</td>
<td>Item Number</td>
<td>Construction</td>
<td>Minimum Finished Thickness Face-to-Face (In Inches)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>Noncombustible studs - non-bearing interior partition</td>
<td>18</td>
<td>One layer of 3/4&quot; Type &quot;X&quot; gypsum wallboard applied to each side of 3 1/4&quot; metal studs at 24&quot; o.c.</td>
<td>4 3/4</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Two layers of 1/2&quot; Type &quot;X&quot; gypsum wallboard applied to each side of 3 1/2&quot; metal studs at 24&quot; o.c. Stagger joints 24&quot; o.c. each layer and side.</td>
<td>6 1/2</td>
</tr>
<tr>
<td>Wood Studs interior partition</td>
<td>20</td>
<td>2&quot; x 4&quot; wood studs 16&quot; on center with two layers 1/2&quot; regular gypsum wallboard applied vertically or horizontally each side, joints staggered.</td>
<td>5 1/2</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Wood studs with space filled with insulating bals attached to studs, 1/2&quot; regular gypsum wallboard. Mineral or slag wool bals shall weigh at least 1.0 lb. and glass wool bals at least 0.6 lb. per square foot of wall surface.</td>
<td>4 3/4</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>2&quot; x 4&quot; wood studs 16&quot; on center with 3/4&quot; Type &quot;X&quot; gypsum wallboard.</td>
<td>4 3/4</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>2&quot; x 4&quot; wood studs 16&quot; on center with two layers 1/2&quot; Type &quot;X&quot; gypsum wallboard each side.</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>3/4&quot; drop siding or 3/8&quot; exterior type plywood over 1/4&quot; gypsum sheathing on 2&quot; x 4&quot; wood studs at 16&quot; on center on exterior surface with interior surface treatment as required for one-hour rated interior wood stud partitions.</td>
<td>Varies</td>
</tr>
<tr>
<td>Exterior or interior walls</td>
<td>25</td>
<td>2&quot; x 4&quot; wood studs 16&quot; on center with metal lath and 3/4&quot; exterior cement plaster on each side.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>2&quot; x 4&quot; wood studs 16&quot; on center with 3/4&quot; exterior cement plaster on the exterior surface with interior surface treatment as required for interior wood stud partitions.</td>
<td>Varies</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>2&quot; x 6&quot; fire-retardant treated wood studs 16&quot; on center. Interior face has two layers of 3/4&quot; Type &quot;X&quot; gypsum wallboard with the base layer placed vertically and face layer placed horizontally.</td>
<td>8 3/4</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>4&quot; No. 18 gauge nonload-bearing metal studs, 16&quot; on center, with 1&quot; portland cement lime plaster on the exterior surface. Interior surface covered with 1&quot; of gypsum platter on 3.4# expanded metal lath.</td>
<td>6 1/2</td>
</tr>
<tr>
<td>Floor or Roof Construction</td>
<td>Item No.</td>
<td>Ceiling Construction</td>
<td>Thickness of Floor or Roof Slab (In Inches)</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Normal weight concrete</td>
<td>1</td>
<td>Slab (no ceiling required)</td>
<td>6 1/2, 5 1/2, 4 1/2, 3 1/2</td>
</tr>
<tr>
<td>Lightweight concrete</td>
<td>2</td>
<td>Slab (no ceiling required)</td>
<td>5 1/2, 4 1/2, 3 1/2, 2 1/2</td>
</tr>
<tr>
<td>Reinforced concrete joists</td>
<td>3</td>
<td>Slab with suspended ceiling of vermiculite gypsum plaster over metal lath attached to 5/8&quot; cold-rolled channels spaced 12&quot; on center. Ceiling located 6&quot; below joists.</td>
<td>3, 2</td>
</tr>
<tr>
<td>Reinforced concrete joists</td>
<td>4</td>
<td>5/8&quot; Type &quot;X&quot; gypsum wallboard attached to hat-shaped galvanized steel channels spaced 24&quot; on center, and supported along their length at 35&quot; intervals.</td>
<td></td>
</tr>
<tr>
<td>Steel joist construction with a reinforced concrete slab on top poured on a metal lath form.</td>
<td>5</td>
<td>Gypsum plaster on metal lath attached to the bottom chord.</td>
<td>2 1/2, 2 1/4, 7/8, 5/8</td>
</tr>
<tr>
<td></td>
<td>Ceiling of Type &quot;X&quot; gypsum wallboard attached to furring channels 12&quot; on center. Channels wire tied to bottom chord of joists or suspended below joists on wire hangers.</td>
<td>2 1/2, 2</td>
<td>5/8, 7/8</td>
</tr>
<tr>
<td>3&quot; deep cellular steel deck with concrete slab on top. Slab thickness measured to top cells.</td>
<td>7</td>
<td>Suspended ceiling of 5/8&quot; vermiculite gypsum plaster base coat and 1/4&quot; vermiculite acoustical plaster on metal lath attached at 6&quot; intervals to 5/8&quot; cold-rolled channels spaced 12&quot; on center with No. 16 gauge wire. Beams within envelope and with a 2 1/4&quot; air space between beam soffit and lath have a 4-hour rating.</td>
<td>2 1/2</td>
</tr>
</tbody>
</table>
### TABLE NO. 43-C

**MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS**

<table>
<thead>
<tr>
<th>Floor or Roof Construction</th>
<th>Item No</th>
<th>Ceiling Construction</th>
<th>Thickness of Floor or Roof Slab (In Inches)</th>
<th>Minimum Thickness of Ceiling (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2&quot; deep steel roof deck on steel framing. Rigid insulation board composed of wood fibers with cement binders of thickness shown bonded to deck with unfinished asphalt adhesives. Covered with a fire-retardant roof covering.</td>
<td>8</td>
<td>Ceiling of gypsum plaster on metal lath. Lath attached to 3/4&quot; furring channels spaced at 12&quot; on center. 3/4&quot; channel saddle tied to 2&quot; channels with doubled No. 16 gauge wire ties. 2&quot; channels spaced 36&quot; on center suspended 2&quot; below steel framing and saddle - tied with No. 6 gauge wire.</td>
<td>1 1/4</td>
<td>1/4 1/4</td>
</tr>
<tr>
<td>Double wood floor over wood joists spaced 16&quot; on center.</td>
<td>9</td>
<td>Gypsum plaster over 5/8&quot; Type &quot;X&quot; gypsum lath. Nails spaced at 16&quot; on center.</td>
<td>1 1/4</td>
<td>1/4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Portland cement perlite, vermiculite gypsum or gypsum plaster on metal lath. Nails spaced at 5&quot; on center.</td>
<td>1 1/4</td>
<td>1/4</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>1/2&quot; Type &quot;X&quot; gypsum wallboard nailed to joists with 6d cooler nails spaced 6&quot; on center. End joints of wallboard centered on joists.</td>
<td>1/2</td>
<td></td>
</tr>
<tr>
<td>Plywood stressed skin panels consisting of 5/8&quot; thick interior C-D (exterior glue). Top stressed skin on 2&quot; x 6&quot; nominal (minimum) stringers. Adjacent panel edges joined with 8d common wire nails spaced 6&quot; on center. Stringers spaced 12&quot; maximum on center.</td>
<td>12</td>
<td>1/2&quot; thick wood fiberboard weighing 15 to 18 lbs. per cu. ft. installed with long dimension parallel to stringers or 5/8&quot; standard (exterior) plywood glued and nailed to stringers. Nailing to be with 5d cooler nails spaced 12&quot; on center.</td>
<td>1/2</td>
<td></td>
</tr>
</tbody>
</table>

1

43-11
<table>
<thead>
<tr>
<th>Floor or Roof Construction</th>
<th>Item No.</th>
<th>Ceiling Construction</th>
<th>Thickness of Floor or Roof Slab (In Inches)</th>
<th>Minimum Thickness of Ceiling (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on 1(\frac{1}{4})&quot; deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10&quot; where deck is less than No. 26 gauge and 8'-0&quot; where deck is No. 26 gauge or greater. Slab reinforced with No. 19 gauge hexagonal wire mesh. Fire retardant roof covering on top.</td>
<td>18</td>
<td>None</td>
<td>4 hr. 3 hr. 2 hr. 1 hr. 4 hr. 3 hr. 2 hr. 1 hr.</td>
<td>2 (\frac{1}{4}) None</td>
</tr>
<tr>
<td>Floor and beam construction consisting of 3&quot; deep cellular steel floor units mounted on steel members with 1:4 (Portland cement to perlite aggregate) perlite concrete floor slab on top.</td>
<td>19</td>
<td>Suspended envelope ceiling of perlite gypsum plaster on metal lath attached to (\frac{3}{4})&quot; cold rolled channels, secured to 1 (\frac{1}{4})&quot; cold rolled channels spaced 42&quot; on center supported by No. 6 wire 36&quot; on center. Beams in envelope with 3&quot; minimum air space between beam soffit and lath have a 4 hour rating.</td>
<td>2 1 None</td>
<td></td>
</tr>
</tbody>
</table>
# TABLE NO. 43-C
## MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS

<table>
<thead>
<tr>
<th>Floor or Roof Construction</th>
<th>Item No.</th>
<th>Ceiling Construction</th>
<th>Thickness of Floor or Roof Slab (In Inches)</th>
<th>Minimum Thickness of Ceiling (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 hr. 3 hr. 2 hr. 1 hr. 4 hr. 3 hr. 2 hr. 1 hr.</td>
<td>1 hr.</td>
</tr>
<tr>
<td>Plywood stressed skin panels consisting of ( \frac{3}{4}'' ) thick interior C-D (exterior glue) top stressed skin on 2'' x 6'' nominal (minimum) stringers. Adjacent panel edges joined with 8d common wire nails, spaced 6'' on center, stringers spaced 12'' maximum on center.</td>
<td>14</td>
<td>( \frac{1}{2}'' ) thick wood fiberboard weighing 15 to 18 lbs. per cu. ft. installed with long dimension parallel to stringers or ( \frac{7}{8}'' ) standard (exterior glue), plywood glued and nailed to stringers. Nailing to be with 5d cooler nails spaced 12'' on center.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vermiculite concrete slab proportioned 1:4 (Portland cement to Vermiculite aggregate) on a 1 ( \frac{1}{2}'' ) deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10'' where deck is No. 26 gauge or greater. Slab reinforced with 4'' x 8'' No. 12/14 welded wire mesh.</td>
<td>15</td>
<td>None</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on a 1 ( \frac{1}{2}'' ) deep steel deck supported on individually protected steel framing. Slab reinforced with 4'' x 8'' No. 12/14 welded wire mesh.</td>
<td>16</td>
<td>None</td>
<td>( \frac{3}{4}'' )</td>
<td></td>
</tr>
<tr>
<td>Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on a ( \frac{7}{8}'' ) deep steel deck supported by steel joists 4'' on center. Maximum span of deck is 6'-10'' where deck is less than No. 26 gauge and 8'-0'' where deck is No. 26 gauge or greater. Fire-retardant roof covering on top.</td>
<td>17</td>
<td>Perlite gypsum plaster on ( \frac{2}{3}'' ) furring channels attached with No. 16 gauge wire ties to lower chord of joists.</td>
<td>2 2 1/4 3/4</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 44
PROTECTION OF THE PUBLIC
DURING CONSTRUCTION OR DEMOLITION

SECTION 4401. SCOPE.

(a) General. This Chapter shall establish minimum safety requirements for the protection of the public during construction or demolition operations, and the erection and maintenance requirements for barricades, walkways, railings, and fences on public or private property.

(b) Loads. Structures required by this Chapter shall not be loaded in excess of the safe carrying capacity of the materials used.

(c) Dust. All dust resulting from construction or demolition operations shall be settled in a manner approved by the Department.

(d) Transportation Approval. Trucks and other equipment used by the contractor shall not interfere with or block either vehicular or pedestrian traffic, except as approved by the appropriate Division of the Department of Public Works.

(e) Rubbish and Waste. All adjacent streets, alleys, and public ways and places shall be kept free and clear of rubbish, refuse, and loose material resulting from construction or demolition operations.

(f) Extinguishers. See Fire Code.

SECTION 4402. PUBLIC PROPERTY.

(a) General. It shall be unlawful for any person to utilize any City property for the construction of any building, structure or utility; storage or placement of materials or equipment; placement of barricade or the erection of fences or covered walkways, except in accordance with the provisions of this Building Code. In addition, approval shall be obtained from the Traffic Engineer, City Engineer, and as required by the Revised Municipal Code.

(b) Protection. It shall be unlawful for any person to perform work on any building or structure in a manner to endanger persons or property on Public Property. Protection shall be provided as specified in this Chapter and the Revised Municipal Code.

(c) Storage. Storage of materials or equipment required for construction or demolition work shall not be permitted in the alley right-of-way or on public sidewalk, except as approved by the Department of Public Works.

(d) Damage to Public Property. As a condition of obtaining a Building Permit, the permit holder shall assume liability for any damage to public property occasioned by the construction or demolition operations.

(e) Permit. A permit shall be required for all covered walkways, fences, barricades and railing prior to erection.

(f) Protection of Utilities. Materials used in or equipment required for construction or demolition work shall not be placed or stored so as to obstruct free and convenient approach to any fire hydrant, Fire Department connection, fire or police alarm box, any utility box, any catch basin or manhole, traffic control device, the or free flow of water to any catch basin, alley or any other public drainage areas. Every street lamp, traffic control device, utility box, fire or police alarm box, fire hydrant, and every catch basin and manhole that may be endangered by any
work being performed or by the placement or storage of any materials and equipment shall be protected against damage. This protection shall be maintained as is necessary and shall be completely removed when the status of the work permits.

SECTION 4403. SITE PREPARATION.

(a) **Temporary Utilities.** When necessary to maintain power, water, or other utility lines during construction or demolition work, these lines shall be temporarily relocated or protected as approved by the Department and the Utility Company.

SECTION 4404. PUBLIC AND OTHER GROUND LEVEL PROTECTION.

(a) **General.** A covered walkway shall be provided when the distance from the building, structure or utility to be constructed or demolished is less than 10 feet to the inside edge of the sidewalk or when the height exceeds the horizontal distance from the building, structure or utility to the inside edge of the sidewalk. The construction or demolition of a building, structure or utility shall not commence until the required pedestrian protection structures are in place. The Department may require the permit holder to submit the method and schedule for demolition. Where this is required, work shall not be performed until the method and schedule are approved by the Department.

**EXCEPTION:** Where Emergency Demolition is necessary to remove a dangerous structure, building or utility, the ground level protection requirements may be waived when approved by the Department.

(b) **Obstruction.** Thoroughfares which are open to the public shall be kept clear and unobstructed at all times.

(c) **Covered Walkways and Railings.** The height of all covered walkways shall be at least 8 feet. The height of all railings shall be at least 4 feet. The width of all covered walkways shall be at least 4 feet or as may be required by the Department of Public Works to avoid congestion. A railing shall be maintained on the street side of the walkway during construction or demolition work. A splash board, a minimum of 12 inches in height shall be provided where the walk adjoins a traffic lane.

1. The covered walkways shall be provided with lighting from sunset to sunrise. This lighting shall provide a minimum of 60 watt bulbs spaced every 10 feet. In addition to this lighting, flashing amber lights, with a capacity of at least 100 watts, shall be provided on the exterior of the walkway, at both ends and in the center.

2. The outside edge and ends of the roof deck of the covered walkway shall be provided with a bulkhead, at least 42 inches above the roof deck of the walkway.

3. Covered walkway openings for loading or unloading purposes, shall be kept closed at all times except during the actual loading or unloading operations.

4. The flooring of a covered walkway shall consist of planking at least 2 inches in thickness, closely laid, or may be covered with at least 3/4 inch plywood. In either case, the floor shall be smooth. All members
of the covered walkway shall be braced and connected to resist displacement of members or distortion of the framework.

5. The roof of all covered walkways shall be made weatherproof.

6. Solid walls of covered walkways shall be built and placed on the side of the walkway nearest to the construction or demolition and shall extend the entire length of the building site and shall be turned and extended to the building line.

7. The entire structure shall be designed to carry the live and dead loads to be imposed, provided that every structure shall be designed to carry a minimum live load of at least 150 pounds per square foot, uniformly loaded, and 20 pounds per square foot wind load. Uplift forces due to wind shall be included.

(d) **Fences In Lieu of Covered Walkways.** Fences may be used to enclose construction and demolition sites when approved by the Department and the Traffic Engineer.

**SECTION 4405. WALKWAYS AND BARRICADES FOR EXCAVATIONS.**

(a) **Required.** Walkways or barricades shall be provided for excavations adjacent to the public way in accordance with the applicable portions of this Chapter and of the Revised Municipal Code.

(b) **Warning Lights.** During sunset and sunrise, flashing amber lights shall be placed on barricades adjacent to the public way.

**SECTION 4406. MAINTENANCE AND REMOVAL OF PROTECTIVE DEVICES.**

(a) **Maintenance.** The protection shall be maintained in place and kept in good order for the entire length of time the public may be endangered.

(b) **Removal.** Every protection fence or barricade shall be removed within 10 days after the protection is no longer required by this Chapter for the protection of the public.
CHAPTER 45
PRIVATE CONSTRUCTION ON PUBLIC PROPERTY

SECTION 4501. GENERAL.

(a) Scope. Except as otherwise permitted in this Chapter, and the Revised Municipal Code, no part of any building, structure, utility addition, alteration or construction hereafter erected shall project onto the Public Right-of-Way. For purposes of this Building Code and Chapter, any projection on private property delegated to the Public Way, shall be treated as the Public Right-of-Way. (Refer also to Article 330 of the Revised Municipal Code).

(b) Construction.

1. Buildings, structures or utilities, including appendages regulated by this Building Code and Chapter shall be constructed of materials as required by this Chapter and Chapters 17 through 22 of this Building Code. Nothing in this Building Code shall prohibit the construction and use of a structure between buildings and over or under a public way provided the structure complies with all the requirements of this Building Code. See Chapter 17 for Bridges.

2. Balconies, appendages, marqueses, canopies, fixed awnings and movable awnings shall be designed and constructed to safely support the load requirements as shown in Chapter 23.

(c) Permits. A revocable permit shall be obtained from the Manager of Public Works prior to the issuance of a permit from the Department.

(d) Projections. Any projection, as regulated by this Chapter shall be the distance measured horizontally from the property line to the outer most point of the projection.

(e) Locations. Every marquee, canopy, fixed awning or movable awning shall be located as not to interfere with the operation of any exterior standpipe or obstruct the clear passage of stairways or exits from the building or the installation or maintenance of overhead electrical equipment.

(f) Ventilation Outlets. Ventilation outlets fronting onto the public way shall provide a minimum height of at least 7 feet from the sidewalls or alley floor.

(g) Horizontal Clearance. All permitted projections shall provide a horizontal clearance of at least 2 feet inside the curb line.

SECTION 4502. PROJECTION INTO ALLEYS.

(a) General. No part of any structure or any appendage shall project into an alley unless a 14 feet clearance above the alley grade is maintained. EXCEPTION: A curb of buffer may project not more than 9 inches and not exceed a height of 9 inches above grade.

SECTION 4503. SPACE BELOW SIDEWALK.

(a) General. The space adjoining a building below a sidewalk on public property may be used and occupied in connection with the building for any purpose consistent with this Building Code. The right to use and occupy space on condition that the right so to use and occupy may be revoked by the City at any time and that the owner of the building shall construct
the necessary enclosures for this space from the building and pay all costs and expenses attendant therewith.

SECTION 4504. BALCONIES AND APPENDAGES.

(a) General. Architectural projections may project over the public property of the building site a distance as determined by the clearance of the lowest point of the projection above the grade immediately below, as follows:
   1. When the clearance above the public way is less than 8 feet, no projection is permitted.
   2. When the clearance above the public way is 8 feet or more, a projection of one inch for each additional one inch of clearance is permitted provided the projection does not exceed a distance of 4 feet.

SECTION 4505. MARQUEES.

(a) Height. All marquees shall be at least 8 feet above the public way.
(b) Construction. A marquee shall be supported entirely from the building and constructed as required by this Chapter and under Types of Construction, Chapters 17 through 22.
(c) Roof Construction.
   1. The roof of marquees shall be water-tight and shall have a slope of not more than one inch in 4 feet. Roofs shall drain toward the building or structure and shall be provided with conductors connected with the storm sewer or under the sidewalk to the face of the curb.
   2. The roof, or any part thereof, may be a skylight provided that plastic or laminated safety glass shall be used. See Chapters 54 and 60.

SECTION 4506. CANOPIES AND AWNINGS.

(a) Height. A canopy or awning shall be at least 8 feet above the public way. Canvas valances shall be permitted but shall be at least 7 feet above the public way.
(b) Construction. Canopies or awnings shall be constructed as required by this Chapter and Chapters 17 through 22.

   EXCEPTION: Where fabrics are used in conjunction with a canopy or awning they shall meet the fire retardant qualities of NFPA Pamphlet No. 701.

(c) Materials. Canopy and awning frames shall be constructed of noncombustible materials except that glass or similar fragile material shall not be permitted in any part of the canopy or awning.
(d) Movable Awnings. Movable awnings shall be supported entirely by the wall of the building or structure to which they are attached and shall have a frame designed to support loads. The covering shall be canvas, cloth or other approved material. All fabrics shall be flame-proof as provided for in NFPA Pamphlet No. 701.

SECTION 4507. DOORS. Doors, when either fully opened or when opening, shall not project beyond the property line. See Chapter 33.

SECTION 4508. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:
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CHAPTER 46
DEMOLITION AND MOVING

SECTION 4601. GENERAL.

(a) **Scope.** In addition to the other requirements of this Building Code, the Revised Municipal Code and the Fire Code, this Chapter shall govern the demolition and moving of buildings, structures and utilities. Any device or equipment such as scaffolds, ladders, derricks, hoists, or similar, used in connection with demolition or moving shall be constructed, installed, maintained, and operated in accordance with the requirements governing the construction, installation, maintenance, and operation of such device or equipment as specified in other portions of this Building Code.

(b) **Loads.** Structures, or parts of structures, or any floor or temporary support, or scaffold, sidewalk barricade or bridge, or any device or equipment, shall not be loaded in excess of the safe carrying capacity.

(c) **Danger Signs.** Every demolition project shall be provided with Danger Signs, which shall be posted around the property. See Chapter 1 for the posting of Danger Signs.

(d) **Cleaning Brick.** The cleaning of brick or lumber at the job site shall be performed only by employees of the demolition contractor.

(e) **Dust.** All dust resulting from demolition operations shall be settled with water, as approved by the Department.

(f) **Transportation Approval.** Trucks and other equipment used by the contractor shall not interfere with, or block, either vehicular or pedestrian traffic, except when approved by the Department of Public Works. Where it becomes necessary to transport units of a wrecked building, structure, or utility, upon and through the public streets or alleys, or other public ways and places, permission to do so shall be obtained from the Department of Public Works.

(g) **Rubbish and Waste.** All adjacent streets, alleys, and other public ways and places shall be kept free and clear of all rubbish, refuse and loose material resulting from the moving, demolition, or demolition removal operations.

(h) **Sale of Material on Job site.** The sale of any material on a demolition or moving site is hereby prohibited, except as approved by the Department. See Chapter 1 for violations.

(i) **Sanitary Facilities.** Toilet facilities shall be provided on each demolition or moving site, in accordance with the requirements of Chapter 3 and/or Chapter 50 of this Building Code.

(j) **Extinguishers.** When cutting torches are required on any demolition or moving, approved type extinguishers shall be provided. The approval and number required shall be that as set forth by the Fire Department. See Fire Code.

(k) **Liability Insurance.** Prior to the issuance of a permit by the Department, any person, firm, or corporation demolishing or moving any building, structure, or utility, shall provide insurance to cover bodily injury and property damage to the public or public property. A copy of the certificate of liability insurance shall be provided to the Department, and this insurance shall contain a noncancellation clause and be valid at all times during demolition or moving operations.
EXCEPTON: Homeowners or the demolition of Group I or J occupancies when approved by the Department.

1. **Insurance.** The minimum amount of insurance to be provided shall be that indicated herein.

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<tr>
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2. **Other Permittee.** Whenever any other permittee, except a homeowner, performs such work, he shall be required to show proof of insurance in the same amounts as indicated herein.

(i) **Damage to Public Property.** As a condition of obtaining a permit to wreck or move any building, structure, or utility, the permittee assumes liability for any damage to public property occasioned by such moving, demolition, or removal operations.

(m) **Permit.** A permit shall be required for the erection of all covered walkways and railings. See Chapter 3.

(n) **Protection of Utilities.** Materials or equipment used in, or required for, demolition or moving operations shall not be placed or stored so as to obstruct free and convenient approach to any fire hydrant, fire or police alarm box, any utility box, catch basins or manholes, or so as to interfere with the free flow of water in any street or alley gutter. Every street lamp, utility box, fire or police alarm box, fire hydrant, and every catch basin and manhole that might be damaged by any work being performed, or by the placement or storage of any materials or equipment, shall be protected adequately against such damage. This protection shall be maintained only as long as the actual work may require, and shall be completely removed as soon as the work status permits.

**SECTION 4602. PREPARATORY OPERATIONS.**

(a) **Survey.** Prior to the start of demolition operations, a survey shall be made of the structure to determine the condition of the structure, and to determine the possibility of unplanned collapse of any portion of the building or structure. Any adjacent building or structure shall be similarly surveyed, and the demolition contractor shall possess, in writing, evidence that this survey has been performed. For buildings 4 stories or more in height a professional engineers report shall be filed with the Department prior to any demolition. This report shall contain information as to type of construction, method of demolition, street, sidewalk or other public way closures, method of protecting the public and pertinent data pertaining to adjacent structures. The Department may request an engineers report for other demolition operations when deemed necessary. Buildings being demolished containing friable asbestos shall conform to the provisions of the National Emission Standard for asbestos.

(b) **Damage by Fire, Flood, or Other.** When persons are required to work within a structure to be demolished which has been damaged by fire, flood, explosion, or other cause, the structure shall be braced or shored for safety.
(c) **Utility Shut Off.** All electric, gas, water, steam, sewer, and other service lines shall be shut off, capped, or otherwise controlled outside the building line prior to beginning demolition work.

(d) **Relocation of Utilities.** Any power, water, or other utilities required to be maintained during demolition, shall be temporarily relocated and protected.

(e) **Dangerous Utilities.** Determination shall be made by the contractor if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed by the demolition contractor, and the hazard eliminated prior to demolition operations.

(f) **Glass Hazard.** Where a hazard exists from the fragmentation of glass, the hazard shall be removed.

(g) **Wall Opening Hazard.** Wall openings shall be protected to a height of approximately 42 inches above the floor.

(h) **Exterior Wall-Floor Demolition.** The demolition of exterior walls and floor construction shall begin at the top of the structure and proceed downward. Each story of exterior wall and floor construction shall be removed and dropped into the storage space before commencing the removal of exterior walls and floors in the story next below.

**SECTION 4603. STAIRS, PASSAGEWAYS AND LADDERS.**

(a) **Access.** Only those stairways, passageways and ladders designated as means of access to the structure of a building shall be used. Other access ways shall be closed at all times.

(b) **Maintenance.** All stairs, passageways, ladders, and incidental equipment thereto shall be periodically inspected and maintained in a clean, safe condition.

(c) **Stairwells.** In a multistory building when a stairwell is being used as access, it shall be properly illuminated by either natural or artificial means, and completely and substantially covered-over at a point not less than 2 floors below the floor on which the work is being performed, and access to the floor where the work is in progress shall be through a properly lighted, protected and separate passageway.

(d) **Doorways.** All access doorways or thoroughfares to the property shall be kept barricaded, except during the actual passage of men or equipment.

**SECTION 4604. CHUTES.**

(a) **Prohibition.** Material shall not be dropped to any point lying outside the exterior walls of the structure unless the area is protected. Where the distance from the property line or sidewalk is equal to, or greater than the height of the demolition work, materials may be dropped by gravity to the ground, provided dust control is maintained.

(b) **Enclosure.** All material chutes or sections thereof, at an angle of 45 degrees or more from the horizontal shall be entirely enclosed, except for openings equipped with closures at each floor level for the insertion of materials. The opening shall not exceed 48 inches in height measured along the wall of the chute. At all stories below the top floor, openings shall be kept closed when not in use.
(c) **Gate.** A substantial gate shall be installed in each chute at, or near the discharge end. When chutes are used, a competent employee shall be assigned to control the operation of the gate, and the backing and loading of trucks. When operations are not in progress, the area surrounding the discharge end of the chute shall be securely closed off.

(d) **Guardrail.** Any chute opening into which workmen dump debris shall be protected by a substantial guardrail, approximately 42 inches above the floor or other surface on which the men stand to dump material. Any space between the chute and the edge of the openings in the floors through which it passes shall be solidly covered over.

(e) **Toeboard-Bumper.** Where the material is dumped from motorized equipment or wheel barrows, a securely attached toeboard or bumper not less than 4 inches thick and 6 inches high shall be provided at each chute opening.

**SECTION 4605. REMOVAL OF WALLS, MASONRY SECTIONS AND CHIMNEYS.**

(a) **Floor Loads.** Masonry walls, or other sections of masonry shall not be permitted to fall upon floors of the building in such masses as to exceed the safe carrying capacities of the floors.

(b) **Free Standing Walls.** No wall section which is more than one story in height shall be permitted to stand alone without lateral bracing. All walls shall be left in a stable condition at the end of each shift.

(c) **Cutting Load-Supporting Members.** Structural or load-supporting members on any floor shall not be cut or removed until all stories above such floor have been demolished and removed. This provision shall not prohibit the cutting of floor beams for the disposal of materials, or for the installation of equipment.

(d) **Skeleton Type Buildings.** In buildings of steel or concrete frame construction, the framing may be left in place during the demolition of the masonry. Where this is performed, all beams, girders and similar structural supports shall be cleared of all loose material as the masonry demolition progresses downward.

(e) **Walls Serving as Support.** Walls which serve as retaining walls to support earth or adjoining structures shall not be demolished until the earth has been properly braced, or adjoining structures have been properly supported.

(f) **Walls Serving as Retainers.** Walls which are to serve as retaining walls against which debris will be piled shall not be used unless they are capable of safely supporting the imposed loads.

**SECTION 4606. CATCH PLATFORMS.**

(a) **General.** During the demolition of the exterior walls of a structure originally more than 70 feet high, catch platforms shall be erected along the exterior faces of such walls.

(b) **Height.** Such catch platforms shall be constructed and maintained not more than 3 stories below the story from which the exterior walls are being removed. When the demolition has progressed to within 3 stories of ground level, catch platforms shall not be considered necessary.

(c) **Width.** Catch platforms shall be at least 5 feet in width, measured in a horizontal direction from the face of the structure, and shall consist of
outriggers and planks. Planks shall be laid tight together and without
openings between such planks and the wall.
(d) **Material.** Catch platforms may be constructed of material other than
wood provided such material is of equal strength and does not otherwise
lessen the security against falling material.
(e) **Loading.** Catch platforms shall be capable of sustaining a live load of at
least 125 pounds per square foot.
(f) **Incline.** The catch platforms shall be inclined so that the outer edge is
at least 6 inches higher than the inner edge.
(g) **Supports - Outrigger.** Supports shall consist of outriggers of ample
strength, secured against turning, and spaced not more than 10 feet
apart.
1. Each outrigger shall have ample support against the building or in
window openings and shall be properly secured.
(h) **Enclosure.** The outer edge of each catch platform shall be provided
with a substantial enclosure constructed at an angle of approximately 45
degrees with the horizontal and having its outer edge at least 48 inches
from the platform measured along the slope of the enclosure.
1. The enclosure shall consist of galvanized wire mesh made of at least
No. 16 U.S. gage wire and 1 1/2 inch mesh. The enclosure shall be
secured to supports placed not more than 10 feet apart.
2. There shall be no openings between the platform and the enclosure.
3. Supports for the enclosure shall be at least 2 inches by 6 inches in
section with the greater dimension at right angles to the enclosure.

**SECTION 4607. STORAGE.** The storage of waste material and debris on
any floor shall not endanger the structural stability of the building.

**SECTION 4608. MACHINE DEMOLITION.** Machine demolition shall be
subject to approval by the Department.

**SECTION 4609. THE USE OF EXPLOSIVES.** For use of explosives, see
Fire Code.

**SECTION 4610. MOVING.**
(a) **Compliance.** Buildings, structures, or utilities which are moved from
one location to another, within or from the City, shall conform to all re-
quirements of this Building Code. These buildings, structures, or
utilities shall be inspected and approved by the Department prior to
moving. See Chapter 3.
(b) **Other Requirements.** During actual moving operations on the public
way, one or more men shall be stationed on the roof of the structure
being moved to determine that there is no interference with trees, wires,
traffic signals, signs, or other obstructions.
(c) **Utilities Disconnect.** See Section 4602.
(d) **Filling Holes and Clearing of Site.** See Section 4612.
(e) **Approvals.** Prior to the issuance of a permit by the Department and the
subsequent moving of any building, structure, or utility, approval shall
be obtained from the Traffic Engineer.
(f) **Storage of Moved Buildings.** Buildings, structures, or utilities shall
not be stored on any property for more than 72 hours, unless approved by
the Department.
SECTION 4611. AFTER REMOVAL. Upon completion of the removal of a building, structure, or utility, either by demolition or moving, the ground shall be left in a clean, smooth condition. Holes, basements, or cellars shall be filled with an inorganic material; provided, however, the top one foot of fill shall be clean earth. The filling of such excavations shall not be required when a building permit has been issued for a new building on the site, and construction is to be started within 60 days after completion of the demolition or moving operations. The holder of the building permit shall provide a temporary barricade protecting the excavation on all sides as specified for safety by the Department. The temporary barricade may remain in position for a time not exceeding 3 days, after which a solid barricade or fence shall be provided, or the excavation filled.

SECTION 4612. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply.

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CHAPTER 47
LATH, PLASTER AND GYPSUM WALLBOARD

SECTION 4701. GENERAL.
(a) **Scope.** In addition to the other requirements of this Building Code, this Chapter shall govern the installation of lathing, plastering and gypsum wallboard. Where fire-resistive construction is required, this Chapter and Chapter 43 shall also apply.
(b) **Tests.** The Department may require that test holes be made in the wall or ceiling for the purpose of determining the thickness and proportioning of the plaster, lath, or wallboard, provided the permit holder has been notified 24 hours in advance of the time for conducting the test.
(c) **Definitions.** For the purposes of this Chapter, the definitions as specified in the glossary of Lath and Plaster Specifications and Finishes, Book 9 by the Mountain States Bureau for Lathing and Plastering, Inc., shall apply.

SECTION 4702. MATERIALS. See Section 4713.

SECTION 4703. VERTICAL ASSEMBLIES.
(a) **General.** In addition to the requirements of this Section, vertical assemblies of plaster or gypsum wallboard shall be designed to resist the loads specified in Chapter 23 of this Building Code. For wood framing see Chapter 25. For metal framing see Chapters 27 and 28.
(b) **Wood Framing.** Wood framing supports for lath or gypsum wallboard shall be at least 1-1/2 inches in its least dimension. Wood striping or furring shall be at least 1-1/2 inches thickness in its least dimension, except that furring strips not less than 3/4 by 1-1/2 inch dimension may be used over solid backing.
(c) **Studless Partitions.** The minimum thickness of vertically erected studless solid plaster partitions of 3/8 inch and 3/4 inch rib metal lath, or 1/2 inch thick long length gypsum lath and gypsum wallboard partitions shall be 2 inches.

SECTION 4704. HORIZONTAL ASSEMBLIES.
(a) **General.** In addition to the requirements of this Section, supports for horizontal assemblies of plaster or gypsum wallboard shall be designed to support all loads as specified in Chapter 23 of this Building Code. For wood framing, see Chapter 25. For metal framing, see Chapters 27 and 28.
1. **Type I, II, AND IV BUILDINGS.** Ceiling construction shall be of noncombustible or fire retardant treated wood materials, including all supports and covering materials. Where ceilings are required to be fire-resistive within a corridor, room, or other area, all openings shall be fire-protected in an approved manner. See Chapter 42 for other requirements.
2. **TYPE III AND V BUILDINGS.** Ceiling construction shall consist of any construction permitted in this Building Code.
(b) **Wood Framing.** Wood striping or suspended wood systems, where used, shall be at least 1-1/2 inches thick in its least dimension, except
that furring strips of at least 3/4 by 1-1/2 inch dimension may be used over solid backing.

(c) **Hangers, Runners and Furring.**

1. **Hangers.** Hangers for suspended ceilings shall be at least the sizes set forth in table No. 47-A, fastened to or embedded in the structural framing, masonry, or concrete. Hangers shall be saddle-tied around main runners to develop the full strength of the hangers. Lower ends of flat hangers shall be bolted with 3/8 inch bolts to runner channels, or bent tightly around runners and bolted to the main part of the hanger.

2. **Runners and Furring.** The main runner and cross-furring shall be at least the sizes set forth in Table No. 47-A, except that other steel sections of equivalent strength may be substituted. Cross-furring shall be securely attached to the main runner by saddle-tying with not less than one strand of No. 16, or 2 strands of No. 18 U.S. gauge tie wire or approved equivalent attachments.

**SECTION 4705. INTERIOR LATH.**

(a) **General.** Gypsum lath shall not be installed until weather protection for the installation is provided. Where wood frame walls and partitions are covered on the interior with portland cement plaster or tile of similar material and are subject to water splash, the framing shall be protected with an approved moisture barrier.

(b) **Application of Gypsum Lath.** The thickness, spacing of supports, and the method of attachment of gypsum lath shall be as set forth in Tables No. 47-B and No. 47-C. Approved wire and sheet metal attachment clips may be used.

1. Gypsum lath shall be applied with the long dimension perpendicular to supports, and with end joints staggered in successive courses. End joints may occur on one support when stripping is applied the full length of the joints.

2. Where electrical radiant heat cables are installed on ceilings, the stripping, if conductive, may be omitted for a distance not to exceed 12 inches from the walls.

3. Where lath edges have joint gaps exceeding 3/8 inch, the joint gaps shall be covered with stripping or cornerite. Stripping or cornerite may be omitted when the entire surface is reinforced with not less than one inch No. 18 U.S. gauge woven wire. When lath is secured to horizontal or vertical supports not used as structural diaphragms, end joints may occur between supports when lath ends are secured together with approved fasteners.

4. Cornerite shall be installed so as to retain position during plastering at all internal corners. Cornerite may be omitted when plaster is not continuous from one plane to an adjacent plane.

(c) **Application of Metal Plaster Bases.** The type and weight of metal lath, and the gauge and spacing of wire in welded or woven lath, the spacing of supports, and the methods of attachment to wood supports shall be as set forth in Tables No. 47-B and 47-C.

1. Metal lath shall be attached to metal supports with not less than No. 18 U.S. gauge tie wire spaced not more than 6 inches apart, or with approved equivalent attachents.
2. Metal lath or wire fabric lath shall be applied with the long dimension of the sheets perpendicular to supports.

3. Metal lath shall be lapped not less than 1/2 inch at sides and one inch at ends. Wire fabric lath shall be lapped at least one mesh at sides and ends, but not less than one inch. Rib metal lath with edge ribs greater than 1/8 inch shall be lapped at sides by nesting outside ribs. When edge ribs are 1/8 inch or less, rib metal lath may be lapped 1/2 inch at sides, or outside ribs may be nested. Where end laps of sheet do not occur over supports, they shall be securely tied together with not less than No. 18 U.S. gauge wire.

4. Cornerite shall be installed at all internal corners to retain position during plastering. Cornerite may be omitted when lath is continuous or when plaster is not continuous from one plane to an adjacent plane.

SECTION 4706. EXTERIOR LATH.

(a) General. For projections from buildings required to be fire-resistive, see Chapter 17.

(b) Corrosion Resistance. All lath and lath attachments shall be corrosion-resistant materials.

(c) Backing. Backing or lath shall provide sufficient rigidity to permit plaster application.
   1. Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.
   2. Gypsum lath or gypsum board shall not be used.

(d) Weather-Resistive Barriers. Weather-resistive barriers shall be installed as required in Chapter 17 (Weather Protection). Definition of Weather Exposed Surfaces, See Chapter 4.

(e) Application of Metal Plaster Bases. The application of metal lath or wire fabric lath shall be as specified in Section 4705 (c), and shall be furred out from vertical supports or backing not less than 1/4 inch, except as set forth in Footnote No. 2, Table No. 47-B.
   1. Where no external corner reinforcement is used, lath shall be furred out and carried around corners to at least one support on frame construction.
   2. A weep screed shall be provided at the foundation plate line on all exterior stud walls. The screed shall be of a type which will allow trapped water to drain to the exterior of the building.

SECTION 4707. INTERIOR PLASTER.

(a) General. Plastering with gypsum plaster or portland cement plaster shall be not less than 3 coats when applied over metal lath or wire fabric lath, and shall be not less than 2 coats when applied over other bases permitted by this Chapter. Showers and public toilet walls shall conform to Section 4705.
   1. Plaster shall not be applied directly to fiber insulation board. Portland cement plaster shall be applied directly to gypsum lath, gypsum masonry, or gypsum plaster, except as specified in Section 4706 (c).
   2. When installed, grounds shall assure the minimum thickness of
plaster as set forth in Table No. 47-D. Plaster thickness shall be measured from the face of lath and other bases.

(b) **Base Coat Proportions.** Proportions of aggregate to cementitious materials shall not exceed the volume set forth in Table No. 47-E, for gypsum plaster, and Table No. 47-F, for portland cement and portland cement lime plaster.

(c) **Base Coat Application.** Base coats shall be applied with sufficient material and pressure to form a complete key or bond.

(d) **Interior Masonry or Concrete.** Condition of surfaces shall be as specified in Section 4708(f). Gypsum plaster designed for application to concrete surfaces or approved acoustical plaster may be used. The total thickness of base coat plaster applied to concrete ceilings shall be as set forth in Table No. 47-D. Should ceiling thickness require more than the maximum thickness permitted in Table 47-D, metal lath or wire fabric shall be installed on the surfaces before plastering.

**SECTION 4708. EXTERIOR PLASTER.**

(a) **General.** Plastering with portland cement plaster shall be not less than 3 coats when applied over metal lath or wire fabric lath, and shall be not less than 2 coats when applied over masonry, concrete, or gypsum backing as specified in Section 4706(c). If plaster surface is completely concealed by another wall, plaster application need only be 2 coats, provided the total thickness is as set forth in Table 47-F.

1. On wood frame or metal stud construction with an on-grade concrete floor slab system, exterior plaster shall be applied in a manner to cover, but not extend below, lath and paper.

2. Only approved plasticity agents and amounts may be added to portland cement. When plastic cement is used, additional lime or plasticizers shall not be added. Hydrated lime or the equivalent amount of lime putty used as a plasticizer may be added to portland cement plaster in an amount not to exceed that set forth in Table No. 47-F.

3. For machine placed plasters, asbestos fiber may be added to portland cement plaster in approved amounts. Approved portland cement plaster containing asbestos fiber, blended at the time of manufacture and so labeled, may be used.

4. Gypsum plaster shall not be used on vertical exterior surfaces.

(b) **Base Coat Proportions.** The proportion of aggregate to cementitious materials shall be as set forth in Table No. 47-F.

(c) **Base Coat Application.** The first coat shall be applied with material and pressure to fill solidly all openings in the lath. The surface shall be scored horizontally to provide adequate bond to receive the second coat. The second coat shall be brought out to proper thickness, rodded and floated to provide adequate bond for the finish coat.

(d) **Curing and Interval.** First and second coats of plaster shall be applied and moist-cured as set forth in Table No. 47-F. When applied over gypsum backing as specified in Section 4706(c), or directly to unit masonry surfaces, the second coat may be applied as soon as the first coat has attained sufficient hardness.

(e) **Finish Coats.** Finish coats shall be proportioned and mixed in accordance with Table No. 47-F. Portland cement and lime finish coats shall
be applied over base coats which have been in place for the time periods set forth in Table No. 47-F. The third or finish coat shall be applied with material and pressure to bond to, and to cover, the brown coat.

(f) **Preparation of Masonry and Concrete.** Surfaces shall be clean, free from efflorescence, damp and rough to assure proper bond. If the surface is inadequate to provide proper bond agents or a portland cement dash bond coat mixed in the proportions of 1 1/2 cubic feet of sand to one cubic foot of portland cement shall be applied. The dash bond coat shall be moist cured at least 24 hours. When the dash bond is applied, the first coat of base coat plaster may be omitted. See Table No. 47-D for thickness.

**SECTION 4709. EXPOSED AGGREGATE PLASTER.**

(a) **General.** Exposed natural or integrally colored aggregate may be partially embedded in a natural or colored bedding coat of portland cement or gypsum plaster subject to the provisions of this Section.

(b) **Aggregate.** The aggregate may be applied manually or mechanically, and shall consist of marble chips, pebbles, or similar durable, nonreactive materials, moderately hard (3 or more on the MOH scale).

(c) **Bedding Coat Proportions.** The exterior bedding coat shall be composed of one part portland cement, one part Type S lime and a maximum 3 parts of graded white or natural sand by volume. The interior bedding coat shall be composed of 100 pounds neat gypsum plaster and a maximum 200 pounds of graded white sand. Exterior or interior coat may be a factory prepared bedding coat. The exterior bedding coat shall have a minimum compressive strength of 1,000 pounds per square inch.

(d) **Application.** The bedding coat may be applied directly over the first (scratch) coat of plaster, provided the ultimate overall thickness is a minimum of 7/8 inch including lath. Over concrete or masonry surfaces, the overall thickness shall be a minimum of 1/2 inch.

(e) **Bases.** Exposed aggregate plaster may be applied over concrete, masonry, portland cement plaster base coats, or gypsum plaster base coats.

(f) **Preparation of Masonry and Concrete.** Masonry and concrete surfaces shall be prepared in accordance with the provisions of Section 4708(e).

(g) **Curing.** Portland cement base coats shall be cured in accordance with Table No. 47-F. Portland cement bedding coat shall retain sufficient moisture for hydration (hardening) for 24 hours minimum or, where necessary, shall be kept damp for 24 hours minimum or, where necessary, shall be kept damp for 24 hours by light water spray.

**SECTION 4710. PNEUMATICALLY PLACED PLASTER.**

(a) **General.** Pneumatically placed portland cement plaster shall be a mixture of portland cement and sand, mixed dry, conveyed by air through a pipe or flexible tube, hyrated at the nozzle at the end of the conveyor, and deposited by air pressure in its final position.

(b) **Rebound Material.** Rebound material may be screened and reused as sand in an amount not greater than 25 percent of the total sand in any batch.

(c) **Consistency.** Pneumatically placed portland cement plaster shall consist of a mixture of one part cement to not more than 5 parts sand.
Plasticity agents may be used as specified in Section 4708(a). Except when applied to concrete or masonry, the plaster shall be applied in not less than 2 coats to a minimum total thickness of 7/8 inch. The first coat shall be rodded, as specified in Section 4708(c) in preparation for second coat. The curing period and time interval shall be as set forth in Table No. 47-F.

SECTION 4711. GYPSUM WALLBOARD.

(a) **General.** All gypsum wallboard shall be installed in accordance with the provisions of this Section. Gypsum wallboard shall not be installed on surfaces exposed to the weather except water resistant wallboard may be used as soffits.

1. Gypsum wallboard shall not be installed until weather protection for the installation is provided.

2. Shower and public toilet walls shall conform to Section 4705.

(b) **Supports.** Supports shall be spaced not to exceed the spacing set forth in Table No. 47-G, for single-ply application, and Table No. 47-H, for two-ply application. Vertical assemblies shall comply with Section 4703. Horizontal assemblies shall comply with Section 4704.

(c) **Single-Ply Application.** All edges and ends of gypsum wallboard shall occur on the framing members, except those edges and ends which are perpendicular to the framing members. All edges and ends of gypsum wallboard shall be in contact, except in concealed spaces where fire-resistive construction or diaphragm action is not required.

1. The size and spacing of fasteners shall comply with Table No. 47-G, except where modified by fire-resistive construction meeting the requirements of Chapter 43. Fasteners shall be spaced not less than 3/8 inch from edges and ends of gypsum wallboard. Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line may be omitted, except on shear-resisting elements or fire-resistive assemblies. Fasteners shall be applied to prevent fracture of the face paper with the fastener head.

2. Gypsum wallboard may be applied to wood framing members with an approved adhesive. A continuous bead of the adhesive shall be applied to the face of all framing members, except top and bottom plates, of sufficient size as to spread to an average width of one inch and thickness of 1/16 when the gypsum wallboard is applied. Where the edges or ends of 2 pieces of gypsum wallboard occur on the same framing member, 2 continuous parallel beads of adhesive shall be applied to the framing member. Fasteners shall be used with adhesive application in accordance with Table No. 47-G.

(d) **Two-Ply Application.** The base ply of gypsum wallboard shall be applied with fasteners of the type and size as required for the nonadhesive application of single-ply gypsum wallboard. Fastener spacings shall be in accordance with Table No. 47-H, except where modified by fire-resistive construction meeting the requirements as specified in Chapter 43. The face ply of gypsum wallboard may be applied with gypsum wallboard joint compound or approved adhesive furnishing full coverage between the plies, or with fasteners in accordance with Table No. 47-H. When the face ply is installed with joint compound or adhesive, the joints of the
face ply need not occur on supports. Temporary nails or shoring shall be used to hold the face ply in position until the joint compound or adhesive develops adequate bond.

(e) **Joint Treatment.** Gypsum wallboard single layer, fire rated assemblies shall have joints treated, except where the wallboard is to receive a decorative finish such as wood paneling, battens, acoustical finishes, or any similar application which would be equivalent to the joint treatment.

**EXCEPTION:** Assemblies tested without joint treatment.

**SECTION 4712. SHEAR-RESISTING CONSTRUCTION WITH WOOD FRAME.**

(a) **General.** Gypsum lath and plaster, gypsum sheathing board, and gypsum wallboard may be used on wood studs for vertical diaphragms if applied in accordance with this Section. Shear-resisting values shall not exceed those set forth in Table No. 47-I. The shear values shall not be cumulative with the shear value of other materials applied to the same wall. The shear values may be doubled when the identical materials applied, as specified in this Section, are applied to both sides of the wall.

(b) **Masonry and Concrete Construction.** Gypsum lath and plaster, gypsum sheathing board, and gypsum wallboard shall not be used in vertical diaphragms to resist forces imposed by masonry or concrete construction.

(c) **Wall Framing.** Framing for vertical diaphragms shall comply with Chapter 25, for bearing walls, and studs shall be spaced not further apart than 16 inches center to center. Marginal studs and plates shall be anchored to resist all design forces.

(d) **Height to Length Ratio.** The maximum allowable height to length ratio for the construction in this Section shall be 1 1/2 to 1.

(e) **Application.** End joints of adjacent courses of gypsum lath, gypsum sheathing board, or gypsum wallboard sheets shall not occur over the same stud.

1. Where required in Table No. 47-I, blocking having the same cross-sectional dimensions as the studs shall be provided at all joints that are perpendicular to the studs.

2. The size and spacing of nails shall be as set forth in Table No. 47-I. Nails shall be spaced not less than 3/8 inch from edges and ends of gypsum lath, gypsum sheathing board, gypsum wallboard, or sides of studs, blocking, and top and bottom plates.

3. Gypsum lath shall be applied perpendicular to the studs. Maximum allowable shear values shall be as set forth in Table No. 47-I.

4. Four foot wide pieces of gypsum sheathing board may be applied parallel or perpendicular to studs. 2 foot wide pieces shall be applied perpendicular to the studs. Maximum allowable shear values shall be as set forth in Table No. 47-I.

5. Gypsum wallboard may be applied parallel or perpendicular to studs. Maximum allowable shear values shall be as set forth in Table No. 47-I.
SECTION 4713. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adhesive for Fastening Gypsum Wallboard to Wood Framing, C-557-67.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Backing Board, C-442-67.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Base for Veneer Plaster and Gypsum Veneer Plaster, C-588-68 and C-587-68.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Lath, C-37-69.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Molding Plaster, C-59-65.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Plasters, C-28-68.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Sheathing Board, C-79-67.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Wallboard, C-36-67.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Wallboard Tape and Joint Compound, C-475-70 and C-474-67.</td>
</tr>
<tr>
<td></td>
<td>Fire Test of Building Construction and Material, E-119-74.</td>
</tr>
<tr>
<td></td>
<td>Keene's Cement, C-61-70.</td>
</tr>
<tr>
<td></td>
<td>Lime, C-6-49 (1968) and C-206-49 (1968).</td>
</tr>
<tr>
<td></td>
<td>Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings, C-635-69 and C-636-69.</td>
</tr>
<tr>
<td></td>
<td>Gypsum Drywall Metal Framing, C-754-1974.</td>
</tr>
<tr>
<td></td>
<td>Perlite, Vermiculite and Sand Aggregates for Gypsum Plaster, C-35-70.</td>
</tr>
<tr>
<td></td>
<td>Water Resistant Gypsum Backing Board, C-630-70.</td>
</tr>
</tbody>
</table>

LEGEND

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>ADDRESS</th>
</tr>
</thead>
</table>
| ANSI         | American National Standards Institute  
               1430 Broadway  
               New York, N.Y., 10018 |
| ASTM         | American Society for Testing and Materials  
               1916 Race Street  
               Philadelphia, Pa., 19103 |
| USG          | U.S. Government Printing Office  
               Superintendent of Documents  
               Washington, D.C., 20025 |
| GA           | Gypsum Association  
               1603 Orrington Avenue  
               Evanston, Ill. 60201 |

SECTION 4714. TABLES.
# TABLE NO. 47-A

## SUSPENDED AND FURRED CEILINGS

(For Support of Ceilings Weighing Not More than 10 Pounds per Square Foot)

### Minimum Sizes and Maximum Spans for Main Runners

<table>
<thead>
<tr>
<th>SIZE AND TYPE</th>
<th>MAXIMUM SPACING OF HANGERS OR SUPPORTS (ALONG RUNNERS)</th>
<th>MAXIMUM SPACING OF RUNNERS (TRANVERSE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; - .3 pound per foot, cold or hot-rolled channel</td>
<td>2'0&quot;</td>
<td>3'0&quot;</td>
</tr>
<tr>
<td>1 1/4&quot; - .475 pound per foot, cold-rolled channel</td>
<td>3'0&quot;</td>
<td>4'0&quot;</td>
</tr>
<tr>
<td>1 1/2&quot; - .475 pound per foot, cold-rolled channel</td>
<td>3'6&quot;</td>
<td>3'0&quot;</td>
</tr>
<tr>
<td>1 1/4&quot; - .475 pound per foot, cold-rolled channel</td>
<td>4'0&quot;</td>
<td>5'0&quot;</td>
</tr>
<tr>
<td>1 1/2&quot; - 1.12 pounds per foot, hot-rolled channel</td>
<td>5'0&quot;</td>
<td>5'0&quot;</td>
</tr>
<tr>
<td>2&quot; - 1.26 pounds per foot, hot-rolled channel</td>
<td>5'0&quot;</td>
<td>3'0&quot;</td>
</tr>
<tr>
<td>2&quot; - .59 pound per foot, cold-rolled channel</td>
<td>5'0&quot;</td>
<td>3'6&quot;</td>
</tr>
<tr>
<td>1 1/2&quot; x 1 1/2&quot; x 3/16&quot; angle</td>
<td>5'0&quot;</td>
<td>3'0&quot;</td>
</tr>
</tbody>
</table>

### Minimum Sizes and Maximum Spans for Cross Furring

<table>
<thead>
<tr>
<th>SIZE AND TYPE OF CROSS Furring</th>
<th>MAXIMUM SPACING OF RUNNERS OR SUPPORTS</th>
<th>MAXIMUM SPACING OF CROSS Furring MEMBERS (TRANVERSE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot; diameter pencil rods</td>
<td>2'0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>3/8&quot; diameter pencil rods</td>
<td>2'0&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>5/8&quot; diameter pencil rods</td>
<td>2'6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>3/4&quot; - .3 pound per foot, cold or hot-rolled channel</td>
<td>3'0&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>3/4&quot; - .3 pound per foot, cold or hot-rolled channel</td>
<td>3'6&quot;</td>
<td>16&quot;</td>
</tr>
<tr>
<td>3/4&quot; - .3 pound per foot, hot-rolled channel</td>
<td>4'0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>1&quot; - .410 pound per foot, hot-rolled channel</td>
<td>4'0&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>1&quot; - .410 pound per foot, hot-rolled channel</td>
<td>4'6&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>1&quot; - .410 pound per foot, hot-rolled channel</td>
<td>5'0&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

* *Spans are based on webs of channels being erected vertically.*

* *Other sections of hot or cold-rolled members of equivalent strength may be substituted for those specified.*
<table>
<thead>
<tr>
<th>SIZE AND TYPE</th>
<th>MAXIMUM AREA SUPPORTED (In Square Feet)</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hangers for Suspended Ceilings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.5</td>
<td>No. 9 gauge wire</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>No. 8 gauge wire</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>$\frac{3}{16}$” diameter, mild steel rod$^a$</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>$\frac{7}{32}$” diameter, mild steel rod$^a$</td>
<td></td>
</tr>
<tr>
<td>22.5</td>
<td>$\frac{1}{4}$” diameter, mild steel rod$^a$</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>$1” \times \frac{3}{16}$” mild steel flats$^b$</td>
<td></td>
</tr>
<tr>
<td>For Supporting Runners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Hangers Between Beams$^c$</td>
<td>8</td>
<td>No. 12 gauge wire</td>
</tr>
<tr>
<td>12</td>
<td>No. 10 gauge wire</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>No. 8 gauge wire</td>
<td></td>
</tr>
<tr>
<td>Double Wire Loops at Beams or Joists$^c$</td>
<td>8</td>
<td>No. 14 gauge wire</td>
</tr>
<tr>
<td>12</td>
<td>No. 12 gauge wire</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>No. 11 gauge wire</td>
<td></td>
</tr>
<tr>
<td>For Supporting Furring without Runners$^c$ (Wire Loops at Supports)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Support: Concrete</td>
<td>8</td>
<td>No. 14 gauge wire (2 loops)$^d$</td>
</tr>
<tr>
<td>Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 16 gauge wire (2 loops)$^d$</td>
<td></td>
</tr>
</tbody>
</table>

$^a$ All rod hangers shall be protected with a zinc or cadmium coating or with a rust-inhibitive paint.

$^b$ All flat hangers shall be protected with a zinc or cadmium coating or with a rust-inhibitive paint.

$^c$ Inserts, special clips or other devices of equal strength may be substituted for those specified.

$^d$ Two loops of No. 18 gauge wire may be substituted for each loop of No. 16 gauge wire for attaching steel furring to steel or wood joists.
# TABLE NO. 47-B

## TYPES OF LATH

### MAXIMUM SPACING OF SUPPORTS

<table>
<thead>
<tr>
<th>TYPE OF LATH&lt;sup&gt;b&lt;/sup&gt;</th>
<th>MINIMUM WEIGHT (Per Square Yard) GAUGE AND MESH SIZE</th>
<th>VERTICAL (In Inches)</th>
<th>HORIZONTAL (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire Fabric Lath</td>
<td>1.95 lbs., No. 11 gauge, 2&quot; x 2&quot;</td>
<td>Wood 24, Plaster 24, Other 24</td>
<td>Wood or Concrete 24, Metal 24</td>
</tr>
<tr>
<td></td>
<td>1.4 lbs., No. 16 gauge, 2&quot; x 2&quot;</td>
<td>16, 16, 16</td>
<td>16, 16</td>
</tr>
<tr>
<td></td>
<td>1.4 lbs., No. 18 gauge, 1&quot; x 1&quot;</td>
<td>16&lt;sup&gt;c&lt;/sup&gt;, - , -</td>
<td>- , -</td>
</tr>
<tr>
<td>Woven&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.4 lbs., No. 17 gauge, 1'/2&quot; Hexagonal&lt;sup&gt;f&lt;/sup&gt;</td>
<td>24, 16, 16</td>
<td>24, 16</td>
</tr>
<tr>
<td></td>
<td>1.4 lbs., No. 18 gauge, 1&quot; Hexagonal&lt;sup&gt;f&lt;/sup&gt;</td>
<td>24, 16, 16</td>
<td>24, 16</td>
</tr>
<tr>
<td>3/4&quot; Gypsum Lath (perforated)</td>
<td>16, - , 16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>16, 16</td>
<td>16, 16</td>
</tr>
<tr>
<td>3/4&quot; Gypsum Lath (plain)</td>
<td>16, - , 16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>16, 16</td>
<td>16, 16</td>
</tr>
<tr>
<td>1/2&quot; Gypsum Lath (perforated)</td>
<td>16, - , 16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>16, 16</td>
<td>16, 16</td>
</tr>
<tr>
<td>1/2&quot; Gypsum Lath (plain)</td>
<td>24, - , 24</td>
<td>24, 24</td>
<td>24, 24</td>
</tr>
</tbody>
</table>

<sup>f</sup> Woven wire or welded wire fabric lath, not to be used as base for gypsum plaster, without absorbent paper backing or slot-perforated separator.

<sup>c</sup> Span may be increased to 24 inches on vertical screw or approved nailable assemblies.
<table>
<thead>
<tr>
<th>TYPE OF LATH&lt;sup&gt;b&lt;/sup&gt;</th>
<th>MINIMUM WEIGHT</th>
<th>VERTICAL (In Inches)</th>
<th>HORIZONTAL (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Per Square Yard) GAUGE AND MESH SIZE</td>
<td>Wood Plaster Other</td>
<td>Wood or Concrete Metal</td>
</tr>
<tr>
<td>Expanded Metal Lath (Diamond Mesh)</td>
<td>2.5</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>3.4</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Flat Rib Expanded Metal Lath</td>
<td>2.75</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>3.4</td>
<td>19</td>
<td>24</td>
</tr>
<tr>
<td>Stucco Mesh Expanded Metal Lath</td>
<td>1.8 and 3.6</td>
<td>16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>16</td>
</tr>
<tr>
<td>3/4&quot; Rib Expanded Metal Lath</td>
<td>3.4</td>
<td>24</td>
<td>24&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>24</td>
<td>24&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sheet Lath</td>
<td>4.5</td>
<td>24</td>
<td>d</td>
</tr>
<tr>
<td>3/4&quot; Rib Expanded Metal Lath</td>
<td>5.4</td>
<td>36&lt;sup&gt;e&lt;/sup&gt;</td>
<td>36&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> For Fire-resistive Construction, see Tables No. 43-A, No. 43-B, and No. 43-C. For Shear-resisting Elements, see Table No. 47-I.

<sup>b</sup> Metal lath and wire fabric lath used as reinforcement for portland cement plaster shall be furred out away from verticle supports at least 1/4 inch. Self-furring lath meets furring requirement. Exception: Furring is not required on steel supports having a flange width of 1 inch or less.

<sup>c</sup> Wire backing required on open vertical frame construction except under expanded metal lath and paperbacked wire fabric lath.

<sup>d</sup> May be used for studless solid partitions.

<sup>e</sup> Contact or furred ceilings only. May not be used in suspended ceilings.
<table>
<thead>
<tr>
<th>TYPE OF LATH</th>
<th>NAILED\textsuperscript{a, i}</th>
<th>SCREWS\textsuperscript{a, f}</th>
<th>STAPLES\textsuperscript{a, b}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type and Size</td>
<td>Maximum Spacing\textsuperscript{1}</td>
<td>Maximum Spacing\textsuperscript{1}</td>
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<tr>
<td></td>
<td></td>
<td>Vertical (In Inches)</td>
<td>Horizontal (In Inches)</td>
</tr>
<tr>
<td>Diamond Mesh Expanded Metal Lath and Flat Rib Metal Lath</td>
<td>4d blued smooth box 1 1/2 No. 14 gauge 1/2&quot; head (clipped)\textsuperscript{d} 1&quot; No. 11 gauge 1/2&quot; head, barbed 1 1/4&quot; No. 11 gauge 1/2&quot; head, barbed</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3/4&quot; Rib Metal Lath and Sheet Lath</td>
<td>1 1/4&quot; No. 11 gauge 1/2&quot; head, barbed</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3/4&quot; Rib Metal Lath</td>
<td>4d common 1 1/4&quot; No. 12 1/4&quot; gauge 1/4&quot; head 2&quot; No. 11 gauge 1/4&quot; head, barbed</td>
<td>At Ribs</td>
<td>16</td>
</tr>
</tbody>
</table>

\textsuperscript{a} For Fire-resistive Construction, see Tables No. 43-B and 43-C. For Shear-resisting Elements, see Table No. 47-1. Approved wire and sheet metal attachment clips may be used.

\textsuperscript{b} With divergent points.

\textsuperscript{c} When lath and stripping are stapled simultaneously, increase leg length of staple 1/8 inch.

\textsuperscript{d} For interiors only.

\textsuperscript{e} Attach self-furring wire fabric lath to supports at furring device.

\textsuperscript{f} Screws shall be an approved type long enough to penetrate into wood framing not less than 5/8 inch and through metal supports adaptable for screw attachment not less than 1/4 inch.

\textsuperscript{g} Three attachments per 16-inch wide lath per bearing. Four attachments per 24-inch wide lath per bearing.

\textsuperscript{h} Supports spaced 24 inches o.c. Four attachments per bearing per 16-inch wide lath. Five attachments per 24-inch wide lath per bearing.

\textsuperscript{i} For nailable nonload-bearing metal supports use annular threaded nails or approved staples.

\textsuperscript{j} Maximum spacing of attachments from longitudinal edges shall not exceed 2 inches.
## TABLE NO. 47-C
### TYPES OF LATH ATTACHMENT TO WOOD AND METAL SUPPORTS

<table>
<thead>
<tr>
<th>TYPE OF LATH</th>
<th>NAILS$^{a, i}$</th>
<th>SCREWS$^{a, f}$</th>
<th>STAPLES$^{a, b}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum Spacing$^d$</td>
<td>Maximum Spacing$^d$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(In Inches)</td>
<td>(In Inches)</td>
</tr>
<tr>
<td>Wire Fabric Lath</td>
<td>4d blued smooth box (clinched)$^d$</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1&quot; No. 11 gauge 1/8&quot; head, barbed</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1¼” No. 11 gauge 1/16” head, barbed</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1¼” No. 12 gauge 3/8” head, furring</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3/8&quot; Gypsum Lath</td>
<td>1½” No. 13 gauge 19/64” head, blued</td>
<td>8c</td>
<td>8c</td>
</tr>
<tr>
<td>1½” Gypsum Lath</td>
<td>1½” No. 13 gauge 19/64” head, blued</td>
<td>8c</td>
<td>8c</td>
</tr>
</tbody>
</table>

$^a$ For Fire-resisting Construction, see Tables No. 43-B and 43-C. For Shear-resisting Elements, see Table No. 47-I. Approved wire and sheet metal attachment clips may be used.

$^b$ With divergent points.

$^c$ When lath and stripping are stapled simultaneously, increase leg length of staple 1/8 inch.

$^d$ For interiors only.

$^e$ Attach self-furring wire fabric lath to supports at furring device.

$^f$ Screws shall be an approved type long enough to penetrate into wood framing not less than 5/8 inch and through metal supports adaptable for screw attachment not less than 1/4 inch.

$^g$ Three attachments per 16-inch wide lath per bearing. Four attachments per 24-inch wide lath per bearing.

$^h$ Supports spaced 24 inches o.c. Four attachments per bearing per 16-inch wide lath. Five attachments per 24-inch wide lath per bearing.

$^i$ For nailable nonload-bearing metal supports use annular threaded nails or approved staples.

$^j$ Maximum spacing of attachments from longitudinal edges shall not exceed 2 inches.
TABLE NO. 47-D
THICKNESS OF PLASTER

<table>
<thead>
<tr>
<th>PLASTER BASE</th>
<th>Gypsum Plaster</th>
<th>Portland Cement Plaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded Metal Lath</td>
<td>5/8&quot; minimum&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5/8&quot; minimum&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Wire Fabric Lath</td>
<td>5/8&quot; minimum&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3/4&quot; minimum (interior)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gypsum Lath</td>
<td>1/2&quot; minimum</td>
<td>1/2&quot; minimum</td>
</tr>
<tr>
<td>Masonry Walls&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1/2&quot; minimum</td>
<td>1/2&quot; maximum</td>
</tr>
<tr>
<td>Monolithic Concrete Walls&lt;sup&gt;d,e&lt;/sup&gt;</td>
<td>5/8&quot; maximum</td>
<td>7/8&quot; maximum</td>
</tr>
<tr>
<td>Monolithic Concrete Ceilings&lt;sup&gt;d,e&lt;/sup&gt;</td>
<td>3/8&quot; maximumf,g,h</td>
<td>1/2&quot; maximum&lt;sup&gt;g,h&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> For Fire-resistive Construction, see Tables No. 43-A, No. 43-B, and No. 43-C.
<sup>b</sup> When measured from back plane of expanded metal lath, exclusive of ribs, or self-furring lath plaster thickness shall be 3/4 inch minimum.
<sup>c</sup> When measured from face of support or backing.
<sup>d</sup> Because masonry and concrete surfaces may vary in plane, thickness of plaster need not be uniform.
<sup>e</sup> When applied over a liquid bonding agent, finish coat may be applied directly to concrete surface.
<sup>f</sup> Approved acoustical plaster may be applied directly to concrete, or over base coat plaster, beyond the maximum plaster thickness shown.
<sup>g</sup> On concrete ceilings, where the base coat plaster thickness exceeds the maximum thickness shown, metal lath or wire fabric lath shall be attached to the concrete.
<sup>h</sup> An approved skim coat plaster 1/16 inch thick may be applied directly to concrete.
### TABLE NO. 47-E

**GYPSUM PLASTER PROPORTIONS**

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>COAT</th>
<th>PLASTER BASE OR LATH</th>
<th>MAXIMUM VOLUME AGGREGATE PER 100 POUNDS NEAT PLASTER&lt;sup&gt;b, c&lt;/sup&gt; (Cubic Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Damp Loose Sand&lt;sup&gt;d&lt;/sup&gt;⁴</td>
</tr>
<tr>
<td>Two-coat Work</td>
<td>Base Coat</td>
<td>Gypsum Lath</td>
<td>2&lt;sup&gt;1/2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Base Coat</td>
<td>Masonry</td>
<td>3</td>
</tr>
<tr>
<td>Three-coat Work</td>
<td>First Coat</td>
<td>Lath</td>
<td>2&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Second Coat</td>
<td>Lath</td>
<td>3&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>First and Second Coats</td>
<td>Masonry</td>
<td>3</td>
</tr>
</tbody>
</table>

<sup>a</sup> Wood fibered gypsum plaster may be mixed in the proportions of 100 pounds of gypsum to not more than one cubic foot of sand where applied on masonry or concrete.

<sup>b</sup> For Fire-resistive Construction, see Tables No. 43-A, No. 43-B, and No. 43-C.

<sup>c</sup> When determining the amount of aggregate in set plaster, a tolerance of 10 percent shall be allowed.

<sup>d</sup> Combinations of sand and lightweight aggregate may be used provided the volume and weight relationship of the combined aggregate to gypsum plaster is maintained.

<sup>e</sup> If used for both first and second coats, the volume of aggregate may be two and one-half cubic feet.

<sup>f</sup> Where plaster is 1 inch or more in total thickness the proportions for the second coat may be increased to three cubic feet.
**TABLE NO. 47-F**

**PORTLAND CEMENT PLASTERS**

<table>
<thead>
<tr>
<th>COAT</th>
<th>PORTLAND CEMENT PLASTER&lt;sup&gt;b&lt;/sup&gt;</th>
<th>PORTLAND CEMENT--LIME PLASTER&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Approx. Minimum Thickness&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Minimum Period Moist Curing</th>
<th>Minimum Interval Between Coats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Volume Aggregate per Volume Cement</td>
<td>Maximum Volume Lime per Volume Cement</td>
<td>Maximum Volume Sand per Volume Cement and Lime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First</td>
<td>4</td>
<td>3/4</td>
<td>3 1/4</td>
<td>1/2&quot;e</td>
<td>1 hour</td>
</tr>
<tr>
<td>Second</td>
<td>5</td>
<td>3/4</td>
<td>3 1/4</td>
<td>1st and 2nd Coats 3/4&quot;</td>
<td>1 hour</td>
</tr>
<tr>
<td>Finish</td>
<td>3</td>
<td>—</td>
<td>3</td>
<td>1/8&quot;</td>
<td>8 hours</td>
</tr>
</tbody>
</table>

<sup>a</sup> When determining the amount of aggregate in set plaster, a tolerance of 10 percent shall be allowed.

<sup>b</sup> From 10 to 20 pounds of dry hydrated lime (or an equivalent amount of lime putty) may be added as a plasticizing agent to each sack of portland cement, Type I, Regular. Proportions to one sack of cement shall be:

- Sand (volume):
  - 2 parts
  - 3 parts
  - 4 parts

- Lime (pounds):
  - 10
  - 15
  - 20

<sup>c</sup> No additions of plasticizing agents shall be made.

<sup>d</sup> Total minimum thickness is 7/8 inch.

<sup>e</sup> Measured from face of support or backing to crest of scored plaster.
# TABLE NO. 47-G

**APPLICATION OF SINGLE-PLY GYPSUM WALLBOARD**

<table>
<thead>
<tr>
<th>THICKNESS OF GYPSUM WALLBOARD (Inch)</th>
<th>PLAN OF FRAMING SURFACE</th>
<th>LONG DIMENSION OF GYPSUM WALLBOARD SHEETS IN RELATION TO DIRECTION OF FRAMING MEMBERS</th>
<th>MAXIMUM SPACING OF FRAMING MEMBERS&lt;sup&gt;a&lt;/sup&gt; (Center to Center)</th>
<th>MAXIMUM SPACING OF FASTENERS (Center to Center) (In Inches)</th>
<th>NAILS&lt;sup&gt;b&lt;/sup&gt; TO WOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>Horizontal</td>
<td>Either Direction</td>
<td>16</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>24</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Perpendicular</td>
<td>24</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>5/8</td>
<td>Horizontal</td>
<td>Either Direction</td>
<td>16</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Horizontal</td>
<td>Perpendicular</td>
<td>24</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>24</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

Nail or Screw Fastenings With Adhesives (Maximum Center to Center in Inches)

<table>
<thead>
<tr>
<th>(Column headings as above)</th>
<th>End</th>
<th>Edges</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 or 5/8</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Horizontal</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Perpendicular</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Vertical</td>
<td>24</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

<sup>a</sup> For Fire-resistant Construction, see Tables No. 43-B and No. 43-C. Support spacing of 24 inches may be allowed for ceilings only where fire-resistant construction is not required. For Shear-resisting Elements, see Table No. 47-I.

<sup>b</sup> Where the metal framing has a clinching design formed to receive the nails by two edges of metal, the nails shall be not less than 5/8 inch longer than the wallboard thickness, and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d, No. 13 1/8 gauge, 1 1/4 inch long, 3/16 inch head for 1/8 inch gypsum wallboard, 6d, No. 13 gauge, 1 7/8 inch long, 11/64 inch head for 5/8 inch gypsum wallboard.

<sup>c</sup> Two nails spaced not less than 2 inches apart, nor more than 2 1/2 inches apart and pairs of nails spaced not more than 12 inches center to center may be used.

<sup>d</sup> Screws shall be of an approved type long enough to penetrate into wood framing not less than 5/8 inch and through metal framing not less than 1/4 inch.

<sup>e</sup> Not required.
**TABLE NO. 47-H**

**APPLICATION OF TWO-PLY GYPSUM WALLBOARD**

<table>
<thead>
<tr>
<th>Thickness of Gypsum Wallboard (Each Ply) (Inch)</th>
<th>Plane of Framing Surface</th>
<th>Long Dimension of Gypsum Wallboard Sheets (Center to Center) (In Inches)</th>
<th>Maximum Spacing of Framing Members (Center to Center) (In Inches)</th>
<th>Maximum Spacing of Fasteners (Center to Center) (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{5}{8}$</td>
<td>Horizontal</td>
<td>Perpendicular only</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>$\frac{1}{2}$</td>
<td>Horizontal</td>
<td>Perpendicular only</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>$\frac{3}{8}$</td>
<td>Horizontal</td>
<td>Perpendicular only</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>24</td>
<td>8</td>
</tr>
</tbody>
</table>

**Fasteners and Adhesives**

<table>
<thead>
<tr>
<th></th>
<th>Plane of Framing Surface</th>
<th>Long Dimension of Gypsum Wallboard Sheets (Center to Center) (In Inches)</th>
<th>Maximum Spacing of Framing Members (Center to Center) (In Inches)</th>
<th>Maximum Spacing of Fasteners (Center to Center) (In Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Ply</td>
<td>Horizontal</td>
<td>Perpendicular only</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>$\frac{1}{2}$</td>
<td>Horizontal</td>
<td>Perpendicular only</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>8</td>
<td>Temporary Nailing or Shoring to Comply with Section 4711 (d)</td>
</tr>
<tr>
<td>$\frac{5}{8}$</td>
<td>Horizontal</td>
<td>Perpendicular only</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>Either Direction</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

---

*a For Fire-resistive Construction, see Tables No. 43-B and 43-C. For Shear-resisting Elements, see Table No. 47-I.

*b Nails for wood framing shall be long enough to penetrate into wood members not less than $\frac{3}{4}$ inch and the sizes shall comply with the provisions of Table No. 47-G. For nails not included in Table No. 47-G, use the appropriate size cooler nail as set forth in Table No. 25-24-A of U.B.C. Standard No. 25-24. Nails for metal framing shall comply with the provisions of Table No. 47-G.

*c Screws shall comply with the provisions of Table No. 47-G.

*d Staples shall be not less than No. 16 gauge by $\frac{3}{4}$ inch crown width with leg length of $\frac{3}{4}$ inch, $1 \frac{1}{4}$ inch and $1 \frac{3}{8}$ inch for gypsum wallboard thicknesses of $\frac{3}{8}$ inch, $\frac{1}{2}$ inch and $\frac{5}{8}$ inch respectively.
<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Thickness of Material</th>
<th>Wall Construction</th>
<th>Nail-spacing Maximum (In Inches)</th>
<th>Shear Value</th>
<th>Minimum Nail Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wooven or Welded Wire Lath and Portland Cement Plaster</td>
<td>7/16&quot;</td>
<td>Unblocked</td>
<td>6</td>
<td>180</td>
<td>No. 11 gauge, 1 1/2&quot; long with 7/16&quot; diameter head nail or No. 16 gauge staples having 7/16&quot; long legs.</td>
</tr>
<tr>
<td>Gypsum Lath, Plain or Perforate</td>
<td>7/16&quot; Lath and 1/2&quot; Plaster</td>
<td>Unblocked</td>
<td>5</td>
<td>100</td>
<td>No. 13 gauge, 1 1/4&quot; long, 19/64&quot; head, plasterboard blued nail</td>
</tr>
<tr>
<td>Gypsum Sheathing Board</td>
<td>1/2&quot; x 2' x 8'</td>
<td>Unblocked</td>
<td>4</td>
<td>75</td>
<td>No. 11 gauge, 1 3/4&quot; long, 7/16&quot; head, diamond point, galvanized</td>
</tr>
<tr>
<td></td>
<td>1/2&quot; x 4'</td>
<td>Blocked</td>
<td>4</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>Gypsum Wallboard</td>
<td>1/2&quot;</td>
<td>Unblocked</td>
<td>7</td>
<td>100</td>
<td>5d cooler nails</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blocked</td>
<td>4</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blocked</td>
<td>4</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blocked</td>
<td>Base Ply 9</td>
<td>250</td>
<td>Base Ply - 6d cooler nails</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Face Ply 7</td>
<td></td>
<td>Face Ply - 8d cooler nails</td>
</tr>
</tbody>
</table>

*a These vertical diaphragms shall not be used to resist loads imposed by masonry or concrete walls. Values are for short-time loading due to wind or earthquake and must be reduced 25 percent for normal loading.

*b Applies to nailing at all studs, top and bottom plates, and blocking.
### TABLE NO. 47-J

**SOFTWOOD PLYWOOD PANELING**
(Meeting Requirements of U.B.C. Standard No. 25-9.)

<table>
<thead>
<tr>
<th>PLYWOOD THICKNESS (Inch)</th>
<th>MAX. SUPPORT SPACING (Inches)</th>
<th>NAIL SIZE AND TYPE</th>
<th>NAIL SPACING (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>16**</td>
<td>4d casing or finish</td>
<td>6</td>
</tr>
<tr>
<td>3/8</td>
<td>24</td>
<td>6d casing or finish</td>
<td>6</td>
</tr>
</tbody>
</table>

* Twenty inches if face grain of paneling is across supports.

### TABLE NO. 47-K

**PREFABRICATED STEEL STUDS**

<table>
<thead>
<tr>
<th>Overall Partition Thicknessa (Inches)</th>
<th>Stud Size (Inches)</th>
<th>Stud Spacingb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24'' 19'' 16'' 12''</td>
</tr>
<tr>
<td>3 1/8 or 3 3/8</td>
<td>1 5/8 or 1 7/8</td>
<td>7' 8' 9' 10'</td>
</tr>
<tr>
<td>3 1/4</td>
<td>2</td>
<td>8' 9' 10' 14'</td>
</tr>
<tr>
<td>4</td>
<td>2 1/2</td>
<td>9' 14' 15' 18'</td>
</tr>
<tr>
<td>4 3/4</td>
<td>3 1/4</td>
<td>13' 18' 21' 22'</td>
</tr>
<tr>
<td>5 1/4</td>
<td>4</td>
<td>16' 20' 22' 25'</td>
</tr>
<tr>
<td>7 1/4</td>
<td>6</td>
<td>20' 24' 26' 29'</td>
</tr>
</tbody>
</table>

### TABLE NO. 47-L

**LIMITING HEIGHTS**

<table>
<thead>
<tr>
<th>Stud Width (Inches)</th>
<th>Stud Width (MM)</th>
<th>Stud Spacing, o.c. (Inches</th>
<th>MM)</th>
<th>Single Layer (each side) (Feet</th>
<th>M)</th>
<th>Double Layer (each side) (Feet</th>
<th>M)</th>
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<tbody>
<tr>
<td>1 5/8</td>
<td>41.3*</td>
<td>16 406</td>
<td>8</td>
<td>2.44</td>
<td>10</td>
<td>3.05</td>
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<tr>
<td>2 1/2</td>
<td>63.5</td>
<td>16 406</td>
<td>8</td>
<td>2.44</td>
<td>10</td>
<td>3.05</td>
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<tr>
<td>3 5/8</td>
<td>92.1</td>
<td>16 406</td>
<td>12</td>
<td>3.66</td>
<td>14</td>
<td>4.27</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE 1.** Where studs are continuous through suspended ceilings to the underside of floor or roof above, and ceiling adds stability to the partition or, studs are adequately braced at or below specified limiting height, the overall partition height may be increased 50 percent.

**NOTE 2.** Special height limitations or added bracing may be required for framing used for application of water resistant gypsum backing board to receive ceramic tile. Consult the Board manufacturer's recommendations for special installation details.

* 1 5/8 inch (41.3 mm) studs with single layer of gypsum board recommended for chase walls and closets only.

o.c. On center.
<table>
<thead>
<tr>
<th>Type of Furring</th>
<th>Maximum Spacing (c to c)(^a)</th>
<th>Maximum Span</th>
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<tbody>
<tr>
<td></td>
<td>Inches (MM)</td>
<td>Feet (M)</td>
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<tr>
<td>Furring member (drywall hat shaped)</td>
<td>24 (610)</td>
<td>4 (1.2)</td>
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<tr>
<td>1 ¾ inch (41.3 mm) stud (erected with open side up</td>
<td>24 (610)</td>
<td>5 (1.5)</td>
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<tr>
<td>and against support)</td>
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<td></td>
</tr>
<tr>
<td>2 ½ inch (63.5 mm) stud (erected with web vertical</td>
<td>24 (610)</td>
<td>6 (1.8)</td>
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<tr>
<td>to support)(^b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 ½ inch (92.1 mm) stud (erected with web vertical</td>
<td>24 (610)</td>
<td>8 (2.4)</td>
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<tr>
<td>to support)(^b)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Center to Center

\(^b\) Consult 6.1.6.3 ASTM C 754 for maximum spacing as determined by gypsum board thickness.

\(^b\) A 6 inch (152 mm) length of same size stud shall be nested to form a "box" at each saddle tie.
CHAPTER 48
INCINERATORS, CREMATORIES, FIREPLACES, AND
ARBECUES

SECTION 4801. GENERAL.
(a) Scope. In addition to the other requirements of this Building Code, this
Chapter shall govern the installation, repair, maintenance, and approval
of all incinerators, crematories, fireplaces, and barbecues. For purposes
of this Building Code, barbecues shall be considered fireplaces and shall
meet all the requirements of fireplaces.
(b) Locations Prohibited. Installation of any type incinerator, barbecue
(fixed or portable), or fireplace, in garages or in areas containing ex-
plosive or flammable liquids or fumes, is expressly prohibited, unless sepa-
ratated therefrom by at least a one-hour fire-resistive separation, without
any openings to the areas specified herein. See Chapter 17.
(c) Location of Incinerators. All outside incinerators shall be located in
accordance with Zoning requirements, and shall be so placed that they
will not constitute a fire hazard to adjacent buildings or structures.
(d) Plans. See Chapter 3.
(e) Trash Chute Vent. All trash chutes shall be vented to the outside in an
approved manner.
(f) Trash Chute Charging Doors. Trash chute charging doors shall be an
approved, self-closing, locking type, and shall provide a one-hour fire-
resistive rating.
(g) Trash chute Opening. The opening of a trash chute into the trash
room shall be protected by a counter balanced self-closing door, held
open by a 135 degree F. fusible link or other approved device. This door
shall be in a normally open position.

SECTION 4802. DEFINITIONS.
(a) General. The following words, phrases, terms and their derivatives
shall be interpreted as set forth in this Section.
1. Air. All air supplied to the incinerator equipment for combustion,
ventilation, cooling, etc. Standard air is air at standard temperature
and pressure, namely 60 degrees F., and 29.92 inches mercury.
   A. Excess Air. The air remaining after a fuel has been completely
   burned, or that air supplied in addition to the theoretical quan-
tity.
   B. Overfire Area. Air controlled in quantity and direction sup-
   plied above the fuel bed.
   C. Primary Air. Any air controlled with respect to quantity and
direction, forced or induced, supplied through or adjacent to the
fuel bed, for the purpose of promoting combustion of the com-
bustible materials in the fuel bed.
   D. Secondary Air. Any air controlled with respect to quantity
and direction, supplied beyond the fuel bed, as through ports in
the walls or bridge wall, or the secondary combustion chamber,
for the purpose of completing combustion of combustible
materials in the gases from the fuel bed or to reduce operating
temperature within the incinerator.
E. **Theoretical Air.** The exact amount of air required to supply oxygen for complete combustion of a given quantity of a specific fuel.

F. **Underfire Air.** Air controlled with respect to quantity and direction, forced or induced, supplied beneath the grate that passes through the fuel bed.

2. **Air-Setting Bonding Mortars.** Air-setting bonding mortars are those which take a rigid set when dried. They are prepared from suitable refractory materials by proper selection and combination. Chemical binders impart air-setting properties and maintain the strength of the bond up to the temperature at which the ceramic bond takes effect. Air-setting mortars form mechanically strong joints with high resistance to abrasion and erosion. They bond the wall the whole way through, from the hot to the cold surface.

3. **Auxiliary-Fuel Firing Equipment.** Equipment to supply additional heat, by the combustion of an auxiliary fuel, for the purpose of attaining temperatures sufficiently high:
   A. To dry and ignite the waste material.
   B. To maintain ignition thereof.
   C. To promote complete combustion of combustible solids, vapors, and gases.

4. **Baffle.** Refractory construction intended to change the direction of flow of the products of combustion.

5. **Breeching or Flue Connection.** A passage for conducting the products of combustion to the stack or chimney.

6. **Bridge Wall.** A partition wall between chambers over which pass the products of combustion.

7. **British Thermal Unit.** The quantity of heat required to raise one pound of water from 59 degrees F. to 60 degrees F., usually abbreviated B.T.U., or Btu.

8. **Burning Area.** The horizontal projected area of grate, hearth, or combination thereof, on which active burning takes place.

9. **Burning Rate.** The amount of waste incinerated, usually expressed in pounds per hour per square foot of burning area.

10. **By-Pass.** An arrangement of breechings or flue connections and dampers, to permit the alternate use of two or more pieces of equipment by directing, or diverting, the flow of the products of combustion.

11. **Capacity.** The amount of waste incinerated, usually expressed in pounds per hour with the characteristics or type of waste stipulated.

12. **Checkerwork.** A pattern of multiple openings in refractory through which the products of combustion pass to promote turbulent mixing of the gases.

13. **Chimney, Stack, or Flue.** See Chapter 37.

14. **Curtain Wall.** A partition wall between chambers under which pass the products of combustion.

15. **Damper.** A manually or automatically controlled device to regulate draft, or the rate of flow of air or combustion gases.
   A. **Barometric.** A hinged or pivoted balanced blade placed to admit air to the breeching, flue connection, or stack, thereby automatically maintaining a constant draft in the incinerator.
B. Guillotine. An adjustable blade installed vertically in a breeching or flue connection, arranged to move vertically across the breeching or flue connection.

C. Butterfly. A plate or blade installed in a duct, breeching, flue connection, or stack which rotates on its axis.

D. Sliding. An adjustable blade installed in a duct, breeching, flue connection, or stack, arranged to move horizontally across the duct, breeching, flue connection, or stack.

16. Destructor. An incinerator meeting the requirements of Class III, Class VI, or Class VII incinerators.

17. Down Pass. A gas passageway placed between 2 chambers to carry the products of combustion in a downward direction.

18. Draft. The pressure difference between the incinerator or any component part and the atmosphere, which causes a continuous flow of air and products of combustion through the gas passageways of the incinerator to the atmosphere.
   A. Forced Draft. The pressure difference created by the action of a fan, blower, or ejector which supplies the primary combustion air above atmospheric pressure.
   B. Induced Draft. The pressure difference created by the action of a fan, blower, or ejector which is located between the incinerator and the stack, or at the stack exit.
   C. Natural Draft. The pressure difference created by the stack or chimney, due to its height and the temperature difference between the flue gases and the atmosphere.

19. Drop Arch. Any vertical refractory wall supported by arch construction.

20. Drying Hearth. A surface within the primary chamber upon which wet waste material is deposited for drying prior to burning.

21. Expansion or Setting Chamber. A chamber designed to reduce the velocity of the products of combustion to promote the setting of fly ash from the gas stream.


23. Fireplace. A square, rectangular, circular, or oval opening made at the base of a chimney in or against the wall of a room, or free-standing within a room, and surrounded with brick, stone, metal, or other noncombustible material, to hold an open fire.

24. Flue Connection or Breeching. See Breeching.


26. Fly Ash Collector. Auxiliary equipment designed to remove fly ash in dry form from the products of combustion.

27. Gas Washer or Scrubber. Auxiliary equipment designed to remove pollutants in wet form from the products of combustion.

28. Grate. A surface with suitable openings to support the fuel bed and permit passage of air through the burning fuel. It is usually located in the primary combustion chamber, is designed to permit removal of unburned residue and may be horizontal or inclined, stationary or movable.

29. Heating Value and Heat of Combustion. The heat released by
combustion of a unit quantity of waste or fuel, measured in British Thermal Units.

30. **Heat Release Rate.** The amount of heat liberated during the process of complete combustion, expressed in Btu per hour per cubic foot of the internal furnace volume in which such combustion takes place.

31. **Hot Drying Hearth.** A surface upon which wet material is placed to dry by the action of hot combustion gases that pass successively over the wet material and under the hearth.

32. **Incineration.** The process of igniting and burning solid, semisolid, or gaseous combustible waste to carbon dioxide and water vapor.
   A. **Commercial and Industrial.** Shall be as classified elsewhere in this Chapter. See Section 4815.
   B. **Domestic Gas-Fired Type.** An approved direct-fed gas-fired type, generally located within a building or structure, and designed primarily for use in Group I occupancies for the burning of ordinary waste material, with a capacity of no more than 4 bushels.
   C. **In-Line Type.** A multiple chamber incinerator which when viewed from above, the line of travel of the smoke through the incinerator is a straight line.
   D. **Retort Type.** A multiple chamber incinerator which when viewed from above, the line of travel of the smoke through the incinerator incorporates two 90 degree bends and provides a reversal of the direction of flow.

33. **Mixing Chamber.** A chamber, usually placed between the primary combustion chamber and the secondary combustion chamber, where thorough mixing of the products of combustion is accomplished by turbulence created by increased velocities of the gases, checkerwork, and/or turns in direction of the gas flow.

34. **P.C.E.** Pyrometric Cone Equivalent.

35. **Primary Combustion Chamber.** A chamber within an incinerator where primary ignition and burning of waste occur.

36. **Rubbish.** See Section 4814(c).

37. **Secondary Combustion Chamber.** A chamber where unburned combustible materials from the primary chamber are completely burned.

38. **Settling or Expansion Chamber.** A chamber designed to reduce the velocity of the products of combustion to promote the settling of fly ash from the gas stream.

39. **Trash.** See Section 4814(a) and (b).

**SECTION 4803. FIREPLACES.**

(a) **General.** Fireplaces, barbecues, and smoke chambers shall be of solid masonry, reinforced concrete, or hollow block when the voids are filled with concrete, and shall conform to requirements of this Section. Gas logs are not permitted. See Chapter 51.

(b) **Fireplace Walls.** Structural walls of fireplaces shall be at least 8 inches thick. Firebox walls shall be at least 8 inches in thickness. The firebox shall be 20 inches in depth, and shall be lined with 4 1/2 inches of firebrick. The maximum thickness of joints in firebrick shall be 1/4 inch.
A firebox will be permitted to be open on all sides, provided all fireplace openings are located entirely within one room. All firebrick shall be set in air-setting mortar.

(c) **Fireplace Hoods.** Metal hoods used as a part of a fireplace or barbecue shall be at least No. 18 gauge copper, galvanized steel, or other equivalent corrosion-resistant ferrous metal, with all seams and connections of smokeproof, unsoldered construction. The hoods shall be sloped at an angle of 45 degrees or less from the vertical, and shall extend horizontally at least 6 inches beyond the limits of the firebox. Metal hoods shall be kept a minimum of 18 inches from combustible materials, unless approved for reduced clearance.

(d) **Metal Heat Circulators.** Approved metal heat circulators may be installed in fireplaces, provided the thickness of the fireplace walls is not reduced.

(e) **Smoke Chamber.** All walls shall be at least 8 inches in thickness.

(f) **Clearance.**

1. The distance between a fireplace and combustibles shall be at least 4 inches; and combustibles shall not be placed within 6 inches of the fireplace opening. Wood facings or trim normally placed around the fireplace opening may be permitted when conforming to the requirements of this Section; however, facings or trim shall be furred out from the fireplace wall at least 4 inches, and attached to noncombustible furring strips. The edges of facings or trim shall be covered with an noncombustible material. Where the walls of the fireplace are 12 inches thick, the facing or trim may be directly attached to the fireplace.

2. Parts of metal hoods used as part of a fireplace or barbecue shall be at least 18 inches from combustible material.

(g) **Lining.** The lining shall extend from the throat of the fireplace to a point at least 4 inches above the top of the enclosing masonry walls.

(h) **Areas of Flues, Throats, and Dampers.** The net cross-sectional areas of the flue, and of the throat between the firebox and the smoke chamber of a fireplace, shall be at least that required in Chapter 37. When dampers are used, damper openings, when fully opened, shall be at least equal to the required flue area and shall be a minimum of No. 12 gauge metal.

(i) **Lintel.** Masonry over the fireplace opening shall be supported by an noncombustible lintel.

(j) **Hearth.** Every fireplace shall be provided with a brick, concrete, stone, or other approved incombustible hearth slab at least 12 inches wider on each side than the fireplace opening, and projecting at least 18 inches therefrom. This slab shall be at least 4 inches thick, and shall be supported by incombustible materials or reinforced to carry its own weight and all imposed loads. Combustible forms and centering shall be removed.

**EXCEPTION:** A hearth material shall not be required where the fire pit is depressed at least 6 inches below the rim of the firebox, and the unit is installed at least 30 inches above the floor and designated for cooking purposes only.

(k) **Firestoping.** Firestoping between chimneys and wooden construction shall meet the requirements specified in Chapter 25.
(l) **Support.** Fireplaces shall be supported on foundations designed in conformity with Chapters 23, 24, and 29, or as approved by the Department.

(m) **Screens.** Screens or acceptable protection shall be provided for all fireplace openings.

(n) **Other Type Fireplaces.** Other fireplaces not conforming to the requirements of this Section shall be subject to approval by the Department prior to installation. Imitation fireplaces shall not be used for the burning of gas, solid or liquid fuel. Factory built fireplaces may be installed when approved by the Department, and shall conform to the applicable portions of this Building Code and Chapter. Factory built fireplaces shall bear the seal of a nationally recognized testing laboratory.

**SECTION 4804. DOMESTIC GAS-FIRED INCINERATORS.**

(a) **General.** This Section shall apply to approved gas-fired, freestanding incinerators with a loading capacity of not more than 4 bushels. Gas-fired incinerators shall comply with the following:

1. Clearances to permit access and servicing of the unit shall be provided.

2. When an incinerator is installed in a confined area, and when air is supplied from ventilated adjacent areas to the room housing the incinerator, 2 openings, one near the floor and one near the ceiling, each with a minimum net free area of 100 square inches, shall be provided in the room door or walls.

3. When adjacent areas do not have sufficient air infiltration, air shall be supplied from outdoors directly to the room housing the incinerator through an opening, or openings, with a total net free area of 100 square inches.

4. Incinerators shall have a clearance to combustible material of at least 12 inches at sides and rear, at least 30 inches at front and 36 inches above.

**EXCEPTIONS:**

A. Incinerators approved for installation with a lesser clearance than herein specified may be installed in accordance with the conditions of such approval.

B. Clearance shall not be required when of masonry construction of 4 inches or more thickness, except on the service side where the clearance shall be at least 30 inches.

5. Incinerators shall be mounted or set on masonry floors.

**EXCEPTION:** Incinerators approved for installation on combustible floors may be installed in accordance with the conditions of such approval.

6. All new domestic gas-fired incinerators shall meet the smokeless and odorless requirements of AGA Z-21.6

**SECTION 4805. OTHER TYPES OF INCINERATORS.** Incinerators of types other than those herein regulated, and special large capacity incinerators and refuse burners, shall be constructed and installed in a manner approved by the Department.
SECTION 4806. REFUSE CHUTES. Refuse chutes shall not feed directly to the combustion chamber of an incinerator unless otherwise permitted by this Chapter. Chutes shall discharge into a room or bin enclosed and separated from the incinerator room by floors, ceilings and walls of at least 2-hour fire-resistive construction. The opening through which material is transferred from the room or bin to the incinerator shall be equipped with a 1-1/2-hour fire-resistive door, with an approved self-closing device. Refuse chutes shall rest on an incombustible foundation. The enclosing walls of chutes shall consist of brick or concrete masonry at least 8 inches thick, reinforced concrete at least 6 inches thick, or as approved by the Department.

SECTION 4807. FIXED BARBECUE PITS. Barbecue pits shall conform to the requirements for fireplaces.

SECTION 4808. CREMATORIES.

(a) General. In addition to other requirements of this Building Code, the following shall govern the construction of crematories. For purposes of this Building Code and Chapter, a crematory shall include any device used to incinerate human bodies, for which burial permits are required by either the State of Colorado or the City. Pathological incinerators shall be considered as commercial incinerators.

(b) Construction.

1. Firebox.
   A. The firebox of every crematory shall be enclosed with walls, floors, and ceilings with at least 6 inches of super duty firebrick set in super duty refractory mortar, backed with 2 1/2 inches of insulating firebrick conforming to the requirements of Group 20 of the ASTM C-155, or its equivalent. The outside covering for the firebox shall be constructed of at least 12 U.S. Standard Gauge Steel.

2. Other Types of Fireboxes. Other approved firebox construction may be used in lieu of the requirements of this Section, provided the exterior shell temperature does not exceed 160 degrees F.

3. Firebrick.
   A. Firebrick for lining a crematory combustion chamber shall be super duty firebrick, pyrometric cone, equivalent to at least a cone No. 33, conforming to the requirements of ASTM C-64.
   B. Firebrick for lining secondary combustion chambers, connecting passageways and breechings, shall be at least Type A high duty firebrick, pyrometric cone, equivalent to at least a cone No. 31.5, conforming to the requirements of ASTM C-64.
   C. Super or high duty firebrick, when used, shall be laid in high temperature mortar; medium duty firebrick, when used, shall be laid in high temperature mortar, all conforming to ASTM C-105.

4. Castable Refractory. Fireclay base castable refractory products may be approved in lieu of super or medium duty firebrick, respectively, provided the products are equivalent to super, high, or medium duty fireclay brick, in accordance with Class F, C, or B castable refractory conforming to ASTM C-64.

5. Chimneys. Firebrick for the lining of chimneys shall be at least
Type F medium duty firebrick, pyrometric cone No. 29, conforming to ASTM C-64.

(c) Prefabricated Crematories. Prefabricated crematories shall be approved by the Department when conforming to the requirements of this Chapter, or as an alternate material or method as described in Chapter 1.

(d) Burners.

1. Connections and Installations. In addition to the requirements of this Chapter, installation of gas or liquid fuel burners, venting, piping, and controls in connection with crematories shall comply with Chapters 37 and 51 of this Building Code.

2. Air. Burners for crematories shall be power burners with primary and secondary air supplied by a blower.
   A. Combustion air shall be supplied from outside the building. Air intake shall be designed so that velocity at the louver shall not exceed 300 feet per minute, based on 20 percent excess air.

3. Pilots. Burners shall be provided with a gas or liquified petroleum gas pilot, controlled by a flame rod or ultraviolet scanner, or approved electronic controls.

4. Flame Failure. Burners shall be provided with 100 percent flame failure protection with manual reset or as approved by the Department.

5. Oil. Oil burners shall not use oil heavier than No. 2 fuel oil.

6. Limiting Controls. Crematory burners shall be provided with indicating high temperature limiting controls, with thermocouples mounted in both primary and secondary chambers.

7. Primary and Secondary Chambers. Burners shall be provided in both the primary and secondary chambers.

8. Heat Release. Total heat release within the combustion chamber shall not exceed 40,000 Btu per cubic foot per hour.

9. Barometric Daper. A barometric damper shall be provided to control the draft of the crematory in accordance with manufacturer's recommendations.

10. Induced Draft. Where an induced draft fan is used, a low draft switch shall be provided and interlocked with all burners.

(e) Electrical. Electrical work performed in connection with the installation of a crematory shall be accomplished in accordance with Chapter 53 of this Building Code.

(f) Location.

1. Requirements. Crematories shall be installed in a room which shall comply to the following:
   A. Walls, floor, and ceiling shall be constructed of at least one-hour fire-resistive material, or equivalent to the fire-resistive construction of the building itself, whichever is more restrictive.
   B. Fire-resistive doors shall be installed equivalent to the type of enclosure required.
   C. Openings into a garage or areas where flammable liquids are used or stored shall not be permitted.

2. Prefabricated or Other Approved Crematories. The location of
prefabricated or other approved types of crematories shall require approval from the Department.

(g) **Name Plate.** Every crematory shall be provided with a metal plate, or plates, permanently attached to the crematory in a conspicuous location so that it may be easily read. The plate shall bear the manufacturer's name; the trade name of the crematory, if any; the model number; the rated capacity for which it is designed; and the date installed.

(h) **Operating Instructions.** Complete instructions for the proper operation of the crematory and all necessary equipment shall be posted on a card adjacent to the crematory, and shall include at least the following:
   1. Steps required to start and stop burners.
   2. Operation of controls and instruments.
   3. Routine maintenance required.

(i) **Ventilation.** See Chapter 52.

**SECTION 4809. COMMERCIAL AND INDUSTRIAL INCINERATORS.**

(a) **Location.** Inside incinicators, with their waste material bin or containers, shall be located either in a room or compartment used only for that purpose, or in a room devoted exclusively to boilers or a heating plant. In either case, the room shall be separated from the balance of the building by one-hour fire-resistive walls, floors, and ceilings, with all openings equipped with a one-hour fire-resistive door, and provided with approved self-closing devices.

(b) **Incinerator Room Isolation.** Natural draft incinicators shall be completely isolated from the effect of any air-conditioning system, boiler room induced draft system, or any other ventilating system.

(c) **Sprinklers.** Every incinerator room shall be provided with automatic fire sprinklers as required in Chapter 38, except when the incinerator burns only Type 4 waste, and is approved in writing by both the Department and the Fire Department.

(d) **Egress.** See Chapter 33.

(e) **Ventilation.** Ventilation shall be provided in accordance with the requirements of Chapter 52.

(f) **Incinerator for Combination Waste.** Any incinerator which is designed to burn a combination of wastes, and where such combinations do not fall into the category of the “Classification of Incinicators” as set forth herein, the incinerator shall be Class VI or Class VII. In the design, the specific wastes shall be classified into the standard categories for such wastes, and the portion of the incinerator chamber burning this waste shall conform to the minimum and maximum set forth for that category. The total products of combustion, and the total heat release and burner capacities, shall be used in determining the sizes of the down pass, final combustion chamber, flue connection, and stack.

(g) **Pathological Incinicators.** When Type 4 waste is included in mixed waste, the Department may determine the need for a pathological incinerator.

(h) **Operating Instructions.** The incinerator operator shall follow the written operating instructions of the manufacturer. One copy of the instructions shall be posted in the incinerator room.

(i) **Name Plate.** A name plate shall be conspicuously fastened to the in-
cinerator indicating the manufacturer's name, model number, rated capacity of the unit, the type of waste for which it is designed, and date installed.

(j) **Scrubbers.** Alkaline scrubbers, or other approved devices, shall be required for incinerators burning halogenated compounds.

(k) **Prohibitions.**
1. It shall be unlawful to burn solid waste in any fireplace or barbecue.
2. In-line incinerators with a burning capacity of less than 750 pounds per hour shall not be installed.
   
   **EXCEPTION:** In existing buildings, where space is not available for a retort type incinerator, in-line incinerators shall be installed only with the written approval of the Department.

**SECTION 4810. DESIGN.** Incinerators shall be designated in accordance with the requirements of this Section.

(a) **Incinerator Volume.** The interior incinerator volume requirements of this Chapter shall be calculated by measuring the inside distance between the side walls and from the front end to the rear wall and from paving to roof, excluding ash pit, interior walls, grates, and hearth. Door openings, chutes, charging hoods, or flue connections, shall not be considered a part of the incinerator volume. The volume of the charging door opening through which the refuse is placed in the incinerator may be considered a part of the furnace volume. Roof height above the grate shall not be less than \(4/3 (A_G)^{4/11} \pm 10\) percent where \(A_G\) is the grate area, except Class VI incinerator. Total heat release in the entire incinerator shall not exceed 25,000 Btu per cubic foot per hour.

(b) **Settling Chamber.** A chamber shall be provided in which the products of combustion are reduced in velocity to 9 feet per second at 1400 degrees Farenheit, while traveling in a vertical plane. The length of gas travel at 9 feet per second shall be a distance at least the square root of the horizontal cross-sectional area of the settling chamber, measured from the top of the opening under the curtain wall to the roof of the incinerator, or to the top of the breeching connection, whichever is lower.

(c) **Flame Port.** The flame port shall be designed to provide a velocity of not less than 50 feet per second, calculated at 1,000 degrees F.
   
   **EXCEPTION:** Domestic gas-fired, Class I and Class IA.

(d) **Down Pass.** All incinerators, except gas-fired domestic, shall include a down pass and/or other means of creating turbulence for the gases of combustion, to assure thorough mixing of the gases prior to their entering the secondary combustion chamber.

(e) **Refractory Lining.**
1. Refractory lining 4 1/2 inches in thickness shall be required, except where the area of any wall exceeds 35 square feet. Every wall over 4 feet in height shall be anchored every 4 feet. Castable and/or plastic refractory shall be anchored every 18 inches.
2. Where the area specified in Item 1 of this Sub-Section is exceeded, the lining of all walls and the roof shall be at least 9 inches in thickness.
3. Walls of greater thickness may be required by the Department to provide structural stability.
EXCEPTION: This requirement shall not apply to domestic gas-fired and incinerators of Class I and IA.

(f) Roofs, Arches and Lintels. All roofs or arches shall be so designed that metal supports or lintels are not directly exposed to heat or flame.

(g) Barometric Damper. A barometric damper shall be provided. For natural draft stacks, its free area shall be at least the percentage of the cross-sectional area of the flue connection, breeching, or stack in which it is located as specified in Table No. 48-C.

(h) Dampers.
   1. All incinerators, except gas-fired domestic, shall be provided with a guillotine or sliding damper. Design criteria shall provide at least 10 percent free opening when the damper is in the fully closed position.
   2. Guillotine dampers provided for draft regulation shall be properly counterbalanced, and sliding dampers shall be arranged for easy operation. The dampers shall be constructed of a steel frame with refractory lining or may be constructed entirely of alloy steel to withstand the high temperature. All dampers shall be provided with a damper box, constructed of No. 12 U.S. Gauge Steel, to completely house the damper when in its full open position. All guillotine and sliding dampers shall be provided with an approved locking device.

(i) Mortar. All firebrick shall be laid in high temperature airsetting refractory mortar, meeting the requirements of ASTM C-64. Mortar shall be for the same service as the firebrick.

(j) Metal Casing. A metal casing shall be required for all incinerators.

(k) Insulation. Insulation shall be not less than 2 inches in thickness, but shall provide a shell temperature not in excess of 90 degrees Fahrenheit above normal room temperature after the incinerator is fired for the maximum time normal to the user’s operation, but shall not exceed a temperature of 180 degrees Fahrenheit.

(l) Refuse Charging. Refuse charging may be direct, side, end, or top. However, the charging chutes shall not exceed 6 feet in length, measured from the floor of opening above the incinerator to the outside of the roof of the incinerator. The charging chute shall be constructed of at least No. 12 U.S. Gauge Steel casing, lined with at least 4 1/2 inches of refractory. Where the incinerator is top charged, an induced draft fan shall be provided.

(m) Combustion Air. Air for combustion shall be calculated at 15 pounds per 10,000 Btu total heat release, based on the theoretical air required for complete combustion of liquid and solid fuels of 7 to 7 1/2 pounds of air per 10,000 Btu in these fuels. The requirements shall be 100 percent, or slightly more than 100 percent excess air.

(n) Underfire Air. Underfire air shall not exceed 10 percent of the total air.

SECTION 4811. VENTING. Venting of all incinerators shall conform to the requirements of Chapter 37 and this Section.

(a) Chimney Location.
   1. Height. Every incinerator chimney, except those for domestic gas-fired incinerators, shall extend above the roof as follows:
      A. Natural Draft Chimneys. Natural draft chimneys shall ex-
tend at least 8 feet above the roof, or above the elevation of any part of the building within 10 feet of the chimney.

B. **Induced Draft.** Chimneys serving incinerators provided with induced draft, shall extend at least 3 feet above the roof, or above the elevation of any part of the building within 10 feet of the chimney.

C. **Other Requirements.** When a taller obstruction is within 100 feet of the chimney, an induced draft fan is required unless the chimney extends at least 8 feet above the highest part of the obstruction.

(b) **Chimney Casing.** Incinerator chimneys erected within a building shall be encased in 10 gauge steel. All joints shall be tightly sealed.

(c) **Flue Connections or Breechings.** Flue connections or breechings shall meet the requirements for stacks, except where flue gas temperature reduction is affected. The minimum for unlined breechings shall be 12 gauge Type 316 stainless steel, with clearances as required in Chapter 37 of this Building Code for metal stacks.

(d) **Prohibition.** Incinerators shall not be vented into a chimney or stack serving any other device.

**EXCEPTION:** Gas-fired domestic incinerators.

(e) **Combustion Calculation.** Table No. 48-A includes a column headed “B.T.U. of Aux. Fuel Per Lb. of Waste to be included in Combustion Calculations.” The figures in this column shall be included when determining total heat release within the furnace, and shall also be included, together with the theoretical air required for the fuel, when determining the total products of combustion. The figures in the column headed “Min. Btu/hr. Burner Input per lb. Waste” shall be used to determine minimum capacity of the burner or burners. Secondary burners shall be sized to raise the products of combustion at least 200 degrees Fahrenheit for Type OO, Type O, Type 1, and Type 2 waste, and at least 400 degrees Fahrenheit for waste containing over 10 percent plastics, wax coated or impregnated paper, or other dense smoke producing materials.

(f) **Flue Gas Washers.** Where flue gas washers are installed, a pressure switch and flow switch or thermocouple shall be interlocked with the gas supply to the main burner(s), to interrupt the gas supply in the event of water failure.

**SECTION 4812. BURNERS.** All burners for incinerators shall be power type, and the controls shall comply to the requirements of Chapter 51.

(a) **Secondary Burners.** All new incinerators, except gas-fired domestic, shall provide for secondary burner(s). See Section 4811(e). Primary burners shall be provided as required in Table 48-A.

(b) **Auxiliary Firing.** All auxiliary firing equipment for incinerators and crematories shall comply with Chapter 51.

**SECTION 4813. PERMITS.**

(a) **Permit to Construct.** A permit shall be required to erect an incinerator. See Chapter 3.

**SECTION 4814. WASTE ANALYSIS.** For purposes of this Chapter, all types of waste to be destroyed shall be classified as follows:

(a) **Type 00 Waste.** Trash consisting of a mixture of highly combustible
waste such as paper, paper products, cardboard, cartons, wood boxes, and combustible floor sweepings from commercial and industrial activities. The mixture contains up to 10 percent by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags, and plastic or rubber scrap. This type of waste contains up to 10 percent moisture, 5 percent noncombustible solids, has a bulk density of less than 8 pounds per cubic foot, and has a heating value of 8,500 Btu per pound as fired.

(b) **Type 0 Waste.** Trash consisting of a mixture of highly combustible waste such as paper, paper products, cardboard, cartons, wood boxes, and combustible floor sweepings from commercial and industrial activities. The mixtures contain up to 10 percent by weight of plastic bags, coated paper, laminated paper, treated corrugated cardboard, oily rags, and plastic or rubber scrap. This type of waste contains up to 10 percent moisture, 5 percent noncombustible solids, has a bulk density of 8 to 10 pounds per cubic foot, and has a heating value of 8,500 Btu per pound as fired.

(c) **Type 1 Waste.** Rubbish consisting of combustible waste such as paper, paper products, cartons, rags, wood scraps, sawdust, foliage, and floor sweepings from domestic, commercial and industrial activities. This type of waste contains up to 25 percent moisture, up to 10 percent noncombustible solids, has a bulk density of 8 to 10 pounds per cubic foot, and has a heating value of 6,500 Btu per pound as fired.

(d) **Type 2 Waste.** Refuse consisting of approximately even mixture of rubbish and garbage by weight. This type of waste consists of up to 50 percent moisture, 7 percent noncombustible solids, has a bulk density of 15 to 20 pounds per cubic foot, and has a heating value of 4,300 Btu per pound as fired.

(e) **Type 3 Waste.** Garbage consisting of animal and vegetable wastes. This type of waste contains up to 70 percent moisture, up to 5 percent noncombustible solids, has a bulk density of 30 to 35 pounds per cubic foot, and has a heating value of 2,500 Btu per pound as fired.

(f) **Type 4 Waste.** Human parts and animal remains consisting of carcasses, organs and solid organic wastes. This type of waste contains up to 85 percent moisture, 5 percent noncombustible solids, has a bulk density of 45 to 55 pounds per cubic foot, and has a heating value of 1,000 Btu per pound as fired.

(g) **Type 5 Waste.** By-product waste, gaseous, liquid, or semiliquid such as tar, paints, solvents, sludge, fumes, etc. Btu values shall be determined for the individual materials to be incinerated.

(h) **Type 6 Waste.** Solid by-product waste such as rubber, plastics, wood-waste, etc. Btu values shall be determined for the individual materials to be incinerated.

**SECTION 4815. CLASSIFICATION OF INCINERATORS.**

(a) **Class I.** Portable, packaged, or job assembled, direct fed incinerators of 5 cubic feet storage capacity or 25 pounds per hour burning rate for Type 1 or Type 2.

(b) **Class IA.** Portable, packaged, or job assembled, direct fed incinerators of 5 cubic feet to 15 cubic feet primary chamber volume or 25 pounds per hour up to, but not including, 100 pounds per hour burning rate for Type 1 of Type 2 waste.
(c) **Class IIA.** Flue-fed incinerators shall be served by two flues, one for charging waste and one for carrying the products of combustion.

(d) **Class III.** Direct-fed incinerators with a burning rate of 100 pounds per hour and over, for Type 00, Type 0, Type 1, or Type 2 waste.

(e) **Class IV.** Direct-fed incinerators with a burning rate of 75 pounds per hour, or over, for Type 3 waste.

(f) **Class V.** Municipal incinerators.

(g) **Class VI.** Crematory and pathological incinerators for Type 4 waste.

(h) **Class VII.** Incinerators designed for specific by-product wastes for Type 5 or Type 6.

**SECTION 4816. REQUIREMENTS FOR INCINERATORS BY CLASSES.**

(a) **General.** These requirements are in addition to the requirements of Section 4809.

(b) **Class I.** This Class for Type 1 or Type 2 waste.
   1. Incinerators shall have a sufficient thickness of refractory lining and insulation to prevent the shell temperature from exceeding 100 degrees Fahrenheit above normal room temperature, but shall not exceed 180 degrees Fahrenheit. Provisions shall be made for expansion to reduce or eliminate injury to the incinerator.
   2. Incinerators shall be constructed to withstand intermittent internal temperatures of 1,800 degrees Fahrenheit, without cracking, warping, or other failure of structural parts, so as to permit flame passage or emission of combustion gases or sparks to the exterior.

(c) **Class IIA.** This Class for Type 1 or Type 2 waste.
   1. The design shall be such that when the incinerator is fired with normal waste to be burned at its rated capacity (in pounds per hour of Type 1 waste or Type 2 waste), the shell temperatures at any point shall not exceed 90 degrees Fahrenheit above normal room temperature, but shall not exceed 180 degrees Fahrenheit. The only exception to this maximum temperature shall be at the surface of the doors and frame and/or at the breeching outlet. The minimum construction of the incinerator shall be No. 16 gauge steel, exterior casing one inch in thickness of high temperature block insulation, and 2 1/2 inch thickness of high heat duty firebrick or a 2 1/2 inch thickness of castable or plastic refractory. The castable or plastic shall be properly anchored to the exterior steel casing.
   2. Incinerators shall be constructed to withstand intermittent internal temperatures of 1,800 degrees Fahrenheit, without cracking, warping, or other failure of structural parts, so as to permit flame passage or emission of combustion gases or sparks to the exterior.

(d) **Class IIB.** This Class of incinerator is for Type 1 or Type 2 waste, fed in small compact packages from 2 or more floors above the incinerator. This Class of incinerator shall be provided with automatic sequence of operation.
   1. Class IIB incinerators shall be served by two flues, one for charging waste and one for carrying the products of combustion. A positive method shall be employed to prevent smoke and fumes from escaping into the charging flue. Provisions shall be made to ensure that the charging flue remains free of vermin and odor.
2. The minimum burning area shall be 0.10 square foot per sleeping room, and combustion calculations based on 3 hours burning per day. Burning area may consist of a combination drying hearth and cast iron grate, but the hearth area shall not exceed 50 percent of the total burning area.

3. The primary chamber shall have a volume of at least 4 cubic feet for each square foot of burning area. The shell temperature shall not exceed 90 degrees Fahrenheit above normal room temperature, but shall not exceed 180 degrees Fahrenheit.

4. Primary (underfire), secondary and overfire air shall be provided through adjustable openings, to meet the minimum requirements set forth in Section 4810(n).

5. Service openings at each floor shall not have a daylight opening that exceeds 1/3 the cross-sectional area of the charging flue. In no case shall the daylight opening exceed 160 square inches. Service opening or other charging device shall be designed with no projection into the flue and with the opening to the flue interior closed off while the service opening door is fully open. This door shall close automatically upon release.

A. Service openings shall be located in an area of the building where ventilating or air conditioning will not create negative pressures, i.e., use the flue as a source of air when the service opening is open.

6. Refractory lining of the incinerators shall meet the requirements of Section 4810(e).

7. Incinerators under this Class shall contain a system to control gas velocities and emissions. This system shall include secondary combustion chambers, burners, settling chambers, and gas washers or scrubbers.

(e) **Class III.** This Class of incinerator is for Type 1 or Type 2 waste.

1. When designed to burn Type 1 waste, the incinerator shall contain cast iron grates, stationary or dump, or combination thereof, with air openings of at least 40 percent of total burning area. In lieu of 100 percent grate area, up to 20 percent of the total burning area may be solid hearth.

2. When designed to burn Type 2 waste, the incinerator shall contain combination drying hearth and cast iron grate area, each approximately 50 percent of the total burning area. Where step grates or sloping grates are used in lieu of hearth, they shall provide at least 50 percent of the grate surface.

3. Maximum burning rate per square foot of primary area shall be as indicated in Table 48-B. The areas of grate and hearth shall be calculated on a horizontal projected area, and not on the line of the slope or area of individual steps.

(f) **Class IV.** This Class of incinerator is for burning Type 3 waste on a hot drying hearth.

1. Maximum burning rate per square foot of primary area shall be as indicated in Table 48-B. The area of the hearth shall be calculated on a horizontal projected area, and not on the line of the slope or area of individual steps.

48-15
2. Gas fuel burners shall be provided as required in Table 48-A. Burners shall comply with the provisions of Section 4812.

(g) **Class V.** Construction of this Class of equipment shall be subject to special design formulae.

1. The incinerator shall provide for automatic feeding and firing. Prior to installation, plans and design criteria shall be submitted to the Department for review and approval.

(h) **Class VI.** This Class of incinerator is for Type 4 waste.

1. The incinerator shall be designed to burn the refuse on a hot refractor hearth. The maximum burning rate per square foot of hearth shall be as indicated in Table 48-13.

2. The incinerator shall have burners in both the primary and the secondary chambers, and the Btu inputs shall be as required in Table 48-A. Burners shall comply with the requirements of Section 4812.

3. The curtain wall shall be designed to direct the hot gases beneath the hearth.

4. The volume of the primary chamber shall not be more than 60 percent of the total incinerator volume.

(i) **Class VII.** This Class shall be the same as Class III, Class IV, and Class VI, except that heat release, burning rate and velocities shall be determined from an analysis of waste to be incinerated in each instance.

**SECTION 4817. INCINERATOR DESIGN.**

(a) **General.** An incinerator deviating from this Chapter as to design and/or construction shall be considered an equal, if tests outlined in Subsection (b) of this Section show that emission standards are met. Design criteria and drawings shall be submitted to the Department for approval.

(b) **Test Procedures.** The ASME (Power Test Code, PTC 27) procedures shall serve as a basis for smoke and fly ash emission tests. All tests shall be conducted at rated capacity or less for a continuous duration of 3 hours or less. Tests shall be conducted with waste typical of that to be generated by the user.

**SECTION 4818. INCINERATOR CONSTRUCTION.**

(a) **General.** Minimum construction requirements shall be as set forth in this Chapter. High temperature block insulation shall be required for its high insulating qualities and resistance to deformation under high temperature. High heat duty refractory shall be required for its resistive qualities to temperature, spalling, abrasion, and disintegration.

(b) **Intent.** It is not the intent of this Chapter to preclude the use of specialty refractory materials for construction, even though such special refractory does not have all the resistive qualities of the refractories outlined herein. Refractory materials approved by the Department may be used in certain areas where the special characteristics are of particular advantage, provided the materials have all of the resistive qualities required for that area. For example, where weight of the structure is an important factor, insulating firebrick or insulating castable may be used, but shall not be used in any area where they will be subject to abrasion from tools, materials, or high velocity gases.

(c) **High Temperature Block.** The high temperature block insulation re-
required by this Chapter shall meet Commercial Standards CS-117 and
ASTM C-612-Class 2.

(d) Firebrick. The high heat duty firebrick required by this Chapter shall be in accordance with ASTM C-64, Type A.

(e) Hydraulic Setting Castable Refractory. The hydraulic setting castable refractory required by this Chapter shall be in accordance with ASTM C-96-Class C.

1. All castable refractory walls shall be installed to form a monolithic structure, and shall be anchored to the exterior shell of the incinerator. The arches of the suspended type shall be constructed so that their weight does not rest on the refractory walls. Alloy steel or refractory anchors shall be spaced not more than 18 inches horizontally and vertically, and in accordance with the refractory manufacturer's instructions.

SECTION 4819. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
</table>

LEGEND

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGA</td>
<td>American Gas Association 605 Third Avenue New York, N.Y. 10016</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers 29 West 39th Street New York, N.Y. 10018</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association 470 Atlantic Avenue Boston, Mass. 02210</td>
</tr>
</tbody>
</table>

SECTION 4820. TABLES.
# Table No. 48-A

## Classification of Wastes to Be Incinerated

<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>Principal Components</th>
<th>Approximate Composition % by Weight and Density</th>
<th>Moisture Content %</th>
<th>Incombustible Solids %</th>
<th>B.T.U. of Aux. Fuel per lb. of Waste to be Included in Combustion Calculations</th>
<th>Min. Btu/hr Burner Input/lb. Waste Primary Chamber unless otherwise Specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 00 and 0*</td>
<td>Trash</td>
<td>Combustible waste, paper, paper products, cartons, rags, wood scraps, floor sweepings; domestic, commercial, industrial sources. The mixture contains up to 10% plastic bags, coated or treated paper products and rubber or plastic scrap.**</td>
<td>Waste containing less than 10% plastic or rubber scrap. Density of 00 trash less than 8 pounds/cubic foot and 0 trash 8 to 10 pounds/cubic foot.</td>
<td>10%</td>
<td>5%</td>
<td>8500</td>
</tr>
<tr>
<td>Type 1*</td>
<td>Rubbish</td>
<td>Combustible waste, paper, paper products, cartons, rags, wood scraps, floor sweepings; domestic, commercial, industrial sources. Rubbish 100% (Garbage up to 20%) Density 8-10 lbs/ft³</td>
<td>Rubbish</td>
<td>25%</td>
<td>10%</td>
<td>6500</td>
</tr>
</tbody>
</table>

* The above figures on moisture content, ash and B.T.U. as fired have been determined by analysis of many samples for use in computing heat release, burning rate, velocity and other details of incinerator designs. Any design based on these calculations can accommodate minor variations.

** When trash composition is such that any single charge to the incinerator will contain over 10 percent plastic or rubber scrap by weight, the waste shall be classed Type 6.
### TABLE NO. 48-A

**CLASSIFICATION OF WASTES TO BE INCINERATED**

<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>Principal Components</th>
<th>Approximate Composition % by Weight and Density</th>
<th>Moisture Content %</th>
<th>Incombustible Solids %</th>
<th>B.T.U. Value/lb. of Refuse as Fired</th>
<th>B.T.U. of Aux. Fuel per lb. of Waste to be Included in Combustion Calculations</th>
<th>Min. Btu/hr Burner Input/lb. Waste Primary Chamber unless otherwise Specified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2</strong></td>
<td>Refuse</td>
<td>Rubbish 50% Garbage 50% Density 15-20 lbs/ft.³</td>
<td>50%</td>
<td>7%</td>
<td>4300</td>
<td>0</td>
<td>1500 (See Section 4813(f))</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Garbage</td>
<td>Animal and vegetable wastes, restaurants, hotels, markets; institutional, commercial and club sources.</td>
<td>70%</td>
<td>5%</td>
<td>2500</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Animal solids and organic wastes</td>
<td>Carcasses, organs, solid organic wastes; hospital, laboratory, abattoirs, animal pounds and similar sources.</td>
<td>100% Animal and Human Tissue Density 45-55 lbs/ft.³</td>
<td>85%</td>
<td>1000</td>
<td>3000</td>
<td>5000 Primary 3000 Secondary</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Gaseous liquid or semi-liquid wastes</td>
<td>Industrial process wastes.</td>
<td>Variable</td>
<td>Dependent on predominate Components</td>
<td>Variable according to wastes survey</td>
<td>Variable according to wastes survey</td>
<td>Variable according to wastes survey</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Semi-solid and solid wastes</td>
<td>Combustibles requiring hearth, retort, or grate burning equipment.</td>
<td>Variable</td>
<td>Dependent on predominant components</td>
<td>Variable according to wastes survey</td>
<td>Variable according to wastes survey</td>
<td>Variable according to wastes survey</td>
</tr>
</tbody>
</table>

*The above figures on moisture content, ash and B.T.U. as fired have been determined by analysis of many samples for use in computing heat release, burning rate, speed, velocity and other details of incinerator designs. Any design based on these calculations can accommodate minor variations.*

**When trash composition is such that any single charge to the incinerator will contain over 10 percent plastic or rubber scrap by weight, the waste shall be classed Type 6.**
### TABLE NO. 48-B

**MAXIMUM BURNING RATE LBS./SQ. FT./HR.**

**OF VARIOUS TYPES WASTES**

<table>
<thead>
<tr>
<th>Capacity Lbs./Hr.</th>
<th>Logarithm</th>
<th>Types 00,0,1, and 2 Waste Factor 10</th>
<th>Type 3 Waste Factor 8</th>
<th>Type 4 Waste No Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>2.0</td>
<td>20</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>2.30</td>
<td>23</td>
<td>18</td>
<td>12*</td>
</tr>
<tr>
<td>300</td>
<td>2.48</td>
<td>25</td>
<td>20</td>
<td>14*</td>
</tr>
<tr>
<td>400</td>
<td>2.60</td>
<td>26</td>
<td>21</td>
<td>15*</td>
</tr>
<tr>
<td>500</td>
<td>2.70</td>
<td>27</td>
<td>22</td>
<td>16*</td>
</tr>
<tr>
<td>600</td>
<td>2.78</td>
<td>28</td>
<td>22</td>
<td>17*</td>
</tr>
<tr>
<td>700</td>
<td>2.85</td>
<td>28</td>
<td>23</td>
<td>18*</td>
</tr>
<tr>
<td>800</td>
<td>2.90</td>
<td>29</td>
<td>23</td>
<td>18*</td>
</tr>
<tr>
<td>900</td>
<td>2.95</td>
<td>30</td>
<td>24</td>
<td>18*</td>
</tr>
<tr>
<td>1000</td>
<td>3.00</td>
<td>30</td>
<td>24</td>
<td>18*</td>
</tr>
</tbody>
</table>

*The maximum burning rate in lbs./sq. ft./hr. for Type 4 Waste depends to a great extent on the size of the largest animal to be incinerated. Therefore, whenever the largest animal to be incinerated exceeds one-third the hourly capacity of the incinerator, use a rating of 10 lbs./sq. ft./hr. for the design of the incinerator.

### TABLE NO. 48-C

**USE TO DETERMINE MINIMUM FREE AREA**

**OF BAROMETRIC DAMPERS**

(For Natural Draft Stacks Only)

![Graph showing the relationship between free area of the barometric damper in percentage of cross-sectional area of flue connection or stack and height of chimney or stack above base of the incinerator.](image-url)
TABLE NO. 48-D
NATURAL DRAFT STACKS OR CHIMNEYS

<table>
<thead>
<tr>
<th>Incinerator Capacity in lbs per hour</th>
<th>Class III Incinerators</th>
<th>Class IV Incinerators</th>
<th>Class VI Incinerators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type I Waste</td>
<td>Type II Waste</td>
<td>Type III Waste</td>
</tr>
<tr>
<td></td>
<td>Air**</td>
<td>Stack</td>
<td>Air**</td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td>dia</td>
<td>height*</td>
</tr>
<tr>
<td>50</td>
<td>350</td>
<td>14”</td>
<td>35’</td>
</tr>
<tr>
<td>100</td>
<td>525</td>
<td>16”</td>
<td>35’</td>
</tr>
<tr>
<td>150</td>
<td>700</td>
<td>18”</td>
<td>45’</td>
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<tr>
<td>200</td>
<td>1050</td>
<td>20”</td>
<td>45’</td>
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<td>300</td>
<td>1400</td>
<td>22”</td>
<td>50’</td>
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<td>1750</td>
<td>24”</td>
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<td>500</td>
<td>2100</td>
<td>26”</td>
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<td>700</td>
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<td>30”</td>
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<td>800</td>
<td>3150</td>
<td>32”</td>
<td>55’</td>
</tr>
<tr>
<td>900</td>
<td>3500</td>
<td>34”</td>
<td>55’</td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Air supply is given in cfm @ 70° F and is the minimum which shall be available at all times in the incinerator room at atmospheric or a slight positive pressure. The incinerator room or rooms shall not be under a negative or minus pressure. If the incinerator is charged from a room other than the incinerator room, the quantity of air shown shall be available in both rooms.

The quantity of air shown shall be increased to satisfy the following:
1. If stack or chimney is higher than minimum to satisfy the larger barometric damper involved.
2. If any other equipment requiring air supply is located in the incinerator room or charging room.

* Stack heights are based upon the following:
1. Installation made at or near 5000 ft. above sea level.
2. Stack heights measured from base of the incinerator.
3. Incinerator is side charged.
4. Breeching or flue connection not exceeding 10’ in length in a straight run or 3’ including not more than 1 - 90° bend or 2 - 45° bends
5. Stack extends as provided for in Section 4813.

Stack heights shall be increased or may be decreased as follows:
1. Decrease height 25% if stack is directly on top of incinerator eliminating any breeching or flue connection.
2. Increase height 15% if incinerator is top charged.
3. Increase height 15% for each additional 10’ of straight breeching and 15% for each additional 90° bend.
### TABLE NO. 48-E

**INDUCED DRAFT FANS**

<table>
<thead>
<tr>
<th>Incinerator Capacity in lbs. per hour</th>
<th><strong>Class III Incinerators</strong></th>
<th><strong>Type 1 Waste</strong></th>
<th><strong>Type 2 Waste</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Air** Supply</td>
<td>flue gases</td>
<td>cooling air</td>
</tr>
<tr>
<td>100</td>
<td>1020</td>
<td>1080</td>
<td>2160</td>
</tr>
<tr>
<td>150</td>
<td>1530</td>
<td>1620</td>
<td>3240</td>
</tr>
<tr>
<td>200</td>
<td>2040</td>
<td>2160</td>
<td>4320</td>
</tr>
<tr>
<td>300</td>
<td>3060</td>
<td>3240</td>
<td>6480</td>
</tr>
<tr>
<td>500</td>
<td>5110</td>
<td>5400</td>
<td>10800</td>
</tr>
<tr>
<td>600</td>
<td>6130</td>
<td>6480</td>
<td>12960</td>
</tr>
<tr>
<td>700</td>
<td>7150</td>
<td>7560</td>
<td>15120</td>
</tr>
<tr>
<td>800</td>
<td>8180</td>
<td>8640</td>
<td>17280</td>
</tr>
<tr>
<td>900</td>
<td>9200</td>
<td>9720</td>
<td>19440</td>
</tr>
<tr>
<td>1000</td>
<td>10220</td>
<td>10800</td>
<td>21600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incinerator Capacity in lbs. per hour</th>
<th><strong>Class IV Incinerators</strong></th>
<th><strong>Type 3 Waste</strong></th>
<th><strong>Class VI Incinerators</strong></th>
<th><strong>Type 4 Waste</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Air** Supply</td>
<td>flue gases</td>
<td>cooling air</td>
<td>C.F.M. @ 700° F</td>
</tr>
<tr>
<td>50</td>
<td>580</td>
<td>625</td>
<td>1250</td>
<td>1110</td>
</tr>
<tr>
<td>100</td>
<td>870</td>
<td>938</td>
<td>1875</td>
<td>1660</td>
</tr>
<tr>
<td>150</td>
<td>1160</td>
<td>1250</td>
<td>2500</td>
<td>2220</td>
</tr>
<tr>
<td>200</td>
<td>1440</td>
<td>1785</td>
<td>3750</td>
<td>3320</td>
</tr>
<tr>
<td>300</td>
<td>2320</td>
<td>2500</td>
<td>5000</td>
<td>4440</td>
</tr>
<tr>
<td>500</td>
<td>2900</td>
<td>3125</td>
<td>6250</td>
<td>5540</td>
</tr>
<tr>
<td>600</td>
<td>3480</td>
<td>3750</td>
<td>7500</td>
<td>6640</td>
</tr>
<tr>
<td>700</td>
<td>4060</td>
<td>4375</td>
<td>8750</td>
<td>7760</td>
</tr>
<tr>
<td>800</td>
<td>4640</td>
<td>5000</td>
<td>9000</td>
<td>8880</td>
</tr>
<tr>
<td>900</td>
<td>5220</td>
<td>5625</td>
<td>10250</td>
<td>9980</td>
</tr>
<tr>
<td>1000</td>
<td>5800</td>
<td>6250</td>
<td>12500</td>
<td>11080</td>
</tr>
</tbody>
</table>

**Air supply is given in C.F.M. @ 70° F and is the minimum which shall be available at all times in the incinerator room for combustion and fan cooling air. See also notes regarding “air supply” Table 48-D.**

1. The total flue gases or total products of combustion are given in lbs. per hour.
2. The cooling air is given in lbs. per hour and is the air required to be bled into and mixed with the flue gases before entering the induced draft fan and unlined breaching section.
3. The fan capacity is given in C.F.M. @ 700° F which is anticipated temperature of the air-gas mixture entering the induced draft fan.
4. The static pressure of the fan is given as the "cold" (70° F) static pressure. The static pressure at 700° F is 45% of the "cold" static pressure.
5. Water sprays or a combination of water and air may be used to cool the flue gases before they enter the fan. The C.F.M. of the fan reduces but the static pressure of the fan increases to overcome the resistance created by the gas washer or scrubber used.

---

48-22
### TABLE NO. 48-F

**CALCULATIONS**

**PRODUCTS OF COMBUSTION - FURNACE VOLUMES**

<table>
<thead>
<tr>
<th>TYPE 0 WASTE</th>
<th>TYPE 1 WASTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 15 x 8500 10,000</td>
<td>1 x 15 x 6500 10,000</td>
</tr>
<tr>
<td>1 x .85</td>
<td>1 x .65</td>
</tr>
<tr>
<td>1 x .10 x 1.6</td>
<td>1 x .25 x 1.6</td>
</tr>
<tr>
<td>Products of combustion = 13.76 lbs/hr. per lb. of waste</td>
<td>Products of combustion = 10.80 lbs/hr. per lb. of waste</td>
</tr>
<tr>
<td>or 13.76 lbs. x 46.86 3600</td>
<td>or 10.80 lbs. x 46.86 3600</td>
</tr>
<tr>
<td>= 0.85 lbs. of combustibles</td>
<td>= 0.65 lbs. of combustibles</td>
</tr>
<tr>
<td>= 0.16 lbs. of water vapor</td>
<td>= 0.40 lbs. of water vapor</td>
</tr>
<tr>
<td>= 0.179 cu. ft./sec. @ 1400° F.</td>
<td>= 0.140 cu. ft./sec. @ 1400° F.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TYPE 2 WASTE</th>
<th>TYPE 3 WASTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 15 x 4300 10,000</td>
<td>1 x 15 x 2500 10,000</td>
</tr>
<tr>
<td>1 x .43</td>
<td>1 x .25</td>
</tr>
<tr>
<td>1 x .50 x 1.6</td>
<td>1 x .70 x 1.6</td>
</tr>
<tr>
<td>Products of combustion = 7.68 lbs/hr. per lb. of waste</td>
<td>Products of combustion = 1.071 lbs. of air for aux. fuel</td>
</tr>
<tr>
<td>or 7.68 lbs. x 46.86 3600</td>
<td>or 1500 x 10</td>
</tr>
<tr>
<td>= 6.45 lbs. of air</td>
<td>= 3.750 lbs. of air</td>
</tr>
<tr>
<td>= 0.43 lbs. of combustibles</td>
<td>= 0.250 lbs. of combustibles</td>
</tr>
<tr>
<td>= 0.80 lbs. of water vapor</td>
<td>= 1.120 lbs. of water vapor</td>
</tr>
<tr>
<td>= 0.099 cu. ft./sec. @ 1400° F.</td>
<td>= 1.071 lbs. of air for aux. fuel</td>
</tr>
</tbody>
</table>

| 1500 x 13.35 1500 x .044 1050 |
| Products of combustion = 6.253 lbs/hr. per lb. of waste | 0.062 lbs. of aux. fuel |
| or 6.253 lbs. x 46.86 3600 |
| = 0.082 cu.ft./sec. @ 1400° F. |

**NOTE:** The specific gravity of dry air or dry gas is 1.0 and the specific gravity of water vapor is 0.6215. In the above calculations 1.6 is used as a multiplier to correct for the difference in specific gravity between dry air-gas and water vapor. This produces an equivalent weight for water vapor before adding to the other products of combustion. The 1.6 can only be used if it is the intent to convert the total weight of the products of combustion to volume at a given temperature.
### TABLE NO. 48-F
#### CALCULATIONS
##### PRODUCTS OF COMBUSTION - FURNACE VOLUMES

| TYPE 4 WASTE | MINIMUM INCINERATOR VOLUME
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Given in cu. ft./lb. of rated capacity per hr.</td>
</tr>
<tr>
<td>1 x 15 x 1000</td>
<td>= 1.50 lbs. of air</td>
</tr>
<tr>
<td>10,000</td>
<td>= 610 lbs. of combustibles</td>
</tr>
<tr>
<td>1 x .10</td>
<td>= 1.36 lbs. of water vapor</td>
</tr>
<tr>
<td>1 x .85 x 1.6</td>
<td>= 2.15 lbs. of air for aux. fuel</td>
</tr>
<tr>
<td>3000 x 10</td>
<td>= 0.125 lbs. of aux. fuel</td>
</tr>
<tr>
<td>1050 x 13.35</td>
<td>= 5.325 lbs./hr. per lb. of waste</td>
</tr>
<tr>
<td>3000 x .044</td>
<td>= 0.069 cu. ft./sec. @ 1400° F.</td>
</tr>
<tr>
<td>1050</td>
<td>= 8500</td>
</tr>
<tr>
<td>Proucts of combustion</td>
<td>= 25,000</td>
</tr>
<tr>
<td>or 5.325 lbs. x 46.86</td>
<td>Type 0 Waste = 8500</td>
</tr>
<tr>
<td>3600</td>
<td>= 25,000</td>
</tr>
</tbody>
</table>

**NOTE:** The specific gravity of dry air or dry gas is 1.0 and the specific gravity of water vapor is 0.6215. In the above calculations 1.6 is used as a multiplier to correct for the difference in specific gravity between dry air-gas and water vapor. This produces an equivalent weight for water vapor before adding to the other products of combustion. The 1.6 can only be used if it is the intent to convert the total weight of the products of combustion to volume at a given temperature.
CHAPTER 49
MECHANICAL REFRIGERATION

SECTION 4901. GENERAL.
(a) **Required.** All mechanical refrigeration systems and equipment, including the replacement of parts and alterations, shall conform to the requirements of this Chapter and Building Code.
(b) **Approval.** The label of an approved agency attached to the equipment may be accepted by the Department as evidence that the equipment is approved.
(c) **Absorption Equipment.** Direct fired absorption equipment shall be considered as fuel fired equipment, and shall be subject to the applicable portions of Chapters 37, 51, and 52 of this Building Code.
   1. Absorption equipment utilizing ammonia shall be installed outside the building or structure.
   2. Steam or hot water generated absorption equipment shall be installed in a boiler room, machinery room or as may be approved by the Department.
(d) **Supports.** Supports for mechanical equipment shall be designed to carry the load imposed in accordance with the requirements of Chapter 23. Where installed on a roof, the equipment shall meet the requirements of Chapter 32.
   1. Compressors or parts of condenser units, when set on the ground shall be placed on a concrete slab at least 3 inches above the adjoining ground level.
(e) **Enclosure.** Equipment installed on the ground or on the roof of a building accessible to the public shall be enclosed by an approved fence at least 6 feet in height, and provided with a locking gate. See Chapter 36.
(f) **Access and Clearances.** An unobstructed, lighted, direct access opening or passageway not less than 36 inches in the least dimension shall be provided and maintained to all mechanical equipment. All mechanical equipment shall have access of at least 36 inches on 2 sides, and at least 7 feet in height. The required space or opening to service, repair, or replace any component part of the unit shall be maintained.
(g) **Guards.** Approved metal guards shall be provided around all flywheels, fans, pulleys, and belts.
(h) **Prohibitions.**
   1. Refrigerating systems or parts thereof shall not be located in any elevator shaft, nor in any location where the equipment may be subject to mechanical damage.
   2. Mechanical equipment shall not be placed in any hazardous location, and not closer than 10 feet to the edge of any roof unless protected by a 4 foot high, rigidly fixed parapet, or approved railing.
(i) **Ventilation.** Every room or space, other than a machinery room, in which any refrigerant containing parts of a condensing unit are located shall conform to the requirements of Section 4907 of this Chapter.

SECTION 4902. DEFINITIONS. Except as otherwise provided, terms and symbols used in this Chapter shall be defined as follows:
Absorber. That part of the low side of an absorption system used for absorbing (adsorbing) vapor-refrigerant.

Absorption System. See refrigerating system.

Brazed Joint. A gastight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 1000 degrees F. but less than melting temperatures of the joined parts.

Brine. A liquid, used for the transmission of heat without a change in its state, having no flash point or a flash point above 150 degrees F. as determined in an approved manner. See Standards of this Chapter.

Compressor. A specific machine, with or without accessories, for compressing given refrigerant vapor.

Compressor Unit. A condensing unit less the condenser and liquid receiver.

Condenser. A vessel or arrangement of pipe or tubing in which vaporized refrigerant is liquefied by the removal of heat.

Condensing Unit. A specific refrigerating machine combination for a given refrigerant, consisting of one or more power-driven compressors, condensers, liquid receivers (when required), and the regularly furnished accessories.

Container. A vessel for the transportation of refrigerants.

Design Working Pressure. The maximum allowable working pressure for which a specific part of a system is designed.

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

(a) Air Duct. A duct used for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

(b) Pipe Duct. A duct used for encasing pipe.

(c) Wire Duct. A duct used for encasing either moving or stationary wire, rope, etc.

Evaporator. That part of the system in which liquid refrigerant is vaporized to produce refrigeration.

Expansion Coil. An evaporator constructed of pipe or tubing.

Fusible Plug. A device having a predetermined temperature fusible member for the relief of pressure.

Generator. Any device equipped with a heating element used in the refrigerating system to increase the pressure of refrigerant in its gas or vapor state for the purpose of liquefying the refrigerant.

High Side. The parts of a refrigerating system under condenser pressure.

Humanly Occupied Space. A space normally frequented or occupied by people but excluding machinery rooms and walk-in coolers used primarily for refrigerated storage.

Liquid Receiver. A vessel permanently connected to a system by inlet and outlet pipes for storage of a liquid refrigerant.

Low Side. The parts of a refrigerating system under evaporator pressure.

Machinery. The refrigerating equipment forming a part of the refrigerating system including any or all of the following: compressor, condenser, generator, absorber (adsorber), liquid receiver, connection pipe, or evaporator.

Machinery Room. See Section 4906.

Manufacturer. The company or organization which evidences its responsibility by affixing its name or nationally registered trademark or trade name to the refrigeration equipment concerned.
Mechanical Joint. A gastight joint, obtained by the joining of metal parts through a positive holding, mechanical construction.

Nonpositive Displacement Compressor. A compressor in which increase in vapor pressure is attained without changing the internal volume of the compression chamber.

Piping. The pipe or tube mains for interconnecting the various parts of a refrigerating system.

Positive Displacement Compressor. A compressor in which increase in vapor pressure is attained by changing the internal volume of the compression chamber.

Pressure Imposing Element. Any device or portion of the equipment used for the purpose of increasing the refrigerant vapor pressure.

Pressure Limiting Device. A pressure responsive mechanism designed to automatically stop the operation of the pressure imposing element at a predetermined pressure.

Pressure Relief Device. A pressure actuated valve held closed by a spring or other means and designed to automatically relieve pressure in excess of its setting.

Pressure Vessel. Any refrigerant containing receptacle of a refrigerating system other than evaporators, each separate section of which does not exceed 1/2 cubic foot of refrigerant containing volume; expansion coils; compressors; controls; headers; pipes; and pipe fittings.

Receiver. See Liquid Receiver.

Refrigerant. A substance used to produce refrigeration by its expansion or vaporization.

Refrigerating System. A combination of interconnected refrigerant-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat.

(a) Absorption System. A refrigerating system in which the gas evolved in the evaporator is taken up by an absorber.

(b) Sealed Absorption System. A unit system for Group 2 refrigerants only, in which all refrigerant-containing parts are made permanently tight by welding or brazing against refrigerant loss.

(c) Self-Contained System. A complete factory made and factory tested system in a suitable frame or enclosure which is fabricated and shipped in one or more sections, and in which no refrigerant-containing parts are connected in the field, other than by companion or block valves.

(d) Unit System. A self-contained system which has been assembled and tested prior to its installation and which is installed without connecting any refrigerant-containing parts.

Rupture Member. A device that will rupture at a predetermined pressure.

Sealed Absorption System. See refrigeration system.

Self-Contained System. See refrigeration system.

Soldered Joint. A gastight joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at temperatures below 1000 degrees F. and above 400 degrees F.

Stop Valve. A shutoff for controlling the flow of refrigerant.

Tenant. A person, firm, or corporation possessed with the legal right to occupy premises.

Unit System. See refrigeration system.
Welded Joint. A gastight joint, obtained by the joining of metal parts in the plastic or molten state.

SECTION 4903. REFRIGERANT CLASSIFICATION. For purposes of this Chapter refrigerants shall be divided into Groups as follows:

GROUP 1

<table>
<thead>
<tr>
<th>Compound</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide (R 744)</td>
<td>CO</td>
</tr>
<tr>
<td>Dichlorodifluoromethane (R 12)</td>
<td>CCl F</td>
</tr>
<tr>
<td>Dichlorodifluoromethane, 73.8</td>
<td>CCl F</td>
</tr>
<tr>
<td>and Ethyliene Fluoride, 26.2</td>
<td>CH CHF</td>
</tr>
<tr>
<td>Dichloromethane (R 30)</td>
<td>CH Cl</td>
</tr>
<tr>
<td>(Methylene Chloride)</td>
<td></td>
</tr>
<tr>
<td>Dichloromonofluoromethane (R 21)</td>
<td>CHCl F</td>
</tr>
<tr>
<td>Dichlorotetrafluoroethane (R 114)</td>
<td>C Cl F</td>
</tr>
<tr>
<td>Monochlorodifluoromethane (R 22)</td>
<td>CHCIF</td>
</tr>
<tr>
<td>Trichloromonofluoromethane (R 11)</td>
<td>CCl F</td>
</tr>
<tr>
<td>Trichlorotrifluoroethene (R 113)</td>
<td>C Cl F</td>
</tr>
</tbody>
</table>

GROUP 2 (TOXIC)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>NH</td>
</tr>
<tr>
<td>Dichloroethylene</td>
<td>C H Cl</td>
</tr>
<tr>
<td>Ethyl chloride</td>
<td>C C Cl</td>
</tr>
<tr>
<td>Methyl chloride</td>
<td>CH Cl</td>
</tr>
<tr>
<td>Methyl formate</td>
<td>HCOOCH</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>SO</td>
</tr>
</tbody>
</table>

GROUP 3 (FLAMMABLES)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butane</td>
<td>C H</td>
</tr>
<tr>
<td>Ethane</td>
<td>C H</td>
</tr>
<tr>
<td>Ethylene</td>
<td>C H</td>
</tr>
<tr>
<td>Isobutane</td>
<td>(CH ) CH</td>
</tr>
<tr>
<td>Propane</td>
<td>C H</td>
</tr>
</tbody>
</table>

SECTION 4904. Group 1 Refrigerants.

(a) General. Refrigerant systems containing more than the quantity of a Group 1 refrigerant permitted in Table 49-A, shall be of the indirect type, and shall be enclosed in a machinery room.

**EXCEPTION:** The requirements of this Section shall not apply to:

1. A refrigerant system located outside of a building or on the roof of a building, and not less than 20 feet from any door, window, or air inlet in any building.

2. A refrigerant system required in a building used exclusively for ice making or cold storage, together with the usual accessories in connection therewith.

(b) Direct Systems. Direct systems in Group D Occupancies shall be limited to systems each containing not more than 50 percent of the permissible quantities of Group 1 refrigerant as set forth in Table 49-A.

1. When the parts of a system containing refrigerant is located in one or more enclosed spaces, the volume of the smallest enclosed occupied spaces, other than a machinery room, shall be used to determine the permissible quantity of refrigerant in the system.

2. When the evaporator is located in any air duct system, the volume of the smallest occupied space served by any one zone shall be used to
determine the permissible quantity of refrigerant in the system.

SECTION 4905. GROUP 2 AND GROUP 3 REFRIGERANTS.

(a) General. The use of any Group 2 (toxic) or Group 3 (flammable) refrigerants, other than ammonia, is prohibited.

(b) Prohibitions.

1. Ammonia is prohibited for use in an air conditioning system or ice skating rink, and shall be permitted only in a building used exclusively for ice making, cold storage, or for the manufacturing or processing of food or drink, provided the occupant load does not exceed one person per 100 square feet of floor area served by the system. See Chapter 33.

2. Parts of an ammonia refrigeration system shall not be located in any exit, nor less than 20 feet from any door, window, or air inlet when located on the exterior of a building.

(c) Emergency Switch. An accessible single emergency control switch to shut off an ammonia refrigeration machine shall be located outside of and within 10 feet of, the entrance to the space containing the equipment and shall be properly labeled.

SECTION 4906. MACHINERY ROOMS.

(a) Construction. Required machinery rooms shall be of at least one-hour fire-resistive construction, with all interior openings protected with fire assemblies which provide a one-hour fire protection rating. Doors shall be self-closing and tight-fitting. There shall be no openings that will permit passage of escaping refrigerants to other areas of the building. See Section 4904(a).

(b) Exits.

1. Every machinery room containing ammonia refrigerant shall have at least 2 exit doors separated by at least 1/5 the perimeter of the room apart. The openings shall be at least 3 feet in width, by 6 feet 8 inches in length.

2. Every machinery room containing any Group 1 refrigerant shall provide at least one exit door. Openings shall be at least 3 feet in width, by 6 feet 8 inches in height.

3. Machinery room exit door shall open in the direction of egress.

(c) Minimum Area. The machinery room shall provide an area of at least 50 square feet.

SECTION 4907. MACHINERY ROOM VENTILATION. Every machinery room shall be equipped with a mechanical ventilation system arranged to continuously provide a complete change of air in the room at least once every 5 minutes, and discharged to the outer atmosphere at a location not less than 20 feet from any exterior door, window, or ventilation air inlet in any building. Air supply and exhaust ducts for the system shall serve no other area. Makeup air shall be provided in accordance with the provisions of Chapter 52.

SECTION 4908. EQUIPMENT IN A MACHINERY ROOM. Combustion equipment or electric resistive heating devices with exposed elements shall not be located in a machinery room.
SECTION 4909. PIPING AND FITTINGS.

(a) General. All piping, tubing, fittings, and related parts shall comply with the requirements of the standards listed in Section 4918. They shall have a working pressure of not less than that of the system installed. Welded fittings shall be of the same wall thickness as the piping system in which they are installed.

(b) Refrigerant Piping. All materials used in the construction and installation of a refrigeration system shall be suitable for the refrigerant in the system. No equipment or material shall be installed which will deteriorate due to the chemical action of the refrigerant, of the oil, or the combination of both.

1. Tubing. Copper tubing shall not be less than Type L, and shall be free from scale and dirt internally. Soft annealed copper tubing shall be limited to sizes not exceeding 7/8 inch outside diameter. Soldered joint fittings for copper tubing shall be wrought copper.

2. Steel Pipe. Schedule 80 pipe shall be used on all steel piping subject to working pressures in excess of 300 psi, and for steel liquid lines 1 1/2 inch nominal size or smaller.

(c) Chilled Water, Condensing Water, Brine, Drain Piping, and Fittings. Chilled water, condensing water, brine, and drain piping shall be steel or copper. Steel pipe fittings shall be welded, screwed, grooved, or flanged. Copper pipe fittings shall be soldered, brazed, or flared. Approved plastic pipe and fittings may be used in Type III and V buildings, for drain piping above ground only.

SECTION 4910. ERECTION OF PIPING.

(a) General. Piping and tubing shall be installed so as to prevent vibration and strain at joints and connections. It shall be securely supported in a manner to avoid sagging between points of support. The distance between points of support shall not exceed 10 feet. Mechanical joints shall not be made in copper tubing larger than 5/8 inch outside diameter.

EXCEPTION: Pre-charged tubing with factory installed quick connects not exceeding 1 1/8 inch outside diameter is permitted.

(b) Piping on Roof. Piping across the roof of a building shall be supported directly to the structural portion of the roof, and shall conform to the requirements of Chapters 23 and 32.

(c) Piping Height. Piping crossing an open passageway in any building shall be at least 7 1/2 feet above the floor unless against the ceiling of the space.

(d) Obstructions. Passageways shall not be obstructed by piping.

(e) Damage. All piping systems shall be protected from damage.

(f) Underground Piping. All iron and steel piping placed underground shall be coated and wrapped to prevent corrosion. Buried copper piping shall be protected with foamed plastic insulation.

(g) Solder. Copper tubing solder joints shall be 95/5 or brazed solder. High gas refrigerant lines, and all buried lines, shall be high temperature solder.

(h) Penetrations. All piping penetrations through fire rated enclosures shall be sleeved with minimum 24 gauge steel sleeves, and packed tightly with calcium silicate or asbestos rope.
(i) **Insulation:** Piping and equipment insulation shall conform to the test requirements of ASTM E-84. The insulation shall provide a flame-spread not to exceed 25 and smoke development not to exceed 300.

**EXCEPTION:** Fitting Covers.

**SECTION 4911. REFRIGERANT CONTAINING PRESSURE VESSELS.**

(a) **General.** Pressure vessels exceeding 6 inches inside diameter, except those having a maximum internal or external design pressure of 15 psig or less, shall be stamped to be in compliance with the rules of Section VIII of the ASME Boiler and Pressure Vessel Code covering the requirements for the design, fabrication, inspection and testing during construction of unfired vessels.

(b) **Approval.** Pressure vessels not exceeding 6 inches inside diameter, except those which provide a maximum internal or external design pressure of 15 psig or less, shall be listed either individually or as part of refrigeration equipment by an approved nationally recognized testing laboratory, or shall be constructed according to the preceding paragraph.

(c) **Pressure.** Pressure vessels which provide a maximum internal or external design pressure of 15 psig or less, except as noted in a and b of this Section, shall have an ultimate strength to withstand at least 3 times the design pressure and shall be tested by the manufacturer to at least 1 1/3 times the design pressure for which they are rated.

(d) **Relief Devices.** If a pressure relief device is used to protect a pressure vessel not exceeding 6 inches inside diameter, the ultimate strength of the pressure vessel so protected shall be sufficient to withstand at least 2 1/2 times the pressure setting of the pressure relief device.

(e) **Fusible Plug.** If a fusible plug is used to protect a pressure vessel which does not exceed 6 inches inside diameter, the ultimate strength of the pressure vessel so protected shall be sufficient to withstand at least 2 1/2 times the refrigerant saturation pressure corresponding to the stamped temperature on the fusible plug, or at least 2 1/2 times the critical pressure of the refrigerant used, whichever is smaller.

**SECTION 4912. REFRIGERANT STOP VALVES.** A stop valve shall be installed in refrigerant piping at the inlet and discharge of every positive displacement type compressor; the inlet and outlet of every receiver, and the liquid outlet of every condenser where no receiver is used.

**SECTION 4913. PRESSURE LIMITING DEVICE.**

(a) **General.** A pressure limiting device shall be installed on every positive displacement refrigerant compressor, set to stop the action of the compressor at 90 percent of the labeled working pressure of the system.

(b) **Shut-Off Valve.** A shut-off valve shall not be placed between any pressure limiting device and the compressor it serves.

**SECTION 4914. PRESSURE RELIEF VALVES—COMPRESSORS.** Positive displacement compressors of 10 horsepower or more shall be equipped by the manufacturer with a pressure relief device, of adequate size and pressure setting to prevent rupture of the compressor, located between the compressor and stop valve in the discharge side. The discharge from the
relief device may be vented to the atmosphere, or into the low pressure side of the system.

SECTION 4915. PRESSURE RELIEF DEVICES--PRESSURE VESSELS.

(a) **General.** Every pressure vessel over 6 inches in diameter, which may be shut-off by valves from other parts of the system, shall be equipped with a pressure relief device or devices complying with the Standards of this Chapter.

(b) **Type.** Pressure vessels of 3 cubic feet or less gross volume containing liquid refrigerant shall be equipped with a pressure relief valve, fusible plug, or rupture member; provided, however, that a fusible plug is permitted only on the high side of the refrigerating system. Pressure vessels which provide a gross volume of more than 3 cubic feet shall be equipped with a pressure relief valve or rupture member.

SECTION 4916. PRESSURE RELIEF DEVICE REQUIREMENTS.

(a) **General.** Pressure relief devices shall be set to start function at a pressure not to exceed the design working pressure of the pressure vessel as determined by the manufacturer and stamped on the pressure vessel. All piping and fittings used for any relief device discharge piping system shall conform to the Standards of this Chapter.

(b) **Discharge Capacity.** The minimum required rated discharge capacity of the pressure relief device or fusible plug for a refrigerant containing vessel shall be determined by the following:

\[ C = f \times D \times L \]

Where:  
C = Minimum required discharge capacity of the relief device in pounds of air per minute.  
D = Outside diameter of the vessel in feet.  
L = Outside length of the vessel in feet.  
f = Factor depending upon kind of refrigerant as follows:

<table>
<thead>
<tr>
<th>Kind of Refrigerant</th>
<th>Value of f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>0.5</td>
</tr>
<tr>
<td>R-12, R-22 and R-500</td>
<td>1.6</td>
</tr>
<tr>
<td>R-502</td>
<td>2.2</td>
</tr>
<tr>
<td>All other refrigerants</td>
<td>1.0</td>
</tr>
</tbody>
</table>

(c) **Size.** The size of the discharge pipe from the pressure relief device shall be at least the size of the relief device outlet. The discharge from more than one relief device may be run into a common header, the area of which shall be at least the sum of the area of the pipes connected thereto. Whenever the length of the discharge piping exceeds 50 feet, all piping shall be increased one pipe size in diameter.

(d) **Identification.** Every pressure relief device shall have:

1. The name or trademark of the manufacturer of the device.
2. The discharge or bursting pressure setting of the device expressed in pounds per square inch gauge.
3. The minimum diameter of the discharge outlet or orifice of the valve.
4. The discharge capacity of the pressure relief device in pounds of air per minute.
(e) **Valve Set--Seal.** Every pressure relief valve shall be set and sealed by
the manufacturer, or in a laboratory approved by the Department, pro-
vided the valve is properly relabeled.

(f) **Discharge.** Pressure relief devices required by this Section for any
pressure vessel of 3 cubic feet gross volume or more containing Group 1
refrigerant, or any pressure vessel containing ammonia shall discharge
to the atmosphere at a location at least 15 feet above the adjoining
ground level, and at least 20 feet from any window, ventilation opening,
or exit in any building.

(g) **Valve Location.** Every pressure relief device required by this Section
shall be connected as close as practicable to the refrigerant container or
evaporator it serves, and above the refrigerant level in the container or
evaporator.

(h) **Shut-Off.** A stop or shut-off valve shall not be placed between any pres-
sure relief device required by this Section and the pressure vessel it
serves.

**SECTION 4917. LABELS.**

(a) **Label.** Every condenser or receiver shall be provided with a permanent
label which sets forth the type of refrigerant used.

(b) **Power Disconnect.** The main power disconnect for all refrigeration
system motors shall be identified with permanent labels with letters at
least 1/2 inch in height.

**SECTION 4918. TESTING.**

(a) **General.** All field assembled refrigerating systems which may develop
pressures in excess of atmospheric pressure shall be subjected to a test
pressure of at least the pressure set forth in Table No. 49-B for the type
of refrigerant in the system.

(b) **Type.** Pressure tests required by this Section shall be at least the lowest
setting of any pressure relief device installed on the side of the system it
is protecting.

**EXCEPTIONS:**

1. System components which have been factory tested.
2. Pressure vessels constructed in accordance with the Standards
   of this Chapter.

(c) **Design Working Pressure.** The test pressure applied to any
refrigerant container shall be 150 percent of the design working pres-
sure stamped on the container.

(d) **Oxygen.** Oxygen shall not be used for testing.

(e) **Brine, Chilled Water, Water Piping.** All brine, chilled water and con-
densing water piping which are parts of any refrigerating system shall
be tested to a pressure at least the working pressure of the system.

(f) **Drain Piping.** All drain piping shall be water tested and proved leak
tight.

(g) **Test Declaration.** A dated declaration, permanently mounted, pro-
tected and in sight of the compressor, shall be provided for all systems
tested. The declaration shall provide:
   1. The name of the installing contractor.
   2. The refrigerant used in the system.
3. The test pressures applied to the high and low side of the refrigeration system.
The declaration shall be signed and mounted by the licensee prior to final inspection by the Department.

SECTION 4919. STORAGE OF REFRIGERANTS.

(a) **General.** All refrigerant, in excess of the amounts in a refrigeration system, shall be stored in a machinery room in their original containers.

(b) **Discharge.** Whenever refrigerant is removed or withdrawn from any refrigerating system, it shall be discharged into an approved shipping container or the the outside atmosphere.

(c) **Portable Refrigerant Container.** A portable refrigerant container shall not be connected to any refrigerating system for a period longer than is necessary to charge or discharge the refrigerating system.

SECTION 4920. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flash Point by Means of the Pensky-Martens Closed Tester, Method of Test for, Z11.7-1973.</td>
</tr>
<tr>
<td></td>
<td>Pressure Piping: Refrigerant Piping, Code for, B31.5-1968.</td>
</tr>
<tr>
<td></td>
<td>Seamless Copper Tube for Refrigeration Field Service, Specifications for, H23.5-1967.</td>
</tr>
</tbody>
</table>

**LEGEND**

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td></td>
<td>1430 Broadway</td>
</tr>
<tr>
<td></td>
<td>New York, N.Y. 10018</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td></td>
<td>29 West 39th Street</td>
</tr>
<tr>
<td></td>
<td>New York, N.Y. 10018</td>
</tr>
</tbody>
</table>
### TABLE NO. 49-A  
**MAXIMUM PERMISSIBLE QUANTITIES OF GROUP I REFRIGERANT FOR DIRECT SYSTEMS**

<table>
<thead>
<tr>
<th>Refrigerant designation</th>
<th>Name</th>
<th>Maximum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In lbs./1,000 Cu. Ft. of Humanly Occupied Space</td>
</tr>
<tr>
<td>R-11</td>
<td>Trichlorofluoromethane</td>
<td>35</td>
</tr>
<tr>
<td>R-12</td>
<td>Dichlorodifluoromethane</td>
<td>31</td>
</tr>
<tr>
<td>R-22</td>
<td>Chlorodifluoromethane</td>
<td>22</td>
</tr>
<tr>
<td>R-113</td>
<td>Trichlorotrifluoroethane</td>
<td>24</td>
</tr>
<tr>
<td>R-500</td>
<td>Dichlorodifluoromethane, 73.8%, and Ethylidene Flouride, 26.2%</td>
<td>26</td>
</tr>
<tr>
<td>R-502</td>
<td>Chlorodifluoromethane, 48.8%, and Chloropentafluoroethane, 51.2%</td>
<td>30</td>
</tr>
</tbody>
</table>

### TABLE NO. 49-B  
**FIELD LEAK TEST PRESSURES IN POUNDS PER SQUARE INCH**

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>High Pressure Test</th>
<th>Low Pressure Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia..................................</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>Trichloromonofluoromethane (Refrigerant 11)</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Dichlorodifluoromethane (Refrigerant 12)</td>
<td>235</td>
<td>140</td>
</tr>
<tr>
<td>Monochlorodifluoromethane (Refrigerant 22)</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>Trichlorotrifluoroethane (Refrigerant 113)</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Refrigerant 500</td>
<td>225</td>
<td>125</td>
</tr>
<tr>
<td>Refrigerant 502</td>
<td>300</td>
<td>150</td>
</tr>
</tbody>
</table>
CHAPTER 50
PLUMBING

SECTION 5001. GENERAL. This Chapter shall govern the design, installation or removal of plumbing systems including sanitary and storm drainage, plumbing fixtures and receptacles, water supplies, storm water drainage and sewage disposal within buildings. All plumbing systems, including repairs and additions, hereafter installed shall conform with the provisions of this Chapter. See Chapter 1 for approval of alternate methods and materials.

SECTION 5002. IDENTIFICATION-MARKING. Each length of pipe and each pipe fitting, trap, fixture, and device used in plumbing systems shall have cast, stamped, or indelibly marked on it the maker’s name or mark, the gage or weight, and be identified as to the Standard(s) met.

SECTION 5003. DEFINITIONS.
(a) General. For purposes of this Chapter, certain terms are defined as follows:

1. Air Break (Drainage System). A piping arrangement in which a drain from a fixture, appliance, or device discharges indirectly into another fixture, receptor, or interceptor at a point below the flood level rim, but above the trap seal.

2. Air Gap (Drainage System). The unobstructed vertical distance through the free atmosphere between the outlet of waste pipe and the flood level rim of the receptacle into which it is discharging.
   A. Air Gap (Water Distribution System). The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.


5. Area Drain. A drain installed to collect surface or rain water from an open area.

6. Assumed Occupant Load. The number of persons determined in Chapter 5.

7. Backflow. The flow of water or other liquids, mixtures, or substances into the distributing piping system of potable water from any source other than its intended source. Back-siphonage is one type of backflow.

8. Backflow Connection. A connection or condition whereby backflow can occur.

   A. Atmospheric Type. (Vacuum Breaker-Atmospheric) A vacuum breaker which is not designed to be subject to static line pressure.
   B. Pressure Type. (Vacuum Breaker-Pressure) A vacuum breaker designed to operate under conditions of static line pressure.
C. Reduced Pressure Type. An assembly of differential valves and check valves including an automatically opened spillage port to the atmosphere.

10. **Back Siphonage.** The flowing back of used, contaminated, or polluted water from a plumbing fixture or other source into a potable water supply pipe due to a negative pressure in the pipe.

11. **Branch.** Any part of a piping system connected to a riser, main or stack.

12. **Branch Interval.** A length of waste stack not less than 8 feet in length or height, within which horizontal branches are connected to the stack.

13. **Branch Vent.** A vent connecting one or more vents with a vent stack or a stack-vent.

14. **Building.** See Chapter 4.

15. **Building Drain.** That part of the lowest piping of a drainage system which receives the discharge from waste and other drainage pipe inside the walls of the building and conveys it to the building sewer beginning 5 feet outside the building wall.

16. **Building Sewer.** The horizontal piping of a drainage system which extends from the end of the building drain and which receives the discharge of the building drain and conveys it to a sewer, sewage disposal system or other approved disposal system.

17. **Building Storm Drain.** That part of the lowest piping of a drainage system used for conveying surface water, ground water, subsurface water, condensate, cooling water, or other similar discharge to a building storm sewer or a combined building sewer, 5 feet outside the building wall.

18. **Building Storm Sewer.** The extension from the building storm drain to a storm sewer, combined sewer, or other approved disposal system.

19. **Building Subdrain.** That portion of a drainage system which does not drain by gravity into the building sewer.

20. **Circuit Vent.** A branch vent that serves two or more traps and extends from the downstream side of the highest fixture connection of a horizontal branch to the vent stack.

21. **Closed System.** A system designed so that expansion of the water due to temperature changes cannot be relieved by reverse flow in the water supply system.

22. **Combination Fixture.** A fixture combining two or more sink or lavatory compartments in one unit.

23. **Combined Building Sewer.** A building sewer which also receives storm water or other drainage.

24. **Combination Waste and Vent System.** A specially designed system of waste piping embodying the horizontal wet venting of one or more sinks, lavatories, drinking fountains and floor drains by means of a common waste and vent pipe adequately sized to provide free movement of air above the flow line of the drain.

25. **Common Vent.** A vertical vent connecting at the junction of two fixture drains and serving as a vent for both fixtures.

26. **Continuous Vent.** A vent which is a continuation of the drain to which it connects.
27. **Continuous Waste.** A waste from 2 or more fixtures connected to a single trap.

28. **Cross-Connection.** Any physical connection or arrangement of pipes between 2 otherwise separate piping systems, one of which contains potable water and the other water or other fluid or gas of unknown or questionable quality, whereby water may flow from one system to the other, the direction of flow depending on the pressure differential between the 2 systems, or the location of potable piping in or near nonpotable or unknown quality liquids whereby contamination could be introduced into the potable system if backflow should occur.

29. **Dead End.** A branch leading from a waste, vent, building drain, or building sewer which is terminated at a developed length of 2 feet or more by means of a cap, plug, or other closed fitting.

30. **Department.** See Chapter 4.

31. **Developed Length.** The length of drainage or vent piping measured along the center line of the pipe and fitting.

32. **Diameter.** Unless otherwise specifically stated in this Chapter, diameter means the nominal commercially designated size for pipe or tube.

33. **Downspout.** (Also see leader). A water conductor which does not connect to a disposal system.

34. **Drainline.** Any pipe which carries waste water or waterborne wastes in a building drainage system.

35. **Drainage System.** All piping within public or private premises which conveys sewage, storm water, or other liquid waste, and includes the building sewer.

36. **Dwelling Unit.** See Chapter 4.

37. **Effective Opening.** The diameter of a circle or equivalent cross-sectional area.

38. **Fixture Branch-Water Supply Pipe.** The water-supply pipe from the water-distributing pipe to wall or floor line.

39. **Fixture Drain.** The drain pipe from the trap of a fixture to the junction of that drain with any other drain pipe.

40. **Fixture Supply.** The water supply pipe connecting the fixture with the fixture branch.

41. **Fixture Unit.** The design factor selected in order that the load producing values of plumbing fixtures can be expressed approximately as multiples of that factor.

42. **Flood Level.** The level at which water begins to overflow the top or rim of the fixture.

43. **Floor Drain.** An opening in the floor used to drain water from floors into the plumbing system. In homes, floor drains are usually located in the laundry and near the heating boiler, and are fitted with a deep seal trap.

44. **Floor Sink.** A receptor used for the drainage of indirect drains.

45. **Flush Valve.** A device located at the bottom of a tank for flushing water closets and similar fixtures.

46. **Flushometer Valve.** A device designed to discharge a predetermined quantity of water under pressure to fixtures for flushing purposes.
47. **Grease Interceptor.** See Interceptor.
48. **Ground Water.** The water obtained from aquifers beneath the surface of the ground.
49. **Ground Water Supply.** A well, spring, or water pipe used to obtain ground water.
50. **Hangers.** See Supports.
51. **Horizontal Branch.** A branch drain extending laterally from a waste stack or building drain, with or without vertical sections or branches which receives the discharge from one or more fixture drains and conducts it to the waste stack or building drain.
52. **Horizontal Pipe.** Any pipe or fitting which is installed in a horizontal position, or an angle of less than 45 degrees from the horizontal.
53. **Indirect Waste Pipe.** A waste pipe which does not connect directly with the drainage system but which discharges into the drainage system through an air break or air gap into a trap, plumbing fixture, receptor, interceptor or other approved point of disposal.
54. **Individual Vent.** A pipe installed to vent a fixture trap and connect to the vent system above the fixture it serves.
55. **Interceptor.** A receptacle designed and constructed to intercept and prevent the passage of oil, grease, sand, or other materials into the drainage system to which it is connected.
56. **Leader.** A water conductor from the roof to the building storm drain.
57. **Loop Vent.** Similar to a circuit vent except that it loops back and connects with a stack vent instead of the vent stack.
58. **Main.** The principal artery of any system to which branches are connected.
59. **Municipal Water System.** The system by which water is supplied to the City and its inhabitants.
60. **Offset.** A combination of bends which brings one section of pipe out of line into a line parallel with another section.
61. **Plumbing.** The practice, materials, and fixtures used in the installation, extension, removal, maintenance, and alteration of all piping, fixtures, and appurtenances directly connected to the sanitary or storm drainage, venting system, and public water supply within or immediately adjacent to any building or structure; also, the practice and materials used in the installation, extension, or alteration of storm water, sanitary sewer, and water supply systems of any building or structure to their connection with the public water supply system, sewer system, or acceptable disposal facility. The installation, extension, alteration, or maintenance of domestic appliances equipped with back-flow preventers, domestic water heating appliances, and water conditioning appliances not directly connected to the sewer system shall not be construed to be exclusively plumbing.
62. **Plumbing Fixture.** A receptacle designed to receive and discharge water, liquid, or water carried waste into plumbing or drainage system to which it is connected.
63. **Plumbing System.** The drainage and vent system, the water supply distributing pipes, the fixtures and fixture traps, and storm-water drainage, together with their devices, appurtenances, and connections.

64. **Pool.** A water receptacle used for swimming or as a plunge or other bath, designed to accommodate more than one bather at a time.

65. **Potable Water.** Water which is safe for drinking, culinary, and domestic purposes.

66. **Private Water Supply System.** A water supply system from a source other than the municipal water system.

67. **Receptor.** A receptacle directly connected to the drainage system and properly trapped and vented which may receive the drainage from indirect waste piping.

68. **Relief Vents.** A vent pipe to provide circulation of air between drainage and vent systems.

69. **Riser.** A water supply pipe which extends vertically to convey water to branches or fixtures.

70. **Roof Drain.** A drain or receptacle installed to receive water collecting on the surface of a roof and to discharge it to a leader or downspout.

71. **Rough In.** The installation of all portions of the waste, vent and water systems which shall be completed before the plumbing fixtures are installed.

72. **Sand Interceptor.** See Interceptor.

73. **Sanitary Sewer.** A pipe which carries sewage exclusive of storm, surface, and ground water.

74. **Sewage.** Any liquid waste containing animal or vegetable matter in suspension or solution, and may include liquids containing chemicals in solution.

75. **Sewage Ejector.** A non-clogging type pump designed for conducting sewage from sanitary plumbing fixtures in the building.

76. **Slope.** The grade of a line of pipe in reference to a horizontal plane.

77. **Stack.** The vertical main of a system of waste, or vent piping.

78. **Stack Vent.** The extension of a waste stack above the highest horizontal drain connected to the stack.

79. **Story.** For purposes of this Chapter, each branch interval shall constitute a story.

80. **Story-Multi.** For purposes of this Chapter, Multi-Story shall include any building or structure with more than 3 branch intervals.

81. **Subsoil Drain.** A drain or pipe which receives only subsurface water and conveys it to a place of disposal.

82. **Sump.** A tank or pit which receives the discharge from drains, or other wastes, located below the normal grade of the gravity system, and which must be emptied by mechanical means.

83. **Sump Pump.** A pump which handles only clear waste or storm water.

84. **Supports - Hangers - Anchors.** Devices for supporting and securing pipes, fixtures and equipment.

85. **Trap.** A fitting or device designed and constructed to provide a liquid seal which will prevent the back passage of sewer gas without materially affecting the flow of sewage or waste.
86. **Trap Seal.** The vertical distance between the weir and the top of the dip of the trap.
87. **Underground Piping.** Piping in contact with the earth.
88. **Vacuum Breaker.** See Backflow Preventer.
89. **Vent Stack.** A vertical pipe installed for the purpose of providing circulation of air and sewer gas to and from any part of the drainage system.
90. **Vent System.** Piping installed to provide flow of air or sewer gas from a drainage system to protect trap seals from siphonage and back pressure.
91. **Vertical Pipe.** Any pipe or fitting installed in a vertical position, or at an angle of 45 degrees or less from the vertical.
92. **Waste Pipe.** Any pipe which receives the discharge form a plumbing fixture or fixtures.
93. **Water Distribution Pipe.** A pipe which conveys water from the water-service pipe to the fixture branch.
94. **Water Main.** A water-supply pipe for public or community use.
95. **Water Service Pipe.** The pipe from the water main or other source of water supply to the building.
96. **Water Storage Facility.** A reservoir, cistern, storage tank, water supply tank, pressure tank, or similar facility utilized to store water in a water supply system.
97. **Water Distribution System.** The water service pipe, distribution pipes, fixture branches, water storage facilities and related connecting pipes, fittings, valves, and appurtenances on a particular premises.
98. **Weir.** The level at which water leaves the outlet of a trap.
99. **Wet Vent.** Any drain pipe which also serves as a vent.
100. **Yoke Vent.** A pipe connecting upward from the waste stack to a vent stack for the purpose of preventing pressure changes in the stacks.

**SECTION 5004. INSTALLATION METHODS AND MATERIALS.**

(a) **Drainage Piping.** Horizontal drainage piping shall be run in practical alignment at a uniform slope. See Section 5013(d).

(b) **Changes in Direction.** Changes in direction in drainage piping shall be made by the appropriate use of fittings. Single and double sanitary tees and single and double short quarter 90 degree bends may be used in drainage lines only where the direction of flow is from the horizontal to vertical except that short quarter bends (90 degrees) may be used under floor outlet fixtures.

(c) **Prohibited Fittings, Connections and Fixtures.**

1. **General.** A single or double-tee branch, or a tapped tee branch shall not be used as a drainage fitting. No running threads, or saddles shall be used in the drainage system. Drainage piping shall not drilled or tapped. Branch connections shall not be made to a lead bend or lead stub except for the purpose of a dry vent. Required cleanout openings shall not be used for the installation of fixtures. A heel or side-inlet quarter bend (90 degrees) shall not be used as a vent when the vent inlet is placed in a horizontal position.

2. **Obstruction to Flow-Drainage Piping.** Any fitting or connection
which has an enlargement, chamber or recess with a ledge, shoulder or reduction of the pipe area, which offers an obstruction to flow through the drain, or any fitting or connection that offers abnormal obstruction to flow is prohibited. The enlargement of a 3 inch closet bend to 4 inches shall not be considered an obstruction. Back water valves shall not be considered an obstruction.

3. **Protection of Potable Water Supply.**
   A. **Cross Connections.** Potable and nonpotable water supplies shall be distributed through systems entirely independent of each other, and any cross-connection between the supplies is prohibited.
   B. **Potable Water Piping Material.** Materials that have not been previously used for purposes other than potable water shall not be used for pipe, tubing, or fittings in a potable-water supply system.

4. **Drain Valves and Waste Cocks.** Drain valves and waste cocks shall not be installed in underground potable water piping.

5. **Special Wastes.** Toxic, corrosive, flammable, or explosive substances or liquid, vapor, gas, or substances harmful to the drainage system or to the public shall not be discharged into a drain or sewer unless the piping is suitable for the wastes and these wastes are subjected to approved treatment. See Section 5008.

6. **Dead Ends.** In the installation or removal of any part of a drainage system, dead ends shall be avoided except where necessary to extend a cleanout to be accessible.

7. **Prohibited Drainage.** Storm water and subsurface drainage shall not be drained into sewers intended for sewage only, nor shall sewage or special wastes be discharged into storm sewers, unless permitted by the Department.

8. **Types of Vents Prohibited.** Wet venting or stack venting of fixtures shall be prohibited except as permitted in Section 5014. A back vent shall not be installed within 2 pipe diameters of the trap weir.

9. **Type of Traps Prohibited.** A trap which depends for its seal upon the action of movable parts shall not be permitted. A trap with partitions shall not be used, unless the trap is integral with a fixture. A fixture shall not be double-trapped, unless approved by the Department. “S” traps and crown vented “P” traps are prohibited.

(d) **Protection of Pipes.**

1. **Drain Pipes Through and Under Footings; and Pipes Through Foundation Walls.** A waste pipe or building drain passing through a footing or foundation wall shall be installed so that the pipe or wall shall not be weakened. All openings below grade shall be waterproofed by the application of a water-proofing material.

2. **External Corrosion.** Pipes passing through a corrosive environment shall be protected against external corrosion.

3. **Freezing.** Provisions shall be made to protect all plumbing from freezing. All underground pressure water piping outside a building shall be at least 4’ 6” below finished grade.

(e) **Individual Sewage Disposal Systems.** When a public sewer is not available for use, a Permit for an individual sewage disposal system shall be obtained from the Department of Health and Hospitals.
(f) **Insulation.** Pipe insulation shall not exceed a flame-spread of 25 and smoke development rating of 300. See Chapter 52 for pipe insulation in plenums.

**SECTION 5005. METHODS, MATERIALS AND FIXTURES.**

(a) **General.** All methods, materials, and fixtures shall meet established technical standards of quality and strength necessary to produce safe and sanitary plumbing installations. See Section 5017.

(b) **Materials - Special Requirements.**

1. **Sheet Lead.** Sheet lead shall weigh at least 2 1/2 pounds per square foot.

2. **Flanges.** Flanges shall be required for floor and wall mounted fixtures with integral trap. Flanges shall be firmly supported.

**SECTION 5006. JOINTS AND CONNECTIONS.** All joints and connections shall be made airtight and watertight. See Section 5016.

(a) **Types of Joints.**

1. **Caulked Joints.** Caulked joints for cast iron bell and spigot pipe shall be firmly packed with oakum and filled with one inch deep molten lead. Lead shall be caulked.

2. **Threaded Joints.** All burrs shall be removed. Pipe ends shall be reamed or filed out to size of bore, and all chips shall be removed. Pipe joint compound shall be used only on male threads.

3. **Soldered or Brazed Joints.** Soldered or brazed joints for tubing shall be made with approved manufactured fittings. Surfaces to be soldered or brazed shall be cleaned bright. The joints shall be properly fluxed and made with approved solder.

4. **Swedged Joints.** The depth of swedged joints in tubing on drainage and vent piping or between tube or pipe shall be at least 1/2 the diameter of the tube or pipe.

5. **Flared Joints.** All flared joints for soft-copper tubing shall be made with fittings meeting the Standards. The tubing shall be expanded with a flaring tool.

6. **Hot-Poured Joints.** Materials for hot-poured joints for clay or concrete pipe shall not soften sufficiently to destroy the effectiveness of the joint when subjected to a temperature of 160 degrees F., or be soluble in any of the wastes carried by the drainage system, prior to hot-pouring. The joint shall be caulked tight with oakum.

7. **Mechanical Joints.** Mechanical joints shall be made with a flanged collar, or ring gasket and appropriate number of securing bolts, or with a preformed molded ring secured by pulling the pipe together in a manner to compress the molded ring; or by means of a corrosion-resistant joint and clamp assembly surrounding a sealing sleeve of an elastomeric material in a manner that the sleeve is firmly compressed by the tightening device in the clamp assembly in order to provide a tight joint.

8. **Resilient Joints.** Resilient joints in clay or concrete pipe shall be made by using approved resilient materials.

9. **Lead Burned Joints.** Lead burned (welded) joints shall be lapped and the lead shall be fused together to form a uniform weld at least as thick as the lead being joined.
10. **Asbestos Cement Sewer Pipe Joints.** Joints in asbestos cement pipe shall be of the preformed tapered type or with sleeve coupling sealed with rings of the same composition as the pipe. All joints between asbestos cement pipe and metal pipe shall be made by means of an adapter coupling with an approved joint.

11. **Plastic Pipe Joints.** Joints in plastic piping shall be made with approved fittings by either solvent welded or fusion welded connections approved insert fittings and metal clamps and screws of corrosion resistant material, all in accordance with the Standards Connections of plastic pipe to other piping materials shall be made with approved fittings.

12. **Tapped Joints.** The diameter of taps for vent piping or potable water piping shall not exceed 1/2 the diameter of the tapped piping. The tap shall be made by use of a manufactured fitting securely attached.

(b) **Type of Joints.**

1. **Clay Sewer Pipe.** All joints in vitrified clay pipe or between clay and metal pipe shall be made with approved hot-poured jointing material as specified in Section 5006(a) 6 or with resilient joints as specified in Section 5006(a) 8.

2. **Concrete Sewer Pipe.** All joints in concrete sewer pipe or between concrete pipe and metal pipe shall be made with approved hot-poured jointing materials as specified in Section 5006(a) 6 or resilient joints as provided for in Section 5006(a) 8.

3. **Cast Iron Pipe.** Cast iron pipe joints shall be caulked threaded resilient or mechanical joints as specified in Section 5006(a) 1,2, 7, and 8 with approved fittings.

4. **Cast Iron to Other Materials.** Joints between plastic, steel, brass or copper pipe, and cast iron pipe shall be caulked, mechanical, resilient, or threaded joints as specified in Section 5006(a) 1, 2, 7, and 8 with approved fittings.

5. **Steel Pipe.** Joints in steel pipe shall be threaded or mechanical joints in accordance with Sections 5006(a) 2 and 7.

6. **Copper Water Tubing.** All concealed joints for copper water tubing within buildings shall be soldered or brazed. Joints installed under ground shall be brazed or flared. Brazing shall be performed at not less than 1000 degrees F.

(c) **Special Joints.**

1. **Slip Joints.** Slip joints used for water piping, drain, waste and vent piping shall not be concealed.

2. **Expansion Joints.** Approved expansion joints may be used where necessary.

3. **Ground Joints.** Joints which provide a rigid joint when made up shall not be considered as slip joints.

(d) **Water Closets and Pedestal Urinals.** The connection between flange and water closets or pedestal urinals shall be made by means of an approved gasketing material.

(e) **Waterproofing of Openings.**

1. **Pipes Through Roofs or Walls.** When pipes pass through a roof or exterior wall, the openings shall be made watertight.
2. **Flashings.** Exterior openings exposed to the weather shall be flashed with rust-resistant metal or other approved flashing for water proofing purposes.

**SECTION 5007. TRAPS, CLEAN-OUTS.**

(a) **Traps.**

1. **Fixture Traps.** Except when specifically provided in this Building Code, each plumbing fixture, except those having integral traps, shall be separately trapped by a water-seal trap placed as close to the fixture outlet as possible. A combination fixture may be installed with one trap if one compartment is not more than 6 inches deeper than the other(s) and the waste outlets are not more than 36 inches apart.

2. **Integral Traps.** The fixture drain for all fixtures with integral traps shall not be smaller than the fixture outlet. In the case of water closets and pedestal urinals, the drain shall not be less than 3 inches.

3. **Minimum Size.** The size (nominal diameter) of trap for a given fixture shall be sufficient to drain the fixture rapidly and shall be not less than that given in Table 50-F.

4. **"P" Traps.** Traps and tail pieces, if made of brass, shall be not less in thickness than 17 U.S. Standard Gauge, with the gauge stamped on the trap.

5. **Trap Seal.** Each fixture trap shall have a water seal of not less than 2 inches and not more than 4 inches.

6. **Vertical Distance Between Fixture and Trap.** The trap shall be installed as close to the fixture outlet as practical, but in no case shall the trap weir be more than 24 inches below the fixture outlet. Vertical distance may be increased to 48 inches when approved by the Department.

7. **Trap Levels and Protection.** All traps shall be set true with respect to their water seals.

8. **Running Traps.** Runnings traps may be used only with advance approval of the Department and shall have an accessible cleanout at the trap on both the upstream and downstream side of the trap.

(b) **Pipe Clean Outs - General Requirements.**

1. **Material and Design.** The bodies of clean-out ferrules shall conform in thickness to that required for pipe and fittings of the same material.

2. **Location of Clean-Outs.** A clean-out shall be provided at or near the foot of each vertical waste stack.

3. **Cleanout Equivalent.** Where the piping is concealed, a fixture trap or a fixture with integral trap readily removable without disturbing concealed roughing work may be accepted as a cleanout equivalent.

4. **Distance of Clean-Outs.** Clean-outs shall be not more than 50 feet apart for horizontal building drains of 4 inch nominal diameter or less and not more than 100 feet apart for larger pipes. Clean-outs shall be not more than 100 feet apart in building sewer lines.

5. **Size.** Clean-outs shall be of the same nominal size as the pipes into which they are installed up to 4 inches, and at least 4 inches for larger pipes.
6. **Clearances.** Clean-outs on 4 inch or larger pipes shall be so installed that there is a clearance of at least 18 inches for rodding. Clearance for smaller piping shall be at least 12 inches.

7. **Accessibility.** Clean-outs concealed underground in walls, floors, or ceilings shall be extended to the surface. Where it is necessary to conceal a clean-out plug, a removable covering plate or access door shall be provided which will permit access to the plug.

**SECTION 5008. INTERCEPTORS.**

(a) **General.** All interceptors shall be designed and installed so that they will not become air-bound or permit siphonage. They shall be located to be readily and easily accessible for cleaning and inspection. All interceptors shall be an approved type.

1. **Solids Interceptors.** All liquid wastes containing plaster or similar materials shall discharge into an interceptor constructed to intercept these materials prior to entering the drainage system.

2. **Interceptors.** Interceptors, when required shall be constructed and installed to separate undesired materials and to prevent them from entering the drainage system. Interceptors shall be located inside the building only when it is impractical to install an outside interceptor, and only when the installation is approved by the Department.

**SECTION 5009. PLUMBING FIXTURES.**

(a) **Quality of Fixtures.** All plumbing fixtures shall be made of materials with smooth impervious surfaces and shall conform to this Section and Section 5005.

(b) **Installation.**

1. **Securing Fixtures.** All floor-outlet fixtures shall be rigidly secured by screws or bolts. Wall-hung fixtures shall be rigidly supported by approved metal hangers or bolts. Backing shall be provided to receive fixture hold down screws.

(c) **Used Materials and Fixtures.** Used plumbing fixtures and materials shall not be installed unless they have been inspected by the Department and have been found to meet the requirements of this Chapter and to be in satisfactory physical and sanitary condition.

(d) **Water Closet Combinations.** Water closet bowls shall be siphon-jet, reverse-trap, washdown, or blow-out type with floor outlet, or siphon-jet or blow-out type with wall outlet. Water-closet bowls and traps shall be made in one piece and shall be provided with integral flushing rim constructed to flush the entire interior of the bowl. Water-closet bowls for public use shall be of the elongated type.

(e) **Flushometer Valves.** Flushometer valves shall be installed so that they will be accessible for repairing. When the valve is operated, it shall complete the cycle of operation automatically, opening fully and closing positively under the service pressure. At each operation the valve shall deliver water in volume and rate that will thoroughly flush the fixture and refill the fixture trap. Means shall be provided for regulating flushometer valve flow. Not more than one water closet shall be served by a single flushometer valve. Protection against backflow shall be provided as specified in Section 5012(c). Also see Table 50-B.
(f) **Ball Cocks.** Ball cocks shall be antisiphon type and shall be installed with the air inlet ports at least one inch above the overflow level in the tank.

(g) **Urinals.**

1. **Flushing Rim and Trap.** Siphon-jet, blow-out and pedestal urinals shall have integral flushing rims and integral traps except that wash-out and stall urinals may have separate traps. Stall urinals shall have flushing rims or spreaders.

2. **Prohibited Urinals.** Trough urinals are prohibited.

3. **Flushing.** Urinals shall be provided with a tank and automatically actuated valve, or an approved manually operated, flushing device. All automatic flushing devices shall be adjusted to cause thorough flushing of the urinal at regular intervals to maintain sanitary conditions. No more than 4 urinals shall be flushed with one automatic tank or valve, and only if the flush pipe is sized and graded to insure sufficient pressure, volume, and equal distribution of the tank contents. Protection against backflow shall be provided as specified in Section 5012(c).

(h) **Lavatories.** Lavatories shall be provided with waste outlets at least 1 1/4 inches in diameter. Waste outlets shall have open strainers or stoppers. Lavatories for the use of handicapped persons shall be provided and set in accordance with the Standards and Chapter 5.

(i) **Shower Receptacles.** Shower receptacles except those built directly on a slab on the ground or integral with a shower cabinet shall have watertight pans. The pan shall be turned up 1 inch on each wall side at least one inch above the curb and shall be protected against corrosion.

(j) **Sinks.** Sinks shall be provided with waste lines at least 1 1/2 inches in diameter. Waste outlets shall have open strainers or stoppers.

1. **Commercial Sinks.** All commercial sinks used in food preparation areas shall be installed so that any drainage backup is relieved through a floor drain.

(k) **Food Waste Grinder Units.**

1. **Separation Connections.** Domestic and commercial food waste disposal units shall be connected and trapped separately from any other fixture or compartment, except that a continuous waste with flow-directing partition may be used for domestic units. Units may have either automatic or hand operated water supply.

   A. **Food Waste Disposer Mandatory.** New structures arranged or intended to develop food wastes in the direct preparation of food in Group A through I occupancies, shall provide food waste disposal equipment within the premises. Existing structures converted or altered to the uses described above need not meet the requirements of this Section unless the structures are provided with new facilities for food preparation.

2. **Grease Interceptors.** Waste from a food waste grinder shall not be discharged into or through a grease interceptor.

3. **Waste Line.** See Table 50-H.

(l) **Floor Drains.** Floor drains shall have metal traps and be provided with strainers. A floor drain shall not be obstructed by the placement of appliances or equipment. Floor drains in elevator pits shall not be directly connected to a sewer.
(m) **Laundry Trays.** Each compartment of a laundry tray shall be provided with a waste outlet at least 1 1/2 inches in diameter and with a stopper or strainer.

(n) **Washing Machines.** Clothes washing machines shall discharge into a smooth finished trough, a standpipe system, a laundry tray, or a service sink.

(o) **Drinking Fountains.** Drinking fountains shall be provided with an adjustable angle jet type with guard and shall be of a design so that the nozzle will not be flooded in case of drain blockage.

(p) **Minimum Toilet Room Facilities.** See Chapter 5.

**SECTION 5010. HANGERS AND SUPPORTS.**

(a) **General.** Piping in a plumbing system shall be installed without undue strains and stresses and with provisions for expansion, contraction, and structural settlement. Hangers and anchors shall be of sufficient strength to support the pipe and its contents. Supports shall be attached to the building construction.

(b) **Vertical Pipe Support.** Vertical piping shall be secured at every story height or at not more than 15 foot intervals. No-hub cast iron soil pipe shall be supported so that the weight is carried from the pipe to the support and not from the joint to the support.

(c) **Horizontal Pipe Support.** Horizontal piping shall be supported to keep it in alignment, prevent sagging, and to provide the required drainage slope.

1. Cast iron hub and spigot shall be supported within one foot of each hub. Cast iron no-hub pipe shall have each fitting and each length of pipe of less than 4 feet supported with at least one hanger. Horizontal lengths of pipe longer than 4 feet shall be supported on both sides of each joint.

2. Copper tubing, plastic, steel and glass pipe shall be supported at intervals shown in Table 50-A.

3. Pipes in the ground shall be laid on a firm bed for their entire length.

(d) **Expansion and Contraction.** (Plastic) For plastic drainage and vent systems, restraint and expansion fittings shall be used at each branch interval or each 25 feet, whichever is less, to accommodate movement due to contraction and expansion.

(e) **Base of Stacks.** Bases of stacks above grade shall be supported from the building structure.

(f) **Supports.** Wall-hung fixture supports shall be designed so that no undue strain is transmitted to the fixture.

(g) **Thrust Blocks.** Thrust blocks shall be provided for each change of direction of 45 degrees or greater for water piping having mechanical joints not capable of withstanding the stresses caused by the thrust.

**SECTION 5011. INDIRECT WASTE PIPING.**

(a) **General.** An air gap is required where the indirect waste pipe may at anytime be under a vacuum which could cause back siphonage. Where the horizontal length of indirect waste piping required from food preparation equipment exceeds 10 feet, a trap in the indirect waste line shall be provided as near the equipment as practical. Wastes from the following shall discharge through an air gap:
1. Refrigerators, ice makers, steam tables or other receptacles and devices in which food or drink is stored or prepared for commercial purposes.
2. Drains, overflows or vents from the potable water supply system.
3. Devices or apparatus such as sterilizers and potable water stills.

(b) **Pressure Tanks, Boilers and Relief Valves.** If the discharge of waste from this type of equipment is connected by piping to the drainage system, it shall be connected as an indirect waste.

c) **Air Gap Requirements.** The air gap shall be at least twice the effective diameter of the drain served and shall be provided by extending an indirect waste pipe to an open accessible service sink, floor drain, or other fixture which is properly trapped and vented.

d) **Air Break Usage.** Discharge from devices supplied with potable water through an air gap or vacuum breaker may discharge through an air break.

(e) **Commercial Dishwashing Machines.** Dishwashing machines, except those in dwelling units, shall be indirectly connected except that when a dishwashing machine is located adjacent to a floor drain, may be connected directly on the sewer side of the floor drain trap, provided the drain line from the commercial dishwasher is properly trapped and vented.

(f) **Domestic Dishwashers.** The discharge line from the dishwashing machine shall be connected to a separate trap, as an indirect waste, to a dishwasher connection of a disposer, or a baffled sink tailpiece after going through a looped connection. The looped connection shall be at least as high as the underside of the sink counter.

g) **Clear Water Wastes.** Water lifts, expansion tanks, cooling jackets, fire sprinkler systems, or similar devices which waste clear water only shall discharge into a sump or drain into a trapped fixture. Requirements for draining relief outlet wastes, see Section 5011(b).

1. When drip pans under cooling coils discharge to the sanitary drainage system, the discharge shall be through an air break into an approved trapped receptor. The discharge line from pans under cooling coils shall be at least 3/4 inch in diameter.

(h) **Swimming Pools.** Pipes carrying waste water from swimming or wading pools including pool drainage, back wash from filters and water from floor drains which serve walks around the pools, shall be installed as an indirect connection to the building drain or building sewer. Where a recirculation pump is used to discharge waste pool water into the drainage system, the pump discharge shall be installed as an indirect waste to the sewer. See Chapters 57 and 58.

**SECTION 5012. WATER SUPPLY AND DISTRIBUTION.**

(a) **Quality of Water Supply.**

1. **Potable Water.** All premises intended for human occupancy shall be provided with potable water.

2. **Non-potable Water.** Nonpotable water may be used for irrigation, cooling or industrial uses where it cannot contaminate or pollute water or food products intended for human consumption, for flushing water closets and urinals and for other purposes not requiring potable water; provided, however, that nonpotable water shall be
prevented from possible use for drining, culinary, and other
domestic purposes.

(b) **Identification of Piping.** All piping conveying nonpotable water shall
be identified by a distinctive green colored paint with one inch white
paint banding around pipe at 4 foot intervals so that it is readily dis-
tinguished from piping carrying potable water.

(c) **Protection of Potable Water Supply.**
1. **Backflow.** The water distribution system shall be protected against
backflow. Every fixture-supply pipe shall be protected from back-
flow by having the opening from which the water flows spaced a dis-
tance above the flood-level rim of the receptacle into which the
water flows sufficient to provide an air gap of at least twice the
diameter of the effective opening. Where it is not possible to provide
a minimum air gap, the fixture shall be equipped with an accessibly
located back-flow preventer complying with Table 50-B.

2. **Backflow Preventers.** Backflow preventers shall be installed with
any supply fixture, such as hose and spray, hose-end faucet direct
flushing valves, aspirators and under-rim water supply connections
to a plumbing fixture or receptacle in which the surface of the water
in the fixture or the receptacle is exposed at all times to atmospheric
pressure and where the outlet end of which may at times be sub-
merged. Atmospheric backflow preventers shall not be installed on
the inlet side of the control valve, unless spring loaded. Backflow
preventers shall be made of corrosion resistant material.

(d) **Separate Trenches.** The underground water service pipe and the
building drain or building sewer shall be at least 10 feet apart horizon-
tally and shall be separated by undisturbed or compacted earth except
when installed in open utility tunnels. When this condition cannot be
met, relief from this Section may be requested from the Department by
setting forth in writing the details of the proposed alternate and the
reason why these conditions cannot be met.

(e) **Pumps and Other Appliances.** Water pumps, filters, softeners, and
all other appliances and devices shall be connected to prevent con-
tamination of the potable water system.

(f) **Water Storage Equipment.** Potable water storage equipment shall be
designed to prevent contamination of the water supply. The interior of
this equipment shall be accessible. See Chapter 58 for hot water tanks.

1. **Cleaning, Lining, Painting, or Repairing Water Storage
   Equipment.** Potable water storage equipment used for domestic
purposes shall not be lined, painted, or repaired with any material
which will affect the potability of the water supply. The equipment
shall be disconnected from the system during all maintenance
operations to prevent any foreign fluid or substances from entering
the distribution piping.

(g) **Materials.**

1. **Water-Distribution Pipe, Tubing and Fittings.** Materials for
   water distribution pipes and tubing shall be brass, copper, cast iron,
or steel, with approved fittings except that CPVC pipe bearing the
   NSF seal may be used in buildings of Type III and V construction
   and in Type IV construction when enclosed in one hour fire resistive
   construction. All piping used for water distribution shall be capable
of withstanding 125 p.s.i. at 180 degrees F. Allowance shall be made to accommodate expansion of pipe. Threaded ferrous pipe and fittings shall be galvanized (zinc-coated) or cement lined. When used underground, ferrous pipe and fittings shall be coal tar enamel coated and the threaded joints shall be coated and wrapped after installation.

2. **Water Service Pipe.** Materials for water service piping between the property line and the building shall be as specified in Table 50-O.

   (h) **Water-Supply Control.** A main shutoff valve on the water-service pipe shall be provided near the meter and an accessible shutoff valve with drain shall be provided inside near the entrance of the water-service pipe into the building.

   1. **Tank Controls.** Supply lines from pressure or gravity tanks shall be valved at or near their source.

   2. **Individual Control Valves.** Accessible individual control valves shall be provided for all fixtures.

   (i) **Water Distribution System.**

   1. **Water Service Pipe.** The water-service pipe from the street main to the water-distribution system for the building shall be designed to provide an adequate flow of water to meet the requirements of the building at peak demand, but in no case shall be less than 3/4 inch nominal diameter. If water closet flushometer valves or other devices requiring a high rate of water flow are used, the water service pipe shall be designed to supply this flow, but shall be at least 1 inch in diameter.

   2. **Demand Load.** The demand load in the building water-supply system shall be based upon the number and kind of fixtures installed and the probable simultaneous use of these fixtures. In the absence of a specific design analysis, the demand load and pipe sizing shall be based on Table 50-C.

   3. **Size of Fixture-Supply Pipe.** The minimum size fixture supply pipe shall be as set forth in Table 50-D.

   (j) **Auxiliary Pressure.** If the residual pressure in the system is below the minimum allowable at the highest fixture when the flow in the system is at peak demand, an automatically controlled pressure or gravity tank and/or booster pump shall be installed of capacity to supply sections of the plumbing system which are too high to be supplied directly from the public water main. When a booster pump is used on an auxiliary pressure system, there shall be installed a low-pressure cutoff on the booster pump as approved by the Department.

   (k) **Street Pressures.** When the street main has a wide fluctuation in pressure during the day, the water distribution system shall be designed for the minimum pressure available. A pressure regulator valve shall be installed to limit the maximum pressure in the system to 90 p.s.i.g.

   (l) **Hazard and Noise.** Chargeable air chambers or other approved mechanical devices shall be provided to reduce the hazard to the piping system from water hammer.

   (m) **Safety Devices.**

   1. **Pressure Relief Valves and Temperature Relief Valves, or Combination Temperature and Pressure Relief Valves.** Pressure relief valves and temperature relief valves, or combination temperature and pressure relief valves of the thermostatic self-closing
type shall be placed on all water heaters. The pressure side shall be set to relieve at a maximum of 165 pounds per square inch. The temperature side shall be set to relieve at a maximum of 210 degrees F., and shall be capable of discharging sufficient hot water to prevent any further rise in temperature.

2. Approvals. Pressure relief valves, temperature relief valves, and combination temperature and pressure relief valves which meet the requirements of this Chapter shall be considered acceptable provided each valve has a metallic plate stamped or etched with manufacturer's rated relief capacity. Relief valve capacity shall be equal to or greater than the rated Btu input of the heater or heat exchanger.

3. Vacuum Relief. Copper and copper lined tanks shall be provided with vacuum relief valves.

4. Relief-Valve Location. Extended thermostatic self-closing type combination temperature-pressure relief valves shall have the element placed in the tank within 6 inches of the top. Valves without extended element shall be placed directly above the tank on the hot water outlet and not more than 3 inches from the tank. Vacuum-relief valves shall be placed as close to the tank as possible. There shall be no check or shutoff valve between a relief valve and the heater or tank.

5. Relief Outlet Wastes. The outlet of pressure relief valve, a temperature relief valve, or a combination temperature and pressure relief valve, shall be piped and turned down to drain into a sump or into a plumbing fixture as an indirect waste.

6. Size of Relief Outlet Waste. The cross-sectional area of the relief outlet waste shall be equal to or greater than that of the valve outlet.

(n) Water Used for Cooling. Water used for cooling of equipment or similar purposes shall not be returned to the potable water distributing system. When discharged to the building drainage system, the waste water shall be discharged through an indirect waste pipe or air gap.

SECTION 5013. DRAINAGE SYSTEM.

(a) Materials.

1. Above-Ground Piping Within Buildings. Waste piping for drainage systems within a building shall be of cast iron, galvanized steel, lead, brass, copper pipe or copper tube. Plastic pipe bearing the markings NSF DWV may be used in buildings of Types III and V construction. Plastic piping conforming to these requirements and enclosed within a one-hour fire-resistive construction may also be used in Type IV buildings. See Chapter 52 for Air Plenums.

2. Underground Drainage Piping Within Buildings. Underground building drains shall be of hub-type cast iron or Type L copper. For special wastes, underground drains may be of the same material as the above-ground drains.

(b) Separate Trenches. See Section 5012(d).

(c) Building Sewer. A building sewer may be constructed of cast iron, Type L copper, vitrified clay with resilient joints, or plastic pipe bearing the mark NSF-DWV. Building sewers shall not be installed in unstable
soil unless of hub-type cast iron pipe and designed to maintain a uniform slope.

(d) **Drainage Piping Installation.** Connections to horizontal drainage branches shall be made with combination Y and 1/8 bends, Y's, or long turn TY's. Horizontal drainage piping shall be installed at a uniform slope of at least that permitted in Table 50-E, unless designed to give a minimum velocity of 2 fps.

(e) **Fixture Units.**

**Values for Fixtures.** Fixture-unit values as given in Table 50-F designate the relative load weight of different kinds of fixtures, and shall be employed in estimating the total load carried by a waste pipe, and shall be used in connection with the Tables of sizes for waste and drain pipes for which the permissible load is given in terms of fixture units.

(f) **Determination of Sizes of Waste Piping.**

1. **Maximum Fixture Unit Load.** The maximum number of fixture units that may be connected to a given size of building sewer, building drain, horizontal branch, or vertical waste stack shall be as specified in Tables 50-G, H and I.

2. **Minimum Size of Waste Stacks.** Waste stacks shall not be smaller than the largest horizontal branch connected thereto.

3. **Future Fixtures.** When provision is made for the future installation of fixtures, the future fixtures shall be considered in determining the required sizes of drain pipes. Construction to provide for future fixture installation shall be terminated with a plugged fitting or fittings at the stack and shall be vented as required in Section 5014.

4. **Vertical Offsets or Change of Direction.** An offset in a vertical stack, with a change of direction of 45 degrees or less from the vertical, may be sized as a straight vertical stack. In buildings of 10 or more branch intervals, if a horizontal branch connects to the stack within two feet above or below the offset, a relief vent shall be installed in accordance with Section 5014(l). A stack with an offset of 45 degrees or more shall be sized as follows:
   A. The portion of the stack above the offset shall be sized as for a regular stack.
   B. The offset itself, including fittings, shall be sized as for a building drain. See Table 50-G.

(g) **Sumps, Pumps, Ejectors, and Receiving Tanks.** Building subdrains shall discharge into a sump or receiving tank with a gastight cover. Sewage shall be lifted and discharged into the building sewer or drain by sump pumps, sewage ejectors, or similar methods. Sumps or tanks shall either be automatically discharged or have a capacity to hold the maximum accumulated sewage and waste for a period of at least 24 hours, provided that sewage shall be purged from the sump at intervals not exceeding 12 hours. Water-operated ejectors are prohibited. An ejector shall be used on sumps serving one or more water closets. The discharge pipe from the sump shall be sized to handle the discharge from the pump, but in no event smaller than the pump discharge. The size and design of a sump pump shall be determined by the capacity of the sump to be served, the discharge head, and the discharge frequency. A check valve shall be installed in each pump discharge line. The discharge pipe from
the sump pump or ejector to the drainage system shall be connected through a branch “Y” fitting. The drain into which the sump pump or ejector discharges shall be sized to receive the combined flow from the building sump pump or ejector. For size of vents, see Section 5014(j)6.

SECTION 5014. VENTS AND VENTING.

(a) Materials. Vent pipes shall be cast iron, galvanized steel, lead, brass, copper pipe or copper tube. Plastic piping bearing the markings NSF-DWV may be used in building Types III and V construction. Plastic piping conforming to these requirements and enclosed within one-hour resistive construction may also be used in buildings of Type IV construction. See Chapter 52 for air plenums.

(b) Minimum Stack Vent. Any structure on which a building drain is installed shall have at least one stack-vent carried undiminished in size through the roof. The minimum size shall be 3 inches in diameter.

(c) Protection of Trap Seals.

1. Protection of Trap Seals. The protection of trap seals from siphonage, aspiration, or back pressure shall be accomplished by the use of waste stacks with adequate venting in accordance with the requirements of this Building Code. Venting systems shall be designed and installed so that trap seals shall not be subjected at any time to a pneumatic pressure differential of more than one inch of water pressure under design load conditions.

2. Stack Vents. Every waste stack shall be extended vertically as a stack vent to at least 6 inches above the flood level rim of the highest fixture, then to the open air; or the stack vent and vent stack shall be joined within the building at least 6 inches above the flood level rim of the highest fixture, with a single extension from the point of joining to the open air.

(d) Vent Stacks. A vent stack or main vent shall be installed with a waste stack whenever back vents, relief vents, or other branch vents are required for 4 or more branch intervals. The vent stack shall terminate in the open air outside the building, or shall be connected with the building venting system and shall connect with the waste stack through, at, or below the lowest horizontal waste branch or with the building drain. A vertical vent stack connection to the drainage system shall be washed with the lowest fixture tied into the vent stack. Vent stacks shall run undiminished in size for their entire length.

1. Extensions Through Roof. Extensions of vent pipes through a roof shall be terminated at least 6 inches above the roof and shall be flashed. Where a roof is to be used for occupancy, the extensions shall run at least 6 feet above the roof, and be provided with a vandal proof vent cap.

2. Location of Vent Terminal. A vent terminal from a drainage system shall not be located directly beneath any door, window, or other ventilating opening of the building or an adjacent building, nor shall the vent terminal be within 10 feet horizontally of the opening unless it is at least 3 feet above the top of the opening.

3. Extensions Through Wall. Vent terminals extending through a wall, when approved by the Department, shall be at least 10 feet horizontally from any lot line and terminate downward. They shall be screened and shall meet the requirements of Section 5014(d) 2.
Vent terminals shall not terminate under the overhang of a building.

(e) **Vent Pipe Grades and Connections.**

1. **Grades.** Vent and branch vent pipes shall be free from drops or sags, and be graded and connected to drip back to the waste pipe or vent stack by gravity.

2. **Venting of Floor Drains.** Floor drains shall be vented by one of the following methods:
   
   A. As specified in Section 5014(e) 3.
   B. As specified in Section 5014(j).
   C. As specified in Section 5014(p).
   D. A floor drain shall be considered vented when connected to a vented waste line within a distance not exceeding 48 times the inside diameter of the floor drain.
   E. When structural conditions preclude installation as set forth in Section 5014(e) 3, a vent may be run horizontally before being run vertically, provided there is a cleanout in the vertical portion of the vent to permit washing the horizontal vent line.
   F. Unvented floor drains shall not be connected to a horizontal drain within 8’ of the base of any waste stack.

3. **Connections to Waste Pipe.** Where vent pipes connect to a horizontal waste pipe, the vent shall be taken off above the center line of the waste pipe, and the vent pipe shall rise vertically, or at an angle not more than 45 degrees from the vertical, to a point at least 6 inches above the flood level-rim of the fixture it is venting before offsetting horizontally or before connecting to the branch vent.

4. **Connection To Vent Stack.** The connection between a vent pipe and a vent stack shall be at least 6 inches above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents, circuit vents, or loop vents shall be at least 6 inches above the flood level rim of the highest fixture served.

(f) **Fixture Vents.**

1. **Distance of Trap From Vent.** Each fixture trap shall have a protecting vent located so that the slope and the developed length of the fixture drain from the trap weir to the vent fitting are within the requirements set forth in Table 50-J.

2. **Vent Pipe Level.** The vent pipe opening from a waste pipe, except for water closets and similar fixtures, shall not be below the top of the dip of the trap.

(g) **Fixture Connected To Stack At Different Levels.** A common vent may be used for two fixtures set on the same floor level but connecting at different levels in the stack, provided:

1. The vertical drain is one pipe diameter larger than the upper fixture drain.
2. The vertical drain is not smaller than the lower fixture drain.
3. Both drains conform to Section 5014(f).

(h) **Wet Venting.**

1. **Single Bathroom Group.** A single bathroom group of fixtures may be installed on the top floor with a drain from a vented lavatory, kitchen sink or combination fixture serving as a wet vent for a
bathtub or shower stall and for the water closet, except blowout type, provided:
A. No more than one fixture unit is drained into a 1 1/2 inch diameter wet vent.
B. No more than four fixture units drain into a 2 inch diameter wet vent.

2. **Bathroom Groups.** Back to back bathroom groups on top floor consisting of two lavatories and two bathtubs or shower stalls located on the top floor, may be installed on the same horizontal branch with a common vent for the lavatories and with no vent for the bathtubs or shower stalls, provided the wet vent is 2 inches or larger in diameter.

3. **Multistory Bathroom Groups.** On the lower floors of a multistory building, the waste pipe from one or two lavatories may be used as a wet vent for one or two bathtubs or showers provided:
A. The wet vent and its extension to the vent stack is 2 inches in diameter.
B. Each water closet below the top floor is individually vented.
   **EXCEPTION:** In any bathroom group wet vented in accordance with Section 5014(h) 1, 2, and 3, the water closets below the top floor need not be individually vented if the 2 inch waste connects directly into the water closet bend at a 45 degree angle to the horizontal portion of the bend in the direction of flow.

(i) **Stack Venting.**

1. **Single Groups.** A group of fixtures consisting of one bathroom group and a kitchen sink or combination fixture may be installed in a one-story building or on the top floor of a building without individual fixture vents, provided:
   A. Each fixture drain connects independently to the stack.
   B. The water closet and bathtub or shower stall drains enter the stack at the same level.
   C. The drains are in accordance with Section 5014(f)1.

2. **Multiple Groups.** Groups of fixtures consisting of a water closet, basin, shower or tub and a kitchen sink (with disposal and dishwasher) located back-to-back to the bathroom, or 2-bathrooms back-to-back each consisting of one toilet, basin, shower or tub may be installed without individual fixture vents in a one-story building or on the top floor of a building provided:
   A. Each fixture drain connects independently to the stack.
   B. The water closet and bathtub or shower stall drains enter the stack at the same level.
   C. The drains are in accordance with Section 5014(f)1.

3. **Lower Floors.** Lower floors may be vented as in Sections 5014(i)1 and 5014(i)2, provided a separate wye and upright one-eighth bend is installed above the wye.

(j) **Battery Venting.** A uniformly sized horizontal waste branch, to which one or a maximum of eight floor outlet water closets (except blowout type), floor outlet urinals, fixtures having floor outlet, showers, bathtub, or floor drains that are connected in battery, may be vented by a circuit or loop vent which shall take off between the last two upstream fixture connections.
1. In addition, lower floor branches shall be provided with a relief vent taken off downstream of the first fixture connection. When lavatories or similar fixtures in the same branch interval discharge above lower floor branches, each vertical branch shall be provided with a continuous vent, or shall be connected as follows:
   A. Not more than 2 fixture units shall be connected to a 2 inch, or 4 fixture units to a 3 inch loop vent, circuit vent, or to the relief vent used with a loop or circuit vent, provided no other fixture is drained to the vent pipe.

2. Batteries of more than 8 fixtures may be installed, provided a vent as described above is installed for each 8 or fewer fixtures connected.

3. **Dual Relief Vents.** 2 circuit-vented horizontal branches serving not more than 8 water closets in each horizontal branch, as described in Section 5014(j), in the same branch interval, shall have a dual relief vent. When the vents are joined, the point of joining shall be at least 6 inches above the flood-level rim of the highest fixture connected to either branch. When other fixtures discharge above these branches each branch shall be provided with a vent.

4. **Vent Connections.** When the circuit, loop, or relief vent connection is taken off the horizontal branch, the vent connection shall be taken in a vertical line from the top of the horizontal branch.

5. **Fixtures Connected Back To Back Or Side By Side In Battery.** Fixtures connected to one horizontal branch through a double "Y" or a vertical sanitary cross may be installed on a common vent for each 2 fixtures back to back, side by side, or double connection. The common vent shall be installed in a vertical position. A sanitary cross 2" and smaller shall be long turn.

6. **Size of Vent.** Sumps and receiving tanks, except pneumatic ejectors, into which sewage or other wastes are discharged shall be provided with a vent sized in accordance with Table 50-K and 50-L.

   (k) **Pneumatic Ejector.** The air pressure relief pipe from a pneumatic ejector shall not be connected to the regular venting system, but shall be connected to an independent vent stack terminating as required for a vent extension through roofs. The relief pipe shall be sized to relieve air pressure inside the ejector to atmospheric pressure within 10 seconds, but shall be not less than 1 1/4 inches in size. 

   (l) **Relief Vents.** Waste stacks in buildings having more than ten branch intervals shall be provided with a relief vent at each tenth interval installed, counting to begin at the top floor. The size of the relief vent shall be equal to the size of the vent stack to which it connects. The lower end of the relief vent shall connect to the waste stack through a Y below the horizontal branch surrounding the floor and the upper end shall connect to the vent stack through Y not less than 3 feet above the floor level.

   (m) **Suds Waste and Venting**

1. **Where Required.** Sinks, laundry trays, laundry washing machines, and similar fixtures in which sudsy detergents are normally used shall be wasted and vented in accordance with Section 5014(m)2. This requirement shall not apply to single family dwellings.
2. **Method.** In buildings of less than 6 branch intervals, a separate waste pipe for the lowest floor fixtures shall be provided. The connection to the lowest horizontal drain shall not be within 5 feet of the stack. In buildings of 6 or more branch intervals, separate waste and vent stacks for the lower two branch intervals shall be provided.

(n) **Vent Headers.** Stack-vents and vent stacks may be connected into a common vent header at the top of the stacks and then extended to the open air at one location. This header shall be sized in accordance with the requirements of Table 50-K, the number of units being the sum of all units on all stacks connected thereto, and the developed length being the longest vent length from the intersection at the base of the most distant stack to the vent terminal in the open air as a direct extension of one stack.

1. **Size of Circuit or Loop Vent.** The diameter of a circuit or loop vent shall be not less than 1/2 the diameter of the horizontal waste branch. See Table 50-L.

(o) **Size of Vent Piping.** The size of vent piping shall be determined from its length and total of fixture-units connected thereto as provided in Table 50-K.

(p) **Combination Waste and Vent System.**

1. **Where Permitted.** Combination waste-and-vent system shall be permitted only where design conditions preclude the installation of a conventional system as provided in this Building Code.

2. **Limits.** A combination waste-and-vent system is limited to floor drains, drinking fountains, indirect waste receptors, lavatories, and sinks. It consists of an installation of waste piping in which the trap of the fixture is not individually vented. Every waste pipe in the system shall be at least 2 pipe sizes larger than the size required in Section 5013. The drain to which the connection is made shall be vented in the same branch interval, both upstream and downstream of the connection to the drain, and the vents shall be sized in accordance with Table 50-L.

(q) **Single Stack System.** An engineered single-stack system using special fittings designed for systems may be used with prior approval of the Department. See Chapter 1.

**SECTION 5015. STORM DRAINS.**

(a) **Drainage Required.** When drainage is piped to a point of discharge off the premises, roofs, paved areas, yards, courts, and courtyards shall be drained into a storm-sewer system or a combined-sewer system, where the systems are available. Storm drainage shall be discharged so as to minimize the creation of a nuisance or a hazard. A building storm drain shall not be connected to building drain. Roof drains shall form an independent system from any other allowable gravity drains within the building. An interceptor, when required, shall also be provided ahead of any pumping device. See Section 5004(c)7.

1. **Traps.** Leaders and storm drains, when connected to a combined sewer, shall be trapped and vented. One trap on the storm drain of the building may be used.

2. **Expansion Joints.** Expansion joints or sleeves shall be provided where necessary to accommodate temperature variations or other building movement.
3. **Subsoil Drains.** Where subsoil drains are placed under the cellar or basement floor or are used to encircle the building walls, they shall be made of open-jointed, horizontally split, perforated clay tile, perforated bituminized fiber pipe, perforated plastic, or asbestos cement pipe not less than 3 inches in diameter.

(b) **Materials.**

1. **Inside Leaders.** Leaders when placed within a building or run in a vent or pipe shaft shall conform to Section 5013(a)1.

2. **Outside Leaders.** When outside leaders are of sheet metal connected with a building storm drain or storm sewer, they shall be connected to cast iron drain extending above the finish grade and provided with a cleanout.

3. **Underground Drains.** Building storm drains, when underground, shall conform to Section 5013(a)2.

4. **Building Storm Sewer.** Building storm sewers shall conform to Section 5013(c).

(c) **Size of Leaders and Storm Drains.**

1. **Vertical Leaders.** The size of vertical leaders shall be based upon the maximum projected roof area, in accordance with Table 50-M, unless the run off is controlled by engineered weir-type drains as provided for in Section 5015(c)3.

2. **Building Storm Drains.** The size of the building storm drain or any of its horizontal branches having a slope of 1/2 inch or less per foot, shall be based upon the maximum projected roof area to be handled, in accordance with Table 50-N, unless the flow is controlled by an engineered system as provided for in Section 5015(c)3.

3. **Controlled Flow Storm Water System.**
   
   **A. Application.** In lieu of sizing the storm drainage system on the basis of actual maximum projected roof areas as previously described in this Chapter, the roof drainage system may be sized on the equivalent or adjusted maximum projected roof areas which result from controlled flow and storage of storm water on the roof provided approved flow control devices are incorporated into a finished roof.

   **B. Control Device.** A control device shall be installed to limit the rate of discharge of water in gallons per minute not to exceed the rate permitted in Table 50-M and 50-N.

   **C. Roof Construction.** See Chapters 23 and 32.

   **D. Installation.** Control of run off from flat roofs may be controlled devices. Height of stones or other granular material above waterproofed surface shall be discounted and in no case shall the surface in the vicinity of the drain be recessed to create a reservoir. Control devices shall be protected by strainers.

   **E. Drains Required.** At least 2 drains shall be installed in roof areas 10,000 square feet or less and at least 4 drains in roof areas over 10,000 square feet.

4. **Values for Continuous Flow.** Where a continuous or semicontinuous discharge from a pump, air conditioning plant, or similar device, flows into the building storm drain or building sewer, each
gallon per minute of discharge shall be computed as being equivalent to 48 square feet of roof area.

SECTION 5016. TESTS.

(a) Material and Labor For Tests. The equipment, material, power, and labor necessary for the inspections and tests required by this Chapter shall be furnished by the plumbing contractor.

(b) Tests of Drainage and Vent Systems. All of the piping of the plumbing system shall be tested with water or air. Test procedures shall not conflict with material manufacturer printed instructions, but in no case shall tests be less than required by this Section.

1. Water Pressure Test. The water pressure test shall be applied to drainage system, exclusive to the building sewer, either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest opening of the section under test, and each section shall be filled with water. No section shall be tested with less than a 10 foot head of water. In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 feet of the system) shall have been submitted to a test of less than a 10 foot head of water. The water shall be kept in the system, or in the portion under test, for at least 15 minutes before inspection starts. The system shall then be tight and without leaks at all points.

2. Air Test. The air test shall be made by attaching an air compressor or testing apparatus to any suitable opening; and, after closing all other inlets and outlets of the system, forcing air into the system until there is a uniform gage pressure to balance a column of mercury 10 inches in height. This pressure shall be held without introduction of additional air for a period of at least 15 minutes.

(c) Test of Water-Supply System. Upon completion of a section or of the entire water supply system, it shall be tested and proved tight under a water pressure of at least the working pressure under which it is to be used. The water used for tests shall be obtained from the normal source of supply.

(d) Test of Interior Leaders or Downspouts. Leaders or downspouts and branches within a building shall be tested by water or air in accordance with Section 5016(b)1 or 5016(b)2.

SECTION 5017. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cast Iron Screwed Fittings, 125 and 250 lb., B16.4-1971</td>
</tr>
<tr>
<td></td>
<td>Threaded Cast Iron Pipe for Drainage Vent, and Waste Services, A40.5-1943.</td>
</tr>
</tbody>
</table>
Malleable Iron Screwed Fittings, 150 and 300 lb., B16.3-1971.
Seamless Copper Tube, Spec. for, H23.3-1973.
Zinc-Coated (Galvanized) Wrought Iron Sheets, Spec. for, G8.8-1937.
Seamless and Welded Ferritic Stainless Steel Tubing for General Service, Spec. for, ASTM A268.70.
Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses, Spec. for, A120-70.
Seamless Brass Tube, Spec. for B135-71.
Extra Strength Clay Pipe, Spec. for, C700-74.
Concrete Sewer, Storm Drain, and Culvert Pipe, Spec. for, C14-73.
Brass Plate, Sheet Strip, and Rolled Bar, Spec. for, B36-74.
Leaded Brass Plate, Strip, and Rolled Bar, Spec. for, B121-71.
Copper Sheet, Strip Plate, and Rolled Bar, Spec. for, B152-74.
Solder Metal, Spec. for, B 32-70.
Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, D2852-1974.

AWWA
Coal-Tar Enamel. (Protective Coating), 7A.61940.

CISPI
Coupling for No-Hub Cast Iron Waste Pipe, 301-72.

LEGEND

ORGANIZATION

ANSI
American National Standards Institute
10 East 40th Street
New York, N.Y. 10016

ASTM
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

AWWA
American Water Works Association
No. 2 Park Avenue
New York, N.Y. 10016

CISPI
Cast Iron Soil Pipe Institute Standard
2029 K St., N.W.
Washington, D.C. 20006

SECTION 5018. TABLES AND CHARTS.

TABLE NO. 50-A

PIPE HANGER SPACING

<table>
<thead>
<tr>
<th>Material</th>
<th>Pipe Size in Inches</th>
<th>Maximum Spacing in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPPER</td>
<td>$\frac{1}{8}$</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>$\frac{3}{4}$, 1</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>$1 \frac{1}{4}$, $1 \frac{1}{2}$</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>$2 \frac{1}{4}$, 3, $3 \frac{1}{2}$</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6 and Over</td>
<td>14</td>
</tr>
<tr>
<td>STEEL</td>
<td>$\frac{1}{8}$</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>$\frac{3}{4}$, 1, $1 \frac{1}{4}$</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>$1 \frac{1}{2}$, $2$, $2 \frac{1}{2}$</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>3, $3 \frac{1}{2}$</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5 and Over</td>
<td>16</td>
</tr>
<tr>
<td>GLASS</td>
<td>All Sizes</td>
<td>8</td>
</tr>
<tr>
<td>PLASTIC</td>
<td>$\frac{1}{2}$, $\frac{3}{4}$, 1, $1 \frac{1}{4}$, $1 \frac{1}{2}$, 2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>$2 \frac{1}{4}$, 3, 4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>6 and Over</td>
<td>6</td>
</tr>
</tbody>
</table>

Hanger Spacing @ Temperature

<table>
<thead>
<tr>
<th>Below 100°F</th>
<th>101-130°F</th>
<th>131-150°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

50-27
### Table No. 50-B
**Application of Backflow Prevention Devices in Cross-Connections and Where Contamination is Hazardous to the Potable Water Supply**

<table>
<thead>
<tr>
<th>Type of Connection</th>
<th>Degrees of Hazard</th>
<th>Types of Protection</th>
<th>Double Check Valve (Spring Loaded)</th>
<th>Double Check Valve (All Others)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severe</td>
<td>Moderate</td>
<td>Minor</td>
<td>Air-gap</td>
</tr>
<tr>
<td>I. Direct Water Connections subject to pressure:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Pumps, tanks and lines handling:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Sewage and lethal substances</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Toxic substances(^a)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Non-toxic substances(^b)</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>B. Water connection to steam and steam boiler:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Boiler or steam connection to toxic substances(^a)</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2. Boiler or steam connection to non-toxic substances(^b) (boiler blow-off through approved gap)</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)**TOXIC SUBSTANCE:** Any substance (liquid, solid, or gaseous) which, when introduced into the water supply system, creates a danger to the health and well being of the consumer.

\(^b\)**NON-TOXIC SUBSTANCE:** Any substance of a non-poisonous nature that is potable or edible and that creates a severe, moderate, or minor hazard to the domestic water system.

**Examples:**
1. Connections of food processing lines such as syrups, lard, beer, etc.
2. Connections to steam and steam boilers where the steam does not come in contact with poisonous materials.
3. Steam clean-up connection in food plants, apartment house boilers, or pressing boilers, where toxic compounds are used.
4. Connections to enclosed circulating systems, such as radiant heating systems and refrigerated water systems, where toxic compounds are not used.
### TABLE NO. 50-B
**APPLICATION OF BACKFLOW PREVENTION DEVICES IN CROSS-CONNECTIONS AND WHERE CONTAMINATION IS HAZARDOUS TO THE POTABLE WATER SUPPLY**

<table>
<thead>
<tr>
<th>TYPE OF CONNECTION</th>
<th>DEGREES OF HAZARD</th>
<th>TYPES OF PROTECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severe</td>
<td>Moderate</td>
</tr>
<tr>
<td>C. Hot water heating boilers, generators or pressure vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Connection to toxic substances&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Connection to non-toxic substances&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Direct or Indirect Water Connections not subject to pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Low inlet to receptacles containing toxic substances&lt;sup&gt;a&lt;/sup&gt;</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>B. Low inlet to receptacles containing non-toxic substances&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>C. Lawn sprinkler systems (chemical injection prohibited)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>D. Coils or jackets used as heat exchangers in compressors, degreasers or other equipment:</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

<sup>a</sup> **TOXIC SUBSTANCE:** Any substance (liquid, solid, or gaseous) which, when introduced into the water supply system, creates a danger to the health and well being of the consumer.

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**EXAMPLES:**
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2. Connections to steam and steam boilers where the steam does not come in contact with poisonous materials.
3. Steam clean-up connection in food plants, apartment house boilers, or pressing boilers, where toxic compounds are not used.
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<tbody>
<tr>
<td></td>
<td>Severe</td>
<td>Moderate</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. In sewer lines</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. In toxic substances&lt;sup&gt;a&lt;/sup&gt;</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3. In non-toxic substances&lt;sup&gt;b&lt;/sup&gt;</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>E. Flushometer valve toilets and urinals</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>F. Toilet and urinal tanks</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>G. Valved outlets or fixtures with hose attachments which</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>may constitute a cross-connection:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Toxic substances&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Non-toxic substances&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Water connected into domestic water tanks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Plumbing drainage lines</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Reclaimed or recycled water</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

<sup>a</sup> TOXIC SUBSTANCE: Any substance (liquid, solid, or gaseous) which, when introduced into the water supply system, creates a danger to the health and well-being of the consumer.

<sup>b</sup> NON-TOXIC SUBSTANCE: Any substance of a non-poisonous nature that is potable or edible and that creates a severe, moderate, or minor hazard to the domestic water system.

**EXAMPLES:**
1. Connections of food processing lines such as syrups, lard, beer, etc.
2. Connections to steam and steam boilers where the steam does not come in contact with poisonous materials.
3. Steam clean-up connection in food plants, apartment house boilers, or pressing boilers, where toxic compounds are not used.
4. Connections to enclosed circulating systems, such as radiant heating systems and refrigerated water systems, where toxic compounds are not used.
TABLE NO. 50-C

FLOW AND PRESSURE REQUIRED

<table>
<thead>
<tr>
<th>Fixture</th>
<th>Flow Pressure(^a) (p.s.i.)</th>
<th>Flow Rate (g.p.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary basin faucet</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Self-closing basin faucet</td>
<td>12</td>
<td>2.5</td>
</tr>
<tr>
<td>Sink faucet, 5/8 inch</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>Sink faucet, 5/8 inch</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>Bathtub faucet</td>
<td>5</td>
<td>6.0</td>
</tr>
<tr>
<td>Laundry-tub cock, 7/8 inch</td>
<td>5</td>
<td>5.0</td>
</tr>
<tr>
<td>Shower</td>
<td>12</td>
<td>5.0</td>
</tr>
<tr>
<td>Ball cock for closet</td>
<td>15</td>
<td>3.0</td>
</tr>
<tr>
<td>Flushometer valve for urinal</td>
<td>15</td>
<td>15.0</td>
</tr>
<tr>
<td>Garden hose, 50 feet and sill cock</td>
<td>30</td>
<td>5.0</td>
</tr>
<tr>
<td>Flushometer valve for closet</td>
<td>10 to 25</td>
<td>15 to 40(^b)</td>
</tr>
</tbody>
</table>

2. Demand Weight of Fixtures in Fixture Units\(^c\)

<table>
<thead>
<tr>
<th>Fixture or Group(^d)</th>
<th>Occupancy</th>
<th>Type of Supply Control</th>
<th>Weight in Fixture Units(^e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water closet</td>
<td>Public</td>
<td>Flushometer valve</td>
<td>10</td>
</tr>
<tr>
<td>Water closet</td>
<td>Public</td>
<td>Flush tank</td>
<td>5</td>
</tr>
<tr>
<td>Pedestal urinal</td>
<td>Public</td>
<td>Flushometer valve</td>
<td>10</td>
</tr>
<tr>
<td>Stall or wall urinal</td>
<td>Public</td>
<td>Flushometer valve</td>
<td>5</td>
</tr>
<tr>
<td>Stall or wall urinal</td>
<td>Public</td>
<td>Flush tank</td>
<td>3</td>
</tr>
<tr>
<td>Lavatory</td>
<td>Public</td>
<td>Faucet</td>
<td>2</td>
</tr>
<tr>
<td>Bathub</td>
<td>Public</td>
<td>Faucet</td>
<td>4</td>
</tr>
<tr>
<td>Shower head</td>
<td>Public</td>
<td>Mixing valve</td>
<td>4</td>
</tr>
<tr>
<td>Service sink</td>
<td>Office, etc.</td>
<td>Faucet</td>
<td>3</td>
</tr>
<tr>
<td>Kitchen sink</td>
<td>Hotel or Resthr.</td>
<td>Faucet</td>
<td>4</td>
</tr>
<tr>
<td>Water closet</td>
<td>Private</td>
<td>Flushometer valve</td>
<td>6</td>
</tr>
<tr>
<td>Water closet</td>
<td>Private</td>
<td>Flush tank</td>
<td>3</td>
</tr>
<tr>
<td>Lavatory</td>
<td>Private</td>
<td>Faucet</td>
<td>1</td>
</tr>
<tr>
<td>Bathtub</td>
<td>Private</td>
<td>Faucet</td>
<td>2</td>
</tr>
<tr>
<td>Shower head</td>
<td>Private</td>
<td>Mixing valve</td>
<td>2</td>
</tr>
<tr>
<td>Bathroom group</td>
<td>Private</td>
<td>Flushometer valve for closet</td>
<td>8</td>
</tr>
<tr>
<td>Bathroom group</td>
<td>Private</td>
<td>Flush tank for closet</td>
<td>6</td>
</tr>
<tr>
<td>Separate shower</td>
<td>Private</td>
<td>Mixing valve</td>
<td>2</td>
</tr>
<tr>
<td>Kitchen sink</td>
<td>Private</td>
<td>Faucet</td>
<td>3</td>
</tr>
<tr>
<td>Laundry trays (1 to 3)</td>
<td>Private</td>
<td>Faucet</td>
<td>3</td>
</tr>
</tbody>
</table>

\(^a\) Flow pressure is the pressure in the pipe at the entrance to the particular fixture considered.
\(^b\) Wide range due to variation in design and type of flushometer valve closets.
\(^c\) For supply outlets likely to impose continuous demands, estimate continuous supply separately and add to total demand for fixtures.
\(^d\) For fixtures not listed, weights may be assumed by comparing the fixture to a listed one using water in similar quantities and at similar rates.
\(^e\) The given weights are for total demand. For fixtures with both hot and cold water supplies, the weights for maximum separate demands may be taken as 7/4ths the listed demand for supply.

NOTE 1. Chart C-1 gives the estimated demand in gallons per minute corresponding to any total number of fixture units. Chart C-2 indicates an enlargement of Chart C-1 for a range up to 360 fixture units.

NOTE 2. The estimated demand load for fixtures used intermittently on any supply pipe shall be obtained by multiplying the number of each kind of fixture supplied through that pipe by its weight from Table 50-C (2), adding the products, and then referring to the appropriate curve of Charts C-1 and C-2 to find the demand corresponding to the total fixture units. In using this method, it should be noted that the demand for fixture or supply outlets other than those listed in Table 50-C (2) is not yet included in the estimate. The demands for outlets (such as hose connections, air-conditioning apparatus, etc.) which are likely to impose continuous demands during heavy use of the weighted fixtures, shall be estimated separately and added to the demand for fixtures used intermittently, in order to estimate the total demand.
Friction Loss in Head in Lbs. per Sq. In. per 100 Ft. Length

Copper Tubing
Smooth Pipe

Type M
Type L
Type K

PIPE SIZING DATA
Friction Loss in Head in Lbs. per Sq. In. per 100 Ft. Length

STEEL PIPE SIZES

PIPE SIZING DATA
CHART C-5

Friction Loss in Head in Lbs. per Sq. In. per 100 Ft. Length

Flow in Gallons per Minute

Friction Loss in Head in Lbs. per Sq. In. per 100 Ft. Length

CPVC

PIPE SIZING DATA
### TABLE NO. 50-D

**TYPE OF FIXTURE**

<table>
<thead>
<tr>
<th>FIXTURE</th>
<th>PIPE SIZE (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtubs</td>
<td>1/2</td>
</tr>
<tr>
<td>Combination sink and tray</td>
<td>1/2</td>
</tr>
<tr>
<td>Drinking fountain</td>
<td>3/8</td>
</tr>
<tr>
<td>Dish washer, domestic</td>
<td>1/2</td>
</tr>
<tr>
<td>Kitchen sink, commercial</td>
<td>1/2</td>
</tr>
<tr>
<td>Kitchen sink, residential</td>
<td>3/8</td>
</tr>
<tr>
<td>Lavatory</td>
<td>3/8</td>
</tr>
<tr>
<td>Laundry tray 1, 2, or 3 compartments</td>
<td>1/2</td>
</tr>
<tr>
<td>Shower (single head)</td>
<td>1/2</td>
</tr>
<tr>
<td>Sinks (service, slop)</td>
<td>1/2</td>
</tr>
<tr>
<td>Sinks, flushing rim with flushometer valve</td>
<td>3/4</td>
</tr>
<tr>
<td>Urinal (flush tank)</td>
<td>1/2</td>
</tr>
<tr>
<td>Urinal (direct flushometer valve operated)</td>
<td>3/4</td>
</tr>
<tr>
<td>Water closet (tank type)</td>
<td>3/8</td>
</tr>
<tr>
<td>Water closet (flushometer valve operated)</td>
<td>1</td>
</tr>
<tr>
<td>Hose bibbs and sill cocks</td>
<td>1/2</td>
</tr>
</tbody>
</table>

**NOTE:** For fixtures not listed, the minimum supply branch may be made the same as for comparable fixtures.

### TABLE NO. 50-E

**MINIMUM SLOPES FOR WASTE PIPING**

<table>
<thead>
<tr>
<th>Diameter of Pipe (Inches)</th>
<th>Slope per foot (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4, 1 1/2, 2, 2 1/2</td>
<td>1/4</td>
</tr>
<tr>
<td>3, 4, 5, 6</td>
<td>1/8</td>
</tr>
<tr>
<td>8, 10, 12, 15</td>
<td>1/16</td>
</tr>
</tbody>
</table>
**TABLE NO. 50-F**

**BASIS FOR COMPUTING DRAINAGE FIXTURE UNIT VALUES AND TRAP SIZES**

<table>
<thead>
<tr>
<th>Type of Fixture or Group of Fixtures</th>
<th>Drainage Fixture Unit Value (d.f.u.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic clothes washer (2&quot; standpipe)</td>
<td>3</td>
</tr>
<tr>
<td>Bathroom group consisting of a water closet, lavatory and bathtub or shower stall:</td>
<td></td>
</tr>
<tr>
<td>Flushometer valve closet</td>
<td>8</td>
</tr>
<tr>
<td>Tank type closet</td>
<td>6</td>
</tr>
<tr>
<td>Bathtub* (with or without overhead shower)</td>
<td>2</td>
</tr>
<tr>
<td>Bidet</td>
<td>1</td>
</tr>
<tr>
<td>Clinic sink</td>
<td>6</td>
</tr>
<tr>
<td>Combination sink and tray with food waste grinder</td>
<td>4</td>
</tr>
<tr>
<td>Combination sink and tray with one 1 1/2 inch trap</td>
<td>2</td>
</tr>
<tr>
<td>Combination sink and tray with separate 1 1/2 inch traps</td>
<td>3</td>
</tr>
<tr>
<td>Dental unit or cuspidor</td>
<td>1</td>
</tr>
<tr>
<td>Dental lavatory</td>
<td>1</td>
</tr>
<tr>
<td>Drinking fountain</td>
<td>1/2</td>
</tr>
<tr>
<td>Dishwasher, domestic</td>
<td>2</td>
</tr>
<tr>
<td>Floor drains with 2 inch waste</td>
<td>2</td>
</tr>
<tr>
<td>Kitchen sink, domestic, with food waste grinder</td>
<td>2</td>
</tr>
<tr>
<td>Kitchen sink, domestic, with one 1 1/2 inch trap</td>
<td>2</td>
</tr>
<tr>
<td>Kitchen sink, domestic, with food waste grinder and dishwasher 1 1/2 inch trap</td>
<td>3</td>
</tr>
<tr>
<td>Kitchen sink, domestic, with dishwasher 1 1/2 inch trap</td>
<td>3</td>
</tr>
<tr>
<td>Lavatory with 1 1/4 inch waste</td>
<td>1</td>
</tr>
<tr>
<td>Laundry tray (1 or 2 compartments)</td>
<td>2</td>
</tr>
<tr>
<td>Showers (per head)</td>
<td>2</td>
</tr>
<tr>
<td>Sinks:</td>
<td></td>
</tr>
<tr>
<td>Surgeon's</td>
<td>3</td>
</tr>
<tr>
<td>Flushing rim (with flushometer valve)</td>
<td>6</td>
</tr>
<tr>
<td>Service (trap standard)</td>
<td>3</td>
</tr>
<tr>
<td>Service (P trap)</td>
<td>2</td>
</tr>
<tr>
<td>Pot, scullery, etc.</td>
<td>4</td>
</tr>
<tr>
<td>Urinal, pedestal, syphon jet blowout</td>
<td>6</td>
</tr>
<tr>
<td>Urinal, wall lip</td>
<td>3</td>
</tr>
<tr>
<td>Urinal, stall, washout</td>
<td>3</td>
</tr>
<tr>
<td>Wash sink (circular or multiple) each set of faucets</td>
<td>2</td>
</tr>
<tr>
<td>Water closet, tank operated</td>
<td>4</td>
</tr>
<tr>
<td>Water closet, flushometer valve operated</td>
<td>6</td>
</tr>
<tr>
<td>All other fixtures*</td>
<td></td>
</tr>
<tr>
<td>Trap size 1 1/4 inch or less</td>
<td>1</td>
</tr>
<tr>
<td>Trap size 1 1/2 inch</td>
<td>2</td>
</tr>
<tr>
<td>Trap size 2 inch</td>
<td>3</td>
</tr>
<tr>
<td>Trap size 2 1/2 inch</td>
<td>4</td>
</tr>
<tr>
<td>Trap size 3 inch</td>
<td>5</td>
</tr>
<tr>
<td>Trap size 4 inch</td>
<td>6</td>
</tr>
</tbody>
</table>

*a A shower head over a bathtub does not increase the fixture unit value.

*b For a continuous or semi-continuous flow into a drainage system, such as from a pump, sump ejector, air conditioning equipment, or similar device, 2 fixture units shall be permitted for each gallon-per-minute of flow.
### TABLE NO. 50-G

**BUILDING DRAINS AND SEWERS**

**MAXIMUM NUMBER OF FIXTURE UNITS THAT MAY BE CONNECTED TO ANY PORTION\(^a\) OF THE BUILDING DRAIN OR THE BUILDING SEWER.**

<table>
<thead>
<tr>
<th>Diameter of Pipe (Inches)</th>
<th>SLOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\frac{1}{16}) inch</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>2 (\frac{1}{2})</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>180</td>
</tr>
<tr>
<td>4</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
<td>1,400</td>
</tr>
<tr>
<td>6</td>
<td>1,400</td>
</tr>
<tr>
<td>8</td>
<td>2,500</td>
</tr>
<tr>
<td>10</td>
<td>3,900</td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Includes branches of the building drain.

\(^b\) Not over 2 water closets.

All groups A through I occupancies shall have at least one building drain and building sewer of 4 inches.

### TABLE NO. 50-H

**MAXIMUM LOADS FOR WASTE BRANCH AND STACKS HAVING NOT MORE THAN 3 BRANCH INTERVALS**

<table>
<thead>
<tr>
<th>Diameter of Stack (Inches)</th>
<th>Any Horizontal Fixture Branch (d.f.u.(^c))</th>
<th>Total For Stack (d.f.u.(^c))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (\frac{1}{4})</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1 (\frac{1}{2})</td>
<td>2(^a)</td>
<td>4(^a)</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>2 (\frac{1}{4})</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>20(^b)</td>
<td>48(^b)</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>240</td>
</tr>
<tr>
<td>5</td>
<td>225</td>
<td>540</td>
</tr>
<tr>
<td>6</td>
<td>385</td>
<td>930</td>
</tr>
<tr>
<td>8</td>
<td>875</td>
<td>2100</td>
</tr>
</tbody>
</table>

\(^a\) Minimum size for food waste grinder is 2 inches.

\(^b\) Not more than 2 water closets or bathroom groups within each branch interval nor more than 6 water closets or bathroom groups on the stack.

\(^c\) (d.f.u.) Drain fixture unit.
<table>
<thead>
<tr>
<th>Number of Branch Intervals</th>
<th>Diameter of Stack for any:</th>
<th>2&quot;</th>
<th>2 1/4&quot;</th>
<th>3&quot;</th>
<th>4&quot;</th>
<th>5&quot;</th>
<th>6&quot;</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>15&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>one interval</td>
<td>3</td>
<td>7</td>
<td>18a</td>
<td>90</td>
<td>205</td>
<td>350</td>
<td>785</td>
<td>1405</td>
<td>2195</td>
<td>3985</td>
</tr>
<tr>
<td></td>
<td>on stack</td>
<td>13</td>
<td>27</td>
<td>72a</td>
<td>360</td>
<td>820</td>
<td>1400</td>
<td>3140</td>
<td>5620</td>
<td>8780</td>
<td>15,740</td>
</tr>
<tr>
<td>5</td>
<td>one interval</td>
<td>3</td>
<td>6</td>
<td>17a</td>
<td>84</td>
<td>190</td>
<td>325</td>
<td>735</td>
<td>1310</td>
<td>2045</td>
<td>3675</td>
</tr>
<tr>
<td></td>
<td>on stack</td>
<td>16</td>
<td>32</td>
<td>85a</td>
<td>420</td>
<td>950</td>
<td>1625</td>
<td>3675</td>
<td>6550</td>
<td>10,225</td>
<td>18,375</td>
</tr>
<tr>
<td>6</td>
<td>one interval</td>
<td>3b</td>
<td>6b</td>
<td>16a</td>
<td>80</td>
<td>180</td>
<td>310</td>
<td>700</td>
<td>1200</td>
<td>1950</td>
<td>3500</td>
</tr>
<tr>
<td></td>
<td>on stack</td>
<td>18c</td>
<td>36c</td>
<td>96a</td>
<td>480</td>
<td>1080</td>
<td>1860</td>
<td>4200</td>
<td>7500</td>
<td>11,700</td>
<td>21,000</td>
</tr>
<tr>
<td>7</td>
<td>one interval</td>
<td>15a,b</td>
<td>7gb</td>
<td>175</td>
<td>299</td>
<td>675</td>
<td>1205</td>
<td>1880</td>
<td>3375</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>on stack</td>
<td>102a,c</td>
<td>539c</td>
<td>1215</td>
<td>2090</td>
<td>4725</td>
<td>8435</td>
<td>13,160</td>
<td>23,620</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>one interval</td>
<td>170</td>
<td>290</td>
<td>655</td>
<td>1170</td>
<td>1825</td>
<td>3280</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>on stack</td>
<td>1360</td>
<td>2320</td>
<td>5240</td>
<td>9360</td>
<td>14,600</td>
<td>26,240</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>one interval</td>
<td>155b</td>
<td>285</td>
<td>640</td>
<td>1145</td>
<td>1790</td>
<td>3210</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>on stack</td>
<td>1400c</td>
<td>2560</td>
<td>5780</td>
<td>10,310</td>
<td>16,090</td>
<td>28,880</td>
<td></td>
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</tr>
<tr>
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<td>630</td>
<td>1125</td>
<td>1755</td>
<td>3150</td>
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<td></td>
<td></td>
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</tr>
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<td>6300</td>
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<td>17,550</td>
<td>31,500</td>
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<td>265b</td>
<td>620</td>
<td>1110</td>
<td>1730</td>
<td>3100</td>
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</tr>
<tr>
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<td>on stack</td>
<td>2900c</td>
<td>6830</td>
<td>12,200</td>
<td>19,020</td>
<td>31,160</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

a Not more than two water closets or bathroom groups within any one branch interval and not more than 6 water closets or bathroom groups on the stack.
b Loads on any one branch interval for higher stacks shall not exceed these values, however, this shall not preclude the installation of higher stacks.
c Stack loads for additional branch intervals shall not exceed these values.
## TABLE NO. 50-I

**MAXIMUM LOADS FOR WASTE STACKS HAVING FOUR OR MORE BRANCH INTERVALS**

<table>
<thead>
<tr>
<th>Number of Branch Intervals</th>
<th>Diameter of Stack (&quot;&quot;&quot;) for any:</th>
<th>2&quot;</th>
<th>2 1/4&quot;</th>
<th>3&quot;a</th>
<th>4&quot;</th>
<th>5&quot;</th>
<th>6&quot;</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>15&quot;</th>
</tr>
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<tbody>
<tr>
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<td>610</td>
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<td></td>
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<td>7350</td>
<td>13,100</td>
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<tr>
<td>14</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>586b</td>
<td>1080</td>
<td>1690</td>
<td>3030</td>
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<td>14,070</td>
<td>21,960</td>
<td>39,390</td>
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<td></td>
<td></td>
<td>1070b</td>
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<td></td>
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</tr>
<tr>
<td></td>
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<td>15,000c</td>
<td>23,410</td>
<td>42,015</td>
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</tr>
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<td>26,000c</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
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<td>18</td>
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</tr>
</tbody>
</table>

---

a Not more than two water closets or bathroom groups within any one branch interval and not more than 6 water closets or bathroom groups on the stack.

b Loads on any one branch interval for higher stacks shall not exceed these values, however, this shall not preclude the installation of higher stacks.

c Stack loads for additional branch intervals shall not exceed these values.
### TABLE NO. 50-J

**DISTANCE OF TRAP WEIR FROM VENT**

<table>
<thead>
<tr>
<th>Size of Fixture Drain (Inches)</th>
<th>Permissible Distance (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4</td>
<td>2.5</td>
</tr>
<tr>
<td>1 1/2</td>
<td>3.5</td>
</tr>
<tr>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>3</td>
<td>6.0</td>
</tr>
<tr>
<td>4</td>
<td>10.0</td>
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</tbody>
</table>

### TABLE NO. 50-K

**SIZE AND LENGTH OF VENTS**

<table>
<thead>
<tr>
<th>Size of Waste Stack (Inches)</th>
<th>Fixture Units Connected</th>
<th>Diameter of Vent Required (Inches)</th>
<th>Maximum Length of Vent (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 1/4</td>
<td>1 1/2</td>
</tr>
<tr>
<td>1 1/4</td>
<td>2</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>1 1/2</td>
<td>8</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>30</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>30</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>30</td>
<td>50</td>
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<tr>
<td>2</td>
<td>36</td>
<td>26</td>
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</tr>
<tr>
<td>3</td>
<td>30</td>
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</tr>
<tr>
<td>3</td>
<td>10</td>
<td>30</td>
<td>100</td>
</tr>
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<td>3</td>
<td>102</td>
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<td>4</td>
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<td>30</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>530</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>5</td>
<td>530</td>
<td>20</td>
<td>70</td>
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<td>5</td>
<td>200</td>
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<td>350</td>
<td>20</td>
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</tr>
<tr>
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<td>620</td>
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<td>50</td>
</tr>
<tr>
<td>6</td>
<td>960</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>2900</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>600</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>1400</td>
<td>20</td>
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</tr>
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<td>8</td>
<td>2200</td>
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<td>8</td>
<td>7600</td>
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</tr>
<tr>
<td>10</td>
<td>1000</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
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<td>50</td>
</tr>
<tr>
<td>10</td>
<td>15,000</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

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50-41
**TABLE NO. 50-L**

**HORIZONTAL CIRCUIT AND LOOP VENT SIZING TABLE**

| Waste Pipe Diameter (Inches) | Fixture Units: Number not Exceeding | Diameter of Circuit or Loop Vent
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 1/2”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horizontal Length, not Exceeding (Feet)</td>
</tr>
<tr>
<td>1 1/2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
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<tr>
<td>3</td>
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<td>4</td>
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<tr>
<td>5</td>
<td>200</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>1100</td>
<td>—</td>
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</table>

**TABLE NO. 50-M**

**SIZE OF VERTICAL LEADERS AND ROOF DRAINS**

<table>
<thead>
<tr>
<th>Diameter of Leader or Conductora (inches)</th>
<th>Maximum Projected Roof Area (Sq. Ft.)</th>
<th>Flow Rate (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>960</td>
<td>30</td>
</tr>
<tr>
<td>2 1/2</td>
<td>1733</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>2930</td>
<td>91</td>
</tr>
<tr>
<td>4</td>
<td>6130</td>
<td>191</td>
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<td>5</td>
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</tr>
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<td>6</td>
<td>17,995</td>
<td>561</td>
</tr>
<tr>
<td>8</td>
<td>38,660</td>
<td>1205</td>
</tr>
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</table>

*a Table No. 50-M is based on a 3 inch per hour rainfall.*

**TABLE NO. 50-N**

**SIZE OF HORIZONTAL STORM DRAINS**

<table>
<thead>
<tr>
<th>Diameter of Drain (Inches)</th>
<th>1/8 Inch</th>
<th>1/4 Inch</th>
<th>1/2 Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flow Rate (GPM)</td>
<td>Flow Rate (GPM)</td>
<td>Flow Rate (GPM)</td>
</tr>
<tr>
<td>3</td>
<td>1096</td>
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<td>1456</td>
</tr>
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<td>4</td>
<td>2506</td>
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<td>3533</td>
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<td>4453</td>
<td>142</td>
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<td>15,330</td>
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</table>
# TABLE NO. 50-O

## PIPING MATERIAL - WATER, DRAINAGE AND VENT

<table>
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<tr>
<th>Material</th>
<th>USE</th>
<th>Water Piping Distribution</th>
<th>Interior Drainage and Vent Piping</th>
<th>Exterior Drainage Piping</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Service</td>
<td>Under Slab</td>
<td>Above Ground</td>
</tr>
<tr>
<td>ASBESTOS - CEMENT</td>
<td>A</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
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<tr>
<td>CAST IRON</td>
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<tr>
<td>Water Pipe</td>
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<td>A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Hub Type</td>
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<td>NA</td>
<td>A</td>
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<td>No Hub Pipe &amp; Fitting</td>
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<td>NA</td>
<td>NA</td>
<td>NP</td>
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<tr>
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</tr>
<tr>
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<td>A</td>
<td>A</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Type L - Hard Temper</td>
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<td>Soft Temper</td>
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<tr>
<td>Type M - Hard Temper</td>
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<td>NP</td>
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<td></td>
</tr>
<tr>
<td>DWV Hard Temper</td>
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<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
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<tr>
<td>CPVC&lt;sup&gt;a&lt;/sup&gt;</td>
<td>NA</td>
<td>NP</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>PVC</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>A=ACCEPTABLE</td>
<td></td>
<td>NP=NOT PERMITTED</td>
<td>NA=NOT APPLICABLE</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Minimum sched. 40 pipe size (SDR - 13.5).

<sup>b</sup> See Section 5013 (a) 1.
CHAPTER 51
GAS, LIQUID AND SOLID FUEL

SECTION 5101. GENERAL.
(a) Scope. In addition to other requirements of this Building Code, this Chapter shall govern the installation and repair of gas piping, liquid fuel piping, gas, liquid and solid fuel appliances.

SECTION 5102. DEFINITIONS.
(a) General. For purposes of this Chapter, the following definitions shall apply:
1. Air for Combustion. The amount of air required for safely and properly burning fuel at 5,000 feet altitude.
2. Air Shutter. An adjustable device for varying the effective opening of an air passage.
3. Appliance. Heating, cooling, or cooking equipment utilizing gas, liquid or solid fuel, including but not limited to gas lights, stoves, furnaces, boilers, deep fat fryers, ranges, broilers, smelting pots, incinerators, fireplaces, and any fuel-fired device and appurtenances attached thereto.
4. Appliance Connector. An assembly of approved flexible tubing and fittings to carry fuel between a fuel piping outlet and fuel-burning appliance.
5. Appliance, Unvented. An appliance installed so the products of combustion are not conveyed directly to the outside atmosphere.
6. Appliance, Vented. An appliance installed so all the products of combustion are conveyed directly to the outside atmosphere through an approved chimney or venting system.
8. Automatically Controlled Fuel Supply. One in which the fuel supply is turned on and off automatically.
10. Burner. A device for the final conveyance of fuel, or a mixture of fuel and air, to the combustion zone.
11. Burner Valve. A manually or mechanically operated device which controls the flow of fuel to the main burner.
12. Closet. See confined space.
14. Combustion Products. Products resulting from the combustion of a fuel with air, including inerts, but excluding excess air.
15. Condensate. The liquid which separates from a gas, (including flue gases), due to a reduction in temperature.
16. Confined Space. Any room or enclosed space that provides a volume less than 12 times the total volume of a furnace or furnaces, or less than 16 times the total volume of a boiler or boilers located in the room or space. The volume shall be figured on the basis of a ceiling height of 8 feet, or the actual ceiling height if lower than 8 feet.
17. Continuous Pilot. A pilot which operates at all times.
18. **Controls.** Devices designed to regulate the fuel, air, water, and, or electrical supply to an appliance. These may be manual, semi-automatic or automatic.

19. **Damper.** A device which restricts, retards, or directs the flow of air in any duct, or the products of combustion in any heat-producing equipment, its vent connector, vent or chimney.


21. **Drip Pipe.** A vertical pipe installed at a low point in a system of piping to collect and remove condensate or dirt.

22. **Flame Safeguard.** A device which automatically shuts off the main fuel supply when the means of ignition becomes inoperative.

23. **Flue Gases.** Products of combustion and excess air.

24. **Gas.** As used in this Chapter, shall include natural, manufactured, mixed gas, or liquefied petroleum products.

25. **Gas Control Valve (Automatic).** An automatic device for controlling the main gas supply to a gas-fired appliance.

26. **Gas Outlet.** A connection in a gas piping system to which a gas-burning appliance may be attached.

27. **Gas Piping.** Pipe, valves, and fittings used to convey gas, but shall not include:
   A. Any portion of the service piping.
   B. Any approved flexible piping connection 6 feet or less in length between an existing gas outlet and a gas appliance in the same room with the outlet.

28. **Gas Piping System.** An arrangement of gas piping supplied by an individual meter or supply source.

29. **Limit Control.** A device responsive to changes in pressure, temperature, or liquid level for turning on or shutting off the fuel supply to an appliance.

30. **Listed and Listing.** See Chapter 4.

31. **Liquefied Petroleum Gas. (LPG).** Includes any material composed predominately of any of the following hydrocarbons or mixtures of them; propane or butane in either the liquid or gaseous state.

32. **Lubricated Plug Valve.** A plug-and-barrel type valve with means for maintaining a lubricant between the bearing surfaces.

33. **Manual Main Shutoff Valve.** A manually operated valve in the fuel line for the purpose of completely turning on or shutting off the fuel supply to the appliance.

34. **Meter.** An instrument installed to measure the quantity of fuel.

35. **Modulating.** The action of a control from its maximum to minimum position in either predetermined steps or increments of movements.

36. **Pilot.** Flame utilized to ignite the fuel at the main burner or burners.

37. **Pilot Ignition.** A pilot which operates during the lighting cycle and shuts off during main burner operation.

38. **Pilot, Intermittent.** A pilot which operates during the ignition cycle and continues during main burner operation, but is shut off at other times.
39. **Purge.** To eliminate air, water, or other foreign substances from piping system.

40. **Rating, Input.** The amount of fuel, in Btu per hour, that can be safely burned in an appliance derated to 5000 foot altitude. The rating is subject to approval by the Department.

41. **Rating, Output.** The amount of heat, in Btu per hour, that an appliance will deliver when operating at the rated input.

42. **Regulator, Gas Pressure.** A device for controlling and maintaining a uniform gas supply pressure.

43. **Riser.** A fuel gas supply pipe which extends vertically.

44. **Sealed Combustion System Appliances.** Appliances constructed and installed so that all air for combustion is derived from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

45. **Vent.** See Chapter 37.

46. **Vent Connector.** See Chapter 37.

**SECTION 5103. PIPING.**

(a) **General.** Piping shall not be strained, stressed, or bent due to change in temperature or installation; and appliances shall not be supported by, or develop any strain or stress on, the supply piping. Piping shall be protected from physical damage. The building structure shall not be weakened by the installation of the piping.

(b) **Materials.** Pipe used for the installation, extension, alteration, or repair of any fuel piping shall be at least standard weight steel, yellow brass (containing not more than 75 percent copper), or internally tinned or equivalently treated copper of iron pipe size.

1. **Used.** Fuel pipe shall either be new or shall previously have been used only for conveying fuel. Fuel pipe shall be free from internal obstructions, splits, or other imperfections which would render it unfit for the purpose intended. Burred ends shall be reamed.

2. **Fittings.** Fittings used in connection with fuel piping shall be of malleable iron, steel, or yellow brass (containing not more than 75 percent copper), and shall be at least standard weight. The use of cast iron fittings is prohibited.

3. **Valves.** Valves and appurtenances used in connection with the piping shall be of a type designed for the fuel used.

(c) **Installation.** All joints in the piping system, unless welded, shall be screwed joints, having NPT threads. Screwed joints shall be made up with pipe joint material, insoluble in the presence of the system fuel, and applied to the male threads only. The use of soldered joints is prohibited.

1. **Pipe Entrance.** Pipe entrance into the building shall be through the building wall above grade. The opening between the pipe and the wall shall be sealed.

2. **Underground Piping.** Piping may be installed underground, but shall not be installed under any building or structure; in or under concrete slab, driveway slab, or similar. Ferrous piping installed underground shall be protected from corrosion by coatings or wrapping materials, and shall be cathodically protected, if soil conditions warrant. All such horizontal piping shall have at least 15 inches of approved cover. Risers shall be wrapped to a point at least 6 inches
above grade. Pipe protective coatings shall be approved types, machine applied, and conform to recognized standards. Field wrapping shall provide equivalent protection, and is restricted to those short sections and fittings necessarily stripped for threading or welding. Zinc coatings (galvanizing) shall not be deemed adequate protection for piping below ground. Gas piping installed below grade, shall be installed in an individual trench and be effectively supported at all points on undisturbed or well compacted soil. Material used for backfill around the pipe shall be free of rocks, building materials, ashes, and trash.

3. **Pipe Embedded.** Pipe shall not be embedded in a slab or in masonry construction, but shall be laid in a channel provided for the pipe. The channel shall be of depth and width to permit removal or repair of the installed pipe. A cover shall be provided to cover the channel and shall be installed so as not to interfere with the smooth surface of the floor.

   **EXCEPTION:** When necessary, due to structural conditions, approved fuel piping may be installed in other locations when approval has first been obtained from the Department.

4. **Running Threads.** Running threads or long-screw joints are prohibited.

5. **Bushings, Unions, Couplings.** Bushings, unions, and compression couplings shall not be used in concealed work.

6. **Drip Pipes.** Accessible drip pipes shall be provided at points where condensation or dirt will tend to collect.

7. **Supporting and Backfill.** Fuel piping shall be supported by metal straps or hooks at intervals not to exceed that shown in the following Table:

<table>
<thead>
<tr>
<th>Size of Pipe (Inches)</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>6</td>
</tr>
<tr>
<td>3/4 or 1</td>
<td>8</td>
</tr>
<tr>
<td>1 1/4 or larger (horizontal)</td>
<td>10</td>
</tr>
<tr>
<td>1 1/4 or larger (vertical)</td>
<td>Every floor level</td>
</tr>
</tbody>
</table>

8. **Roof Installation.** See Chapter 32.

9. **Building Shutoff.** Gas piping supplying more than one building on any single site shall be equipped with separate shutoff valves to each building, so arranged that the gas supply can be turned on or off to each building. Shutoff valves shall be located outside the building it supplies and shall be readily accessible.

10. **Shutoff Valve.** An accessible manual shutoff valve shall be installed in the fuel supply piping ahead of the main burner, outside of each appliance enclosure, and ahead of the union or flexible connection thereto.

11. **Interconnecting of Gas Systems.** The installation, use, or maintenance of a gas valve which makes it possible to turn on or otherwise direct the flow of gas from one system of gas piping to another, where the systems are supplied with gas from separate suppliers or meters, is hereby prohibited. When liquefied petroleum or other standby gas is interconnected with regular gas piping system, an approved three-way valve or other adequate safeguard approved by the
Department, shall be installed to prevent backflow into either supply system.

12. **Closing Outlets.** It shall be unlawful to remove or disconnect any gas piping or gas appliance without gastight capping or plugging the outlet from which the pipe or appliance was removed. All outlets to which gas appliances are not connected shall be left gas tight.


14. **Concealed Piping.** All plugged or capped openings shall be exposed and accessible. Bushings, unions, and compression-type couplings shall not be used in concealed work.

15. **Prohibitions.** Fuel piping shall not be installed in or through chimneys, corridors, stairways, hoistways, vents, or in ventilating ducts or ventilating shafts.

(d) **LPG Piping.** In addition to the requirements herein and the Fire Code, piping for use with liquefied petroleum gas shall meet the following requirements:

1. **Shutoff Valves.** All main supply shutoff valves shall be outside of the building and shall be accessible. (See Fire Code.)

2. **Pit and/or Basement.** Liquefied petroleum gas piping shall not serve any gas-fired appliance located in a pit or basement.

3. **Valve Approval.** Valves and appurtenances used on the piping shall be designed and approved for use with liquefied petroleum gas.

(e) **Oil Piping.** Oil piping shall meet the following requirements:

Also see Fire Code.

1. **Pipe Construction.** All piping shall be standard weight steel or brass pipe with standard fittings, or brass or coper tubing with flared fittings, except that approved flexible metal hose may be used for reducing the effect of jarring and vibration, or where rigid connections are impractical. Cast iron fittings are prohibited.

2. **Aluminum Tubing.** The use of aluminum tubing is prohibited.

3. **Pipe Size.** Pipe used in the installation of all burners and appliances other than conversion range oil burners shall not be smaller than 3/8 inch iron pipe size or 3/8 inch OD tubing. Copper or brass tubing shall be Type L minimum wall thickness. Flexible metal hose shall be installed in full compliance with its listing.

4. **Pipe Joints.** Pipe joints and connections shall be made tight with a suitable pipe compound. Unions requiring gaskets or packing, running threads or long-screw joints, and sweat fittings, shall not be used.

5. **Pipe Movement.** Allowance shall be provided for expansion, contraction, jarring, and vibration.

6. **Pipe Pitch.** Oil piping from supply tanks shall be laid to pitch toward the tank, without traps.

7. **Shutoff Valves.** Accessible manual shutoff valves shall be installed where required to avoid oil spillage during servicing.

**SECTION 5104. CHECKING FOR GAS LEAKS.** Leaks in existing gas piping shall be located by applying soapy water to the exterior of the piping. Fire, acid, or water shall not be used to locate leaks.
SECTION 5105. SIZING OF PIPE. Pipe used for the installation, extension, alteration, and repair of any gas piping system shall be sized to supply the full number of outlets for the purpose intended (pressure drop not to exceed 3/10ths of one inch W.C.). Pipe sizes shall be determined by use of Table 51-A. When supply pressure and gas appliances permit a pressure drop other than 3/10ths of one inch W.C., an engineered gas piping system may be used as approved by the Department.

SECTION 5106. INSPECTIONS AND TESTS BY THE DEPARTMENT.

(a) General. Upon completion of the installation, alteration, or repair of any piping, and prior to use, the Department shall be notified that the piping is ready for inspection.

(b) Rough Piping Inspection. A rough inspection shall be obtained after all gas piping authorized by the Permit has been installed, but before the piping has been covered or concealed, or any fixture or appliance has been attached. This inspection shall consist of an air pressure test of at least 10 pounds per square inch gage pressure upstream of the appliance connection. Test pressures shall be held for a length of time satisfactory to the Department but in no case for less than 15 minutes with no perceptible drop in pressure. For welded piping, and for piping carrying gas at pressures in excess of 14 inches water column pressure, the test pressure shall be at least 60 pounds per square inch and shall be continued for a length of time satisfactory to the Department, but in no case for less than 30 minutes.

SECTION 5107. DEFECTIVE PIPE OR FITTINGS. Defective pipe or fittings shall be replaced and not repaired. The gas supply to any system found to be leaking shall be shut off until permanent repairs are made.

SECTION 5108. AUTHORITY TO RENDER GAS SERVICE. No person shall render gas service, except an authorized agent or employee of a person engaged in the business of supplying gas. It shall be unlawful to turn on or connect gas, in or on any premises, unless all outlets are properly connected to gas appliances or capped.

SECTION 5109. PURGING.

(a) General. All gas piping shall be fully purged. Piping shall not be purged into the combustion chamber of an appliance.

(b) Discharge. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are sources of ignition.

SECTION 5110. CHIMNEYS AND VENTS. See Chapter 37.

SECTION 5111. FUEL-FIRED APPLIANCES.

(a) General. Fuel-fired appliances shall be of an approved type.

(b) Accessibility. Fuel-fired appliances shall be installed so that burners, orifices, controls, filters, motors, and blowers are readily accessible for observation, inspection, and service.

(c) Room Access. Means of access to rooms or spaces, in which fuel-fired equipment is located, shall conform to Chapter 52 of this Building Code.

(d) Prohibited Locations. Fuel-fired appliances shall not be installed in a
garage or any other location where flammable vapors are likely to be present, unless the design, operation, and installation of the appliance eliminates the possible ignition of flammable vapors. Appliances shall not be installed in bedrooms, bath rooms, toilet rooms, or rooms used for sleeping purposes in new or existing buildings. Unvented appliances shall not be installed.

(e) **Clearance.** See Chapters 52 and 58.

**SECTION 5112. REQUIRED VENTILATION AND AIR FOR COMBUSTION.**

(a) **General.** Provisions of this Section shall apply to all appliances installed in buildings, and which require air for combustion from within the building. This Section is not intended to apply to: (1) sealed combustion system appliances; or (2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and draft hood dilution. Air intake and air discharge openings shall have a minimum face opening separation of 5 feet. Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of fuel, proper venting, and the maintenance of ambient temperature at safe limits under normal conditions of use. Appliances shall be located so as not to interfere with proper circulation of air within the space. When buildings are so tight that normal infiltration does not meet air requirements, outside air shall be introduced.

(b) **Appliances Located in Unconfined Spaces.** If the unconfined space is within a building of tight construction, air for combustion shall be obtained from outdoors or from spaces freely communicating with the outdoors. Under these conditions, a permanent opening or openings shall have a minimum free area of one square inch for every 5,000 Btu per hour of input rating for equipment with atmospheric burners. For other equipment, an opening or openings, having a minimum free area of 0.5 square feet per 1,000,000 Btu per hour, shall be provided not more than 18" above the equipment base, and an equal opening shall be provided at the high point of the room for ventilation air.

Ducts used to convey make-up air from the outside shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be at least 3 inches.

(c) **Appliances Located in Confined Spaces.**

1. **All Air From Inside Buildings.** The confined space shall be provided with 2 separate permanent openings, one near the top of the enclosure and one near the bottom. Each opening shall have a free area of at least one square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure, freely communicating with interior areas having in turn adequate infiltration from the outside.

2. **All Air From Outdoors.** The confined space shall be provided with 2 separate permanent openings, one in or near the top of the enclosure and one in or near the bottom. The openings shall communicate directly, or by means of ducts, with outdoors or to such spaces (crawl or attic), that freely communicate with outdoors.

A. When directly communicating with outdoors, or by means of vertical ducts, each opening shall have a free area of at least one
square inch per 4,000 Btu per hour of total input rating of all appliances in the enclosure. If horizontal ducts are used, each opening shall have a free area of at least one square inch per 2,000 Btu per hour of total input of all appliances in the enclosure.

B. Ducts shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be at least 3 inches.

3. Ventilation Air from Inside Buildings-Combustion Air from Outdoors. The enclosure shall be provided with two separate openings for ventilation, located and sized as described in (c) 1. In addition, there shall be one openings directly communicating with outdoors or to spaces (crawl or attic) that freely communicate with outdoors. This opening shall have a free area described in (b) for combustion air. A duct used to convey make-up air shall be of the same cross-sectional area as the free area of the opening required. The minimum dimension of rectangular air ducts shall be at least 3 inches.

(d) Louvers and Grilles. In calculating free area in this Section, consideration shall be given to the blocking effect of louvers, grilles, or screens protecting openings. Screens used shall not be smaller than 1/4 inch mesh. If the area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified.

(e) Special Conditions Created by Mechanical Exhausting or Fireplaces. Air for combustion shall be furnished to eliminate negative pressures created by the operation of exhaust fans, kitchen ventilation systems, clothes dryers, or fireplaces.

(f) Specially Engineered Installations. The size of combustion air openings specified in (b) and (c) shall not govern when special engineering assures an adequate supply of air for combustion, ventilation, and draft hood dilution.

SECTION 5113. APPLIANCE INSTALLATION.

(a) General. Appliances shall be installed in accordance with the terms of its listing and the manufacturers' instructions.

(b) Rigid Connections. Except as provided herein, every gas appliance shall be rigidly connected to the gas piping outlet with standard weight steel pipe and malleable iron fittings.

(c) Flexible Connectors. Approved flexible metal or fabric and rubber tubing, permanently equipped with union or screw-type end connectors by the manufacturer, may be used for connecting gas appliances designed for portable use. A shutoff valve shall be installed at the point of connection to the gas supply line. Flexible connectors shall not exceed 6 feet in length. Water heating, or space heating appliances shall not be connected with any type of flexible connector. Flexible metal tubing specifically approved, and not exceeding 6 feet in length, may be used to connect gas ranges and dryers.

In no case shall any part of a connector extend through a partition, floor or ceiling.

(d) Low Pressure Cutout Valve. Pumps or apparatus, capable of producing a vacuum in the gas service pipe, shall not be installed unless a low
pressure cutout valve or similar device is provided to prevent the gas pressure at the service outlet from being reduced below the minimum service pressure determined by the serving utility.

(e) **High Pressure Cutout Valve.** When air or oxygen under pressure is used in conjunction with the gas supply, a high pressure cutout such as a check valve shall be provided to prevent air or oxygen from entering the gas supply line.

(f) **Pressure Regulators.** A gas pressure regulator shall be installed with all equipment, when the gas supply pressure varies beyond the design pressure limits of the equipment regulator. A second regulator shall be provided.

1. **Prohibited Locations.** High pressure gas regulators shall not be installed within any Group H or I occupancy. Gas supply pressures within Group H and I occupancies shall not exceed 6 inch water column.

2. **Venting.** Each regulator other than the appliance regulator shall have a properly sized, independent vent to a safe point outside of the building. Vents shall terminate with screened openings and shall face down. Vents shall terminate at a point at least 3 feet from a building opening and at least 20 feet from any mechanically induced air intake into the building. Vents shall not be vented into any equipment combustion chamber, any equipment vent or chimney, or into any exhaust system. Material used for vent piping shall be at least standard weight steel pipe. For roof penetrations see Chapter 32.

3. **Bypass Piping.** A valved bypass may be placed around gas pressure regulators where continuity of service is imperative, and when approved by the Department.

(g) **Approval.** All gas systems shall be approved by the Department prior to installation.

(h) **Draft Hoods.** Approved draft hoods or draft diverters shall be provided in all vent connectors from domestic gas appliances, unless hoods or diverters are built into the appliance, except incinerators and other appliances specifically noted in this Building Code.

(i) **Draft Regulator.** In special cases when draft hoods cannot be used, an automatic draft regulator may be permitted if approved by the Department.

(j) **Rating.** The input rating to all appliances shall be that approved by a recognized laboratory and derated for 5000 foot altitude operation.

(k) **Instructions.** Appropriate operating instructions shall be supplied by the manufacturer or installer of gas appliances, and posted permanently in a conspicuous location on the appliance.

**SECTION 5114. GAS RANGES AND PLATES.**

(a) **Prohibitions.** In new or existing buildings, gas ranges and plates shall not be installed in rooms used for sleeping purposes, and in no case shall be used for heating purposes.

(b) **Venting.** Space heaters integral with ranges shall be vented in accordance with Chapter 37.

(c) **Ranges, Fryers, and Broilers.** Hotel and restaurant ranges, deep fat
fryers, and unit broilers shall be installed in accordance with their approval. For hoods see Chapter 52.

SECTION 5115. GAS REFRIGERATORS. The installation and use of gas-fired refrigerators is prohibited.

SECTION 5116. GAS WATER HEATERS.
(a) Prohibitions. Gas water heaters shall not be installed in any closet used for any purpose, bathroom toilet room, rooms used for sleeping purposes, garages, and crawl spaces. Water heaters shall be installed in accordance with their approval.
(b) Venting. See Chapter 37.

SECTION 5117. GAS DESIGNED STEAM AND HOT WATER BOILERS. See Chapter 37, 58, and other portions of this Chapter.

SECTION 5118. FORCED AIR FURNACES. See Chapters 37 and 52.

SECTION 5119. GRAVITY WARM AIR FURNACES. See Chapter 37 and 52.

SECTION 5120. FLOOR AND WALL-TYPE FURNACES. See Chapter 37 and 52.

SECTION 5121. UNIT HEATERS. See Chapters 37 and 52.

SECTION 5122. CONVERSION BURNERS.
(a) General. Burners shall be installed so that they will not endanger life, health, or property; and shall be installed in accordance with their approval.
(b) Combustion and Ventilation Air. See Section 5112.
(c) Draft Hood. An approved draft hood, or its equivalent, shall be installed on the vent outlet of the appliance when converted to gas. The draft hood shall be located at a point not lower than the top of the highest passageway in the appliance. Appliances of the reversible-flue type shall have the draft hood located at least one foot higher than the top of the highest passageway.

SECTION 5123. LAUNDRY EQUIPMENT. See Chapters 37 and 52.

SECTION 5124. FREE STANDING DOMESTIC INCINERATORS - GAS FIRED. Also, see Chapter 48.
(a) Draft Hoods, Prohibited. A draft hood shall not be installed in the chimney connector.
(b) Automatic Draft Regulators. The use of automatic draft regulators is permitted, provided it is recommended by the manufacturer. The draft regulator shall be the same size as the incinerator vent and shall be installed according to the manufacturer’s recommendations.
(c) Over 4 Bushel. Incinerators in excess of 4 bushel capacity, and not of the free standing type, shall conform to the requirements of Chapter 48.
(d) Piping. All gas supply piping shall be at least standard weight steel pipe, sized and installed in compliance with other provisions of this Chapter.
(e) Prohibited Locations. Installation of incinerators in garages or
enclosed areas containing explosive or flammable liquids is expressly prohibited, unless separated therefrom by at least a 2-hour fire-resistive wall without openings.

(f) Vents. See Chapter 37.

SECTION 5125. MISCELLANEOUS GAS-BURNING EQUIPMENT.

(a) Outdoor Gas Lights and Gas Grills. Gas piping shall conform to other Sections of this Chapter, except as permitted herein.

1. Copper Tubing. Type "K" internally tinned copper tubing, having a nominal diameter of 3/8 inch o.d. or greater, may be used to supply fuel, and only approved flare-type fittings shall be used. Connections from copper to other piping shall be made with an approved dielectric type fitting, where necessary. Tubing need not be wrapped or coated. The depth of the tubing shall be at least 15 inches below the ground level.

2. Gas Lights and Grills. When gas light or gas grill piping is connected to interior gas piping, the piping shall extend through the foundation or wall above grade, and connections made to the copper tubing at a point at least 15 inches below the surface of the ground. Rigid exterior piping above grade shall not be more than 6 inches outside the wall or foundation. The underground portion of steel pipe shall be wrapped or coated. The opening through the wall or foundation shall be sealed to prevent leakage into the building. If the building meter is outside, the extension shall be in the line between the meter and the building, to a point 15 inches below the surface of the ground.

3. Shutoff Valve. An approved shutoff valve shall be installed at an accessible point in the rigid pipe, outside the building and above the level of the ground.

4. Prohibition. Outdoor type gas lights and grills shall not be installed inside any building or semienclosed structure.

5. Venting. The venting requirements of Chapter 37 do not apply.

6. Clearance. Gas lights shall be installed with clearance from combustible materials of at least 6 inches at the sides and at least 12 inches at the top of the light fixture.

7. Light Post. The light post shall be set in concrete, substantially supported with 2 inches of concrete on all sides, and at least 18 inches into the ground.

(b) Other Appliances. All appliances or devices not otherwise specified herein shall be subject to Department approval prior to installation.

SECTION 5126. UNAUTHORIZED DEVICES. Devices intended to reduce gas consumption by attachment to a gas appliance, its gas supply line, or the vent outlet or vent piping, shall not be used unless approved by the Department.

SECTION 5127. ELECTRICAL WIRING AND CONTROLS. See Chapter 53.

SECTION 5128. FUEL-FIRED INDUSTRIAL EQUIPMENT.

(a) General. In addition to other requirements of this Chapter, the requirements in this Section shall apply specifically to appliances which have an
input rating in excess of 400,000 Btu per hour. The location and installation of industrial equipment shall not endanger life, health, and property. Installations shall comply with the Standards of this Chapter and the approval of the Department. All industrial appliances and equipment shall be approved by the Department prior to installation.

(b) Draft. Means for controlling draft shall be installed for each boiler. When a damper is used to limit chimney draft, positive means shall be provided to lock the damper in position.

(c) Dampers. Adjustable (modulating) dampers, where used for fuel/air ratio control, shall be equipped with a device to establish minimum and maximum operating limits. The minimum operating limits for these dampers shall be fixed to obtain air for complete combustion at the minimum burner input. See Chapters 48 and 58.

(d) Burners. Burners and their component parts shall be installed in accordance with the manufacturer's instructions and shall be secured to maintain correct alignment in normal use.

1. Adjustment. The burners shall be installed and adjusted so that there will be no injurious flame impingement on walls or heating surfaces which will cause incomplete combustion or damage to appliance parts.

2. Locking Devices. Burner parts, when adjustable, shall be provided with locking devices to prevent movement or shifting.

3. Combustion. Burners shall maintain complete and stable combustion at the minimum rate of firing or during any sudden change in the gas-firing rate between maximum and minimum input.

(e) Automatic Air Control. When an automatically operated combustion air control is provided, the gas shall be shut off in case of failure.

(f) Mixers. When air under positive pressure is mixed with the gas supply in a mixer and is automatically controlled, controls shall be provided to prevent air from passing back into the gas line, or gas into the air supply. The gas and air supply shall be equipped with controls to prevent gas from entering the burner until the required amount of air is available, and to shut off the gas supply in the event of air failure.

(g) Automatic Fire Rate. On boilers where the firing rate is automatically changed, the air/gas ratio shall be automatically maintained to produce stable combustion at all firing rates.

(h) Pilots. All gas and oil-fired equipment shall be provided with an approved type pilot safeguard.

1. Flame Safeguard. A flame safeguard shall be constructed and installed so that gas cannot flow to the main burner or burner group unless a proven pilot flame is assured. Fuel to main burners and to intermittent or ignition pilots shall be automatically shut off in case of flame failure.

2. Response Time. The response time of the flame safeguard to deenergize the gas shutoff device on flame failure shall not exceed 5 seconds for appliances having inputs in excess of 2,500,000 Btu per hour. Pilot supervision by the flame safeguard shall be only at the point where the flame will ignite the gas at the main burners. The circuit and devices shall be arranged so that the gas will be shut off in case of electrical failure.
**EXCEPTION:** Appliances having an input in excess of 2,500,000 Btu per hour, approved by a recognized testing laboratory or the Department.

3. **Electric Ignition.** Electric ignition systems shall ignite only a pilot. The input to the pilot shall not exceed 3 per cent of the maximum input to the main burner as fired. If ignition of the pilot is not obtained within 60 seconds, the pilot gas shall be turned off automatically. Pilots ignited by automatically or remotely controlled ignition systems shall be supervised.

**EXCEPTION:** Boilers having an input in excess of 2,500,000 Btu per hour, approved by a recognized testing laboratory or the Department.

4. **Supports.** Pilot burners and flame safeguard units shall be supported so that their position relative to each other and to the flame of the main burner, will remain fixed. Means shall be provided to permit observation while firing.

5. **Access and Removal.** Pilot burners and flame safeguard units shall be accessible and removable for servicing. Pilot burners shall be placed so that they may be safely lighted manually, if required.

6. **Pilot Lines.** Pilot lines shall be valved and connected to main fuel supply lines upstream from all main fuel control valves.

7. **Start-Up.** After the piping has been thoroughly purged, the pilot burner shall be lighted and adjusted, and the main burner put into operation in accordance with the manufacturer’s instructions.

8. **Pilot Effect.** Pilot flames shall ignite the fuel at the main burner or burners within 4 seconds.

9. **Pilot Failure.** Pilot flames shall not be extinguished when the main burner or burners are turned on or off.

10. **Carbon.** Pilots shall not deposit carbon.

(i) **Control Valves.** The control valve assembly shall be of an approved type.

1. **Safety Shutoff Valve.** Approved main burner safety shutoff valves shall be required on all boilers. They shall be a normally closed spring loaded type solenoid or motorized fuel valve that does not depend on electricity to shut off the main gas supply. This Section shall apply to all new or existing installations. These valves shall respond to safety devices installed to prevent excessive appliance pressure or temperature.

2. **Locked Bypass.** A locked type bypass may be installed around the safety shutoff valve subject to the approval of the Department.

(j) **Electrical Equipment.** Wiring and controls shall be capable of withstanding the temperatures to which they may be subjected. See Chapter 53.

(k) **Purging.** The flue passages shall be thoroughly purged before lighting of pilots or burners after a shutdown, and also before relighting after an unscheduled extinguishment of burners. This shall be performed by creating air flow through the equipment and by operation of induced and forced draft fans if present.

(l) **Disconnect.** When boiler is shut down for an extended period, means shall be provided to prevent fuel from leaking into the boiler. This shall be accomplished by blocking off, or disconnecting, the fuel supply pipe.
(m) **Maintenance.** The flame safeguard equipment and all other controls of the unit shall be maintained to assure their safe operation.

**SECTION 5129. LIQUID FUEL, LIQUEFIED PETROLEUM GAS AND LIQUEFIED PETROLEUM.**

**AIR-GAS.** The installation of liquid fuel or liquefied petroleum gas fired appliances and their appurtenances shall conform with the requirements as set forth in this Chapter and in NFPA Pamphlet No. 58.

**SECTION 5130. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply.

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI</td>
<td>American Standard Approval Listing and Installation Standards for Gas Appliances and Accessories Listed Herein:</td>
</tr>
</tbody>
</table>
Installation of Oil Burning Equipment, Pamphlet No. 31-1974.
Standards for the Installation of Gas Appliances
and Gas Piping. Pamphlet No. 54-1969.

LEGEND
ANSI
American National Standards Institute
1430 Broadway
New York, New York 10018

NFPA
National Fire Protection Association
470 Atlantic Avenue
Boston, Mass. 02210

INSTRUCTIONS IN THE USE OF TABLE - 51-A

1. Determine the gas demand in cubic feet per hour of each appliance to be attached to the piping system.
2. Measure the length of piping from the gas meter to the outlet farthest from the meter.
3. In table 51-A, select the vertical column indicating this farthest distance, or the next longer distance if the table does not give the exact distance. The vertical column shall be used in sizing all sections of pipe in the piping system.
4. Starting at the farthest outlet from the meter, find in the vertical column just selected, the gas demand for the outlet as determined in Item 1 of this Section. If the exact gas demand figure is not shown, choose the next largest figure in that column.
5. Opposite this demand figure in the column headed "Nominal Iron Pipe Size Inches," find the correct size of pipe to be used. This pipe size is only for that section of pipe carrying the gas demand for the outlet under consideration.
6. Proceed in a similar manner for each outlet.
7. After each outlet has been sized, then size each section of pipe carrying
the gas demand for more than one outlet. This is performed by deter-
mining the total gas demand supply by each section and using that
figure in the farthest distance vertical column as determined in Item 3 of
this Section. (The same distance used in the above calculations).
SECTION 5131. TABLES AND FIGURES.

TABLE NO. 51-A

HOUSE PIPING CAPACITY TABLE
MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR
(Based on 0.3 Inch Water Column Pressure Drop)

<table>
<thead>
<tr>
<th>Nominal Iron Pipe Size (Inches)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
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</thead>
<tbody>
<tr>
<td>1/2</td>
<td>125</td>
<td>88</td>
<td>70</td>
<td>61</td>
<td>54</td>
<td>48</td>
<td>44</td>
<td>41</td>
<td>38</td>
<td>36</td>
<td>33</td>
<td>30</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td>7/8</td>
<td>265</td>
<td>180</td>
<td>145</td>
<td>125</td>
<td>110</td>
<td>100</td>
<td>92</td>
<td>85</td>
<td>81</td>
<td>76</td>
<td>69</td>
<td>61</td>
<td>57</td>
<td>53</td>
</tr>
<tr>
<td>1</td>
<td>500</td>
<td>335</td>
<td>275</td>
<td>235</td>
<td>205</td>
<td>185</td>
<td>175</td>
<td>165</td>
<td>155</td>
<td>145</td>
<td>125</td>
<td>115</td>
<td>105</td>
<td>95</td>
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<tr>
<td>1 1/4</td>
<td>1000</td>
<td>700</td>
<td>565</td>
<td>480</td>
<td>420</td>
<td>385</td>
<td>355</td>
<td>335</td>
<td>305</td>
<td>295</td>
<td>265</td>
<td>240</td>
<td>215</td>
<td>200</td>
</tr>
<tr>
<td>1 1/2</td>
<td>1550</td>
<td>1050</td>
<td>850</td>
<td>730</td>
<td>640</td>
<td>590</td>
<td>540</td>
<td>510</td>
<td>470</td>
<td>440</td>
<td>390</td>
<td>360</td>
<td>340</td>
<td>310</td>
</tr>
<tr>
<td>2</td>
<td>2900</td>
<td>2000</td>
<td>1600</td>
<td>1400</td>
<td>1200</td>
<td>1100</td>
<td>1000</td>
<td>950</td>
<td>890</td>
<td>840</td>
<td>750</td>
<td>680</td>
<td>620</td>
<td>590</td>
</tr>
<tr>
<td>2 1/2</td>
<td>4600</td>
<td>3200</td>
<td>2600</td>
<td>2200</td>
<td>1900</td>
<td>1800</td>
<td>1650</td>
<td>1500</td>
<td>1450</td>
<td>1350</td>
<td>1200</td>
<td>1100</td>
<td>1000</td>
<td>940</td>
</tr>
<tr>
<td>3</td>
<td>8200</td>
<td>5700</td>
<td>4500</td>
<td>3900</td>
<td>3500</td>
<td>3100</td>
<td>2900</td>
<td>2700</td>
<td>2500</td>
<td>2400</td>
<td>2100</td>
<td>1900</td>
<td>1800</td>
<td>1650</td>
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<tr>
<td>4</td>
<td>16,800</td>
<td>11,500</td>
<td>9300</td>
<td>8000</td>
<td>7100</td>
<td>6500</td>
<td>6000</td>
<td>5600</td>
<td>5200</td>
<td>4900</td>
<td>4300</td>
<td>3900</td>
<td>3600</td>
<td>3400</td>
</tr>
</tbody>
</table>

NOTE: In using this table, no allowance is necessary for an ordinary number of fittings.
Reference: ASA Z21.30-1959 (Modified for Denver gas - 0.67 Specific Gravity gas.)
Pipe sizes of specific information relating to actual consumption, the following table may be used as a guide to the average consumption of the appliances listed.
### TABLE NO. 51-B

**GAS CONSUMPTION OF APPLIANCES**  
(Based on Natural Gas having a Btu Content of 840 at 60° F. and 24.7 inches of Mercury)

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Cubic Feet Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Domestic Range</td>
<td>50</td>
</tr>
<tr>
<td>Domestic Water Heater (Storage Type)</td>
<td>30</td>
</tr>
<tr>
<td>Domestic Space Heaters (Circulating)</td>
<td>20</td>
</tr>
<tr>
<td>Domestic Floor Type Furnace</td>
<td>25</td>
</tr>
<tr>
<td>Domestic Central Type Furnace</td>
<td>75</td>
</tr>
<tr>
<td>Domestic Central Type Boilers (Steam or Hot Water)</td>
<td>75</td>
</tr>
<tr>
<td>Commercial Range (Restaurant)</td>
<td>150</td>
</tr>
<tr>
<td>Commercial Griddle or Hot Plate</td>
<td>20</td>
</tr>
<tr>
<td>Commercial Steam Table, per burner</td>
<td>—</td>
</tr>
<tr>
<td>Commercial Coffee Urn</td>
<td>—</td>
</tr>
<tr>
<td>Steam Boilers, per horsepower</td>
<td>—</td>
</tr>
<tr>
<td>Industrial Appliance</td>
<td>Require Individual Determination</td>
</tr>
</tbody>
</table>

<sup>a</sup> Not to be used for setting appliance gas input.
FIGURE 1
Appliances Located in Confined Spaces. All Air from Inside the Building

NOTE: Each opening shall have a free area of not less than one square inch per 1,000 BTU per hour of the total input rating of all appliances in the enclosure.

FIGURE 2
Appliances Located in Confined Spaces, All Air from Outdoors.

NOTE: Each air duct opening shall have a free area of not less than one square inch per 2,000 BTU per hour of the total input rating of all appliances in the enclosure.*

* If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than one square inch per 4,000 BTU per hour of the total input rating of all appliances in the enclosure.

FIGURE 3
Appliances Located in Confined Spaces, All Air from Outdoors Through Ventilated Attic.

NOTE: The inlet and outlet air openings shall each have a free area of not less than one square inch per 4,000 BTU per hour of the total input rating of all appliances in the enclosure.

FIGURE 4
Appliances Located in Confined Spaces, All Air from Outdoors - Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic.

NOTE: The inlet and outlet air openings shall each have a free area of not less than one square inch per 4,000 BTU per hour of the total input rating of all appliances in the enclosure.

FIGURE 5
Appliances Located in Confined Spaces. Ventilation Air from Inside Building - Combustion and Draft Hood Dilution Air from Outside, Ventilated Attic or Ventilated Crawl Spaces.

NOTE: Alternate 1, 2 and 3 are locations for air inlets. Free areas shall be not less than 1 square inch per 5,000 BTU per hour of the total input rating of all appliances in the enclosure.

Attic ventilation louvers are required at each end of attic with alternate air inlet No. 1.

Crawl-Space Ventilation louvers for unheated crawl spaces are required with alternate air inlet No. 3.

Each Ventilation Air Opening from inside the building shall have a free area of not less than 1 square inch per 1,000 BTU per hour of the total input rating of all appliances in the enclosure.
CHAPTER 52
HEATING, COOLING AND VENTILATING

SECTION 5201. GENERAL.

(a) **Scope.** This Chapter shall govern the construction, installation, maintenance, and repair of all electrical and fuel-burning equipment for air heating, ventilating, air conditioning, blower and exhaust appliances and systems, domestic and commercial cooking ranges, plates, and hoods.

(b) **Equipment.** Equipment shall bear the seal of a nationally recognized testing laboratory.

(c) **Type of Fuel.** Appliances shall not be converted from the fuel specified on the rating plate for use with a different fuel without approval by the Department for the fuel to be used.

(d) **Installation.** The installation of heating, cooling, blower exhaust systems, and areas above ceilings or attic spaces, as supply, make up, exhaust air, or return air plenums or ducts is prohibited. Panning of the joist or stud space for return air shall be permitted in Groups I and J occupancies only.

**EXCEPTIONS:** (Plenums)

1. Areas above ceilings may be used for supply or return air plenums in Groups A through H occupancies, provided the ceilings meet the requirements of this and other Sections of this Building Code, and provided no fuel-fired equipment or combustible material is located in this space. The use of ceiling areas as plenums shall be confined to one fire area. All openings in required rated ceilings shall be protected with a fire damper, except in approved perforated rated ceilings.

2. The suspended ceiling material shall not be considered a component of a fire-rated assembly unless all penetrations provide the same fire-resistive rating.

3. All wiring having a covering whose products of combustion are toxic shall not be permitted in plenums except in an approved covered raceway or metal conduit.

4. Plumbing drain, waste, vent, roof drain and temperature control lines, shall be permitted in a plenum when constructed of materials whose products of combustion are not toxic. Cleanouts in plumbing lines shall not be located in a plenum.

5. All duct work located in a plenum shall be constructed of sheet metal or UL 181 approved Class I non-metallic duct. The use of plastic materials whose products of combustion are toxic, for insulation or insulation jackets is prohibited. Gas lines shall not be permitted in a plenum unless the pipe joints are welded or silver-soldered, the piping is tested to 100 psig, or the piping is encased in an air-tight sleeve through the plenum and opened out of the plenum. Metal exhaust ducts passing through the plenum shall have seams and joints sealed air-tight.

(e) **Access.** All appliances shall be readily accessible for inspection, repair, or replacement.
(f) **Separation of Equipment.** Fuel-fired heating equipment shall be separated from air-handling equipment by a fire separation wall of at least one-hour fire-resistive construction. Access to air-handling equipment shall not be through boiler room. Access to boiler room shall not be through air-handling room.

**EXCEPTIONS:**
1. Combination heating and cooling equipment need not comply, provided the heating and cooling equipment is an approved single-package or tandem unit.
2. The equipment is approved for exterior installation.
3. In Groups I and J occupancies.

(g) **Furnace Room Construction.** See Chapter 17.

(h) **Installation or Repairs Affecting Building Structure.** Structural supports for equipment shall conform to other portions of this Building Code.

(i) **Temporary Heating During Construction.** Fuel-fired heaters for temporary heating during construction shall be approved by the Department.

(j) **Guards.** Pulleys, belts, and similar equipment shall be provided with an approved type guard.

(k) **Central Heating.** Where heating is installed, the heating system or systems shall be of the central type, unless otherwise approved.

**EXCEPTION:** Sealed combustion chamber type (through-the-wall-heaters), when approved by the Department. See Chapter 51.

(l) **Openings in Exterior Walls.** See Chapter 17.

(m) **Fire Control of All Ventilation Systems In Excess of 2,000 CFM.**
1. When the supply fan is located in the same smoke or fire zone that it serves, the fan shall be shut down automatically by a product of combustion detection device located in each of the return air systems and the supply air system, after any system filters.
2. When ventilation systems serve more than one smoke or fire zone, the system shall have a product of combustion detection device located in the return or exhaust air stream of each smoke or fire zone which will close a fire damper in the ducts supplying air to that zone. An additional products of combustion detection device shall be located in the supply air system, after the air filters which will stop the supply fan and close all fire dampers in the supply ducts. The dampers shall be located in the required fire partition.
3. The supply air fire control shall not eliminate the need for required fire dampers.

(n) **Heat Exchanger.** When more than fifty percent of the air entering the heat exchanger is taken directly from the outside, at winter design temperature, the heat exchanger through which the air passes shall be constructed of an approved non-corrosive material.

(o) **Prohibitions.**
1. Liquid fuel-burning appliances having an integral or directly-attached fuel tank.
2. Used heating equipment, unless approved.
3. Gas logs or open-flame type equipment.
4. Heating and cooling equipment, ductwork, or piping in elevator shafts, elevator pits, or elevator machine rooms.
5. The repair of heat exchangers. Furnace cement may be used for the resealing of joints, when required, for cast iron furnaces.
6. Gas lines, water lines, sewer lines, or electric lines penetrating any supply, return, or exhaust duct systems.
7. Gas appliances located within 10 feet of the termination of a laundry chute.
8. Access to furnaces, boilers, or to furnace or boiler rooms through any bedroom, bathroom, toilet room, or garage.
9. The installation and use of floor furnaces, pipeless furnaces, and dual-wall floor furnaces.
10. Return air taken from any boiler room, furnace room, kitchen, bathroom, trash room, janitor storage room, toilet room, swimming pool, garage, storage room, or areas containing toxic, flammable, corrosive, radioactive, or pathogenic materials.
11. Fuel-fired unit heaters, suspended furnaces, and duct furnaces in Groups A, B, C, D, and H occupancies.

SECTION 5202. DEFINITIONS.

(a) For the purpose of this Chapter, the following terms shall be defined as follows:

1. **Air Ceiling Plenum.** An air chamber formed by the building structure for air supply or return.
2. **Air Conditioning.** Air conditioning is the process of treating air to control its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.
3. **Air Conditioning System.** A ventilating system containing heat exchangers, blowers, filters, supply, exhaust or return ducts, and any apparatus installed in connection therewith.
4. **Appliance.** A fixture or apparatus designed and manufactured to use electricity, natural gas, manufactured gas, liquified petroleum products, solid fuel, oil, or any gas as a medium for developing light, heat, and power.
5. **Appliance, Unvented.** An appliance designed and installed in a manner so that products of combustion are conveyed directly from the appliance into a vent or chimney and conducted to the outside atmosphere.
6. **Appliance, Vented.** An appliance designed and installed in a manner so that the products of combustion are conveyed directly from the appliance and connected directly into a vent or chimney and conducted to the outside atmosphere.
7. **Boiler or Furnace Room.** See Chapter 4.
8. **Btu.** Abbreviation for British Thermal Unit, or the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit at sea level.
9. **Central Air Heating System.** A heating plant consisting of an air-heating appliance from which the heated air is distributed by means of ducts or pipes, including accessory apparatus and equipment.
10. **Combustion Air.** See Chapter 51.
12. Commercial Cooking Appliance. Shall include ranges, ovens, broilers, and other cooking appliances designed for use in restaurants, hotel kitchens, and commercial establishments.
13. Control, High Limit. A device responsive to change in temperature, used for interrupting the fuel supply when the bonnet temperature exceeds predetermined settings.
14. Control, Safety Pilot. A device to automatically shut off the fuel supply to the main burner when the fuel supply becomes inoperative.
15. Conversion Burner. A burner provided to convert a heating appliance from its designed fuel to a different fuel.
17. Direct-Fired Heating Unit. A unit in which the circulated air comes into direct contact with the flame.
18. Draft Hood or Draft Diverter. See Chapter 37.
19. Duct. A passageway for conveying air, made of sheet metal or other approved material.
22. Exhaust System. An assembly of connected ducts, plenums, fittings, registers, grilles, and hoods through which air is conducted form the space or spaces and exhausted to the outside atmosphere.
23. Filter, Air. A device designed to remove particulates from the heating, cooling, or ventilating air.
24. Fire Area. A fire area, as used in this Chapter, shall mean maximum floor areas allowed in Chapter 5.
25. Fire Damper. An assembly arranged to restrict the passage of air flow automatically in the event of excessive temperature.
26. Fire Door. An approved door, for the protection of an air passage in a Class A opening in a fire wall, installed in accordance with the conditions of its approval and the manufacturer's instruction.
27. Fire Partition Wall. See Chapter 4.
28. Flat-Plate Solar Collector. A solar collector in which the solid surface area absorbing the solar radiation is essentially flat, without the use of concentration.
29. Focusing Solar Collector. A reflective or focusing solar collector which concentrates solar radiation to a thermal receiver.
30. Furnace. A self-contained fuel-fired heating unit with burners, combustion chamber, heat exchanger, and casing.
32. Furnace, (Counterflow). A forced air furnace designed with air flow through the furnace in a vertical path downward.
33. Furnace, (Duct Furnace). A furnace designed for utilizing a duct distribution system. Air circulation is provided by a blower not furnished as an integral part of the furnace.
34. Furnace, (Electric). A furnace designed to utilize electricity as the energy source.
35. **Furnace, (Floor)**. A self-contained furnace designed to be suspended from the floor of the space being heated.

36. **Furnace, (Forced Air)**. A furnace equipped with a blower to provide the primary means for circulating air.

37. **Furnace, (Gravity)**. A furnace which depends upon the difference of the density of warm and cool air for circulation.

38. **Furnace, (Pipeless)**. A gravity furnace in which the entire heat output is delivered through one opening directly above the combustion chamber. Return air enters the unit through grille work around the perimeter of the output grille.

39. **Furnace Room**. See Chapter 4.

40. **Fusible Link**. A device designed to melt, separate, or release at a predetermined temperature.

39. **Furnace Room**. See Chapter 4.

40. **Fusible Link**. A device designed to melt, separate, or release at a predetermined temperature.

41. **Gage-Gauge, (Metal)**. A standard for measuring the thickness of sheet plate iron and steel.

42. **Gas Ranges and Plates**. Gas-fired units used for domestic and commercial cooking or heating.

43. **Heat Exchanger**. A chamber in which heat is transferred through the walls of the chamber to or from the media entering the exchanger.

44. **Heat Shield**. An automatic heat closing device which limits the transfer of heat radiation across the damper.

45. **Heater, Radiant**. A heater utilizing a ceramic, asbestos, clay, or similar material as the radiating media.

46. **Heater, Recessed**. A self-contained heating unit recessed in a wall and located entirely above the floor of the space it is intended to heat.

47. **Heater, Room or Space**. A free-standing heating unit burning solid, gas, or liquid fuel for direct-heating of the space in and adjacent to that in which the unit is located, without external heating pipes or ducts.

48. **Heater, Unit**. A suspended, self-contained, vented, heating appliance having integral means for circulation of air. A high-static unit heater is an appliance incorporating integral means of circulating against 2 inch water gauge or greater. A low-static unit heater is an appliance incorporating an integral means of air circulation, usually a propeller fan, but not intended for duct connection.

49. **Humidifier**. A device used to add moisture to the air.

50. **Incombustible (Non-Combustible)**. See Chapter 4.

51. **Infrared Radiant Heater**. A self-contained heater which directs a substantial amount of its energy output in the form of infrared radiant energy.

52. **Makeup Air**. Outside air required to replace air being exhausted.

53. **Mechanical Equipment Room**. A room or enclosed space housing non-fuel-fired equipment.

54. **Pit**. A depression or excavation below a graded surface.
55. **Plenum.** An air compartment or chamber to which one or more ducts are connected, and which forms part of either the supply or return systems.

56. **Pressure or Velocity Classification of Duct Systems and Plenums.** LOW PRESSURE: Static pressure in the duct or plenum up to 2 inches water gauge. HIGH PRESSURE: Static pressure in the duct or plenum 6 inches water gauge or greater.

57. **Return System.** An assembly of ducts, plenums, fittings, registers, and grilles, through which air from a space or spaces is conducted back to the supply unit.

58. **Sealed Combustion Chamber Appliances.** Appliances constructed and installed so that all air for combustion is derived from the outside atmosphere, and all flue gases are discharged to the outside atmosphere.

59. **Smoke Damper.** A louver-type damper arranged to seal off airflow, automatically, in an air passage.

60. **Solar Collector.** A device designed to collect solar energy.

61. **Solar Collection System.** An integrated operable system for collecting, storing, and controlling solar energy.

62. **Stock.** Material or residue from a manufacturing process that is air-borne.

63. **Supply System.** An assembly of ducts, plenums, fittings, registers, and grilles through which air is conducted from the supply unit to a space or spaces.

64. **Thermal Storage.** A device used to store thermal energy.

65. **Vent.** See Chapter 37.

66. **Ventilation.** The process of supplying or removing air from any space.

SECTION 5203. AIR HEATING, VENTILATION, AND AIR CONDITIONING SYSTEMS IN BUILDING GROUPS A THROUGH H OCCUPANCIES.

(a) **Scope.** This Section shall apply to air duct systems employing mechanical means for the movement of air for heating, ventilation, air conditioning systems, and exhaust systems. See other sections of this Chapter for the removal of flammable vapors or residues, or to systems for conveying dust, stock, or refuse by means of air currents.

(b) **Equipment.**
   1. Mechanical refrigeration, when used with air duct systems, shall conform with the requirements of this Chapter and Chapter 49.
   2. In Group E occupancies, heating and exhaust equipment shall be approved prior to installation.

(c) **Installation.** Air conditioning and exhaust systems shall conform to the following:
   1. Gas-fired heating equipment shall not be located downstream from a cooling unit unless the equipment is approved for that use.
   2. Heating equipment shall not be located upstream from a cooling unit unless the cooling unit is approved for that use.
   3. All fuel-fired heating equipment located within Groups A through H
occupancies shall be installed in a furnace or boiler room in accordance with the requirements of Chapter 17. Combustion air shall be directly from the outdoors in Group E Occupancies when corrosive or flammable vapors are present, access to boiler or furnace rooms shall be from the exterior of the building only.

(d) **Construction of Ducts.** Duct construction shall conform to the following:

1. Ducts shall be constructed entirely of approved materials. See Table 52-A.
2. Ducts shall be constructed to provide structural strength and durability, and shall be at least equal to the thicknesses specified in Table 52-A.
3. Spirally wound ducts under six inches in diameter shall be at least 30 U.S. Gauge steel.
4. Wire glass or approved plastic may be used for inspection ports or windows. See Chapter 60.

**EXCEPTION:** On range hood exhaust duct systems.

5. Ducts or plenums may be of independent construction, or may be formed by parts of the building structure as approved by the Department. The air passage shall be constructed of approved materials.

6. Approved flexible duct connectors used between ducts and air devices in construction Types I, II, III and IV shall be Class 1 in accordance with U.L. 181. The use of flexible ducts is prohibited for use as return air duct and, on gravity furnaces.
   - A. Duct connectors shall not pass through any rated wall, floor, or ceiling.
   - B. Flexible duct connectors shall be continuous, and shall not exceed 10 feet in length or 16 inches in diameter.

7. Vibration isolation connectors in duct systems shall be made of an approved flame-retardant fabric or approved material having a Class 1 rating. Vibration isolation connectors shall not exceed 10 inches in length. Connectors exterior to the building shall be waterproof. Vibration isolation connectors shall not be permitted for range hoods, except when the connectors are located exterior to the building and approved for use.

8. Lining or insulation, when used inside or outside of ducts, shall be of a Class 1 material in accordance with NFPA 90 A.

9. Work involving the use of torches shall not be undertaken on ducts until the system has been made inoperative.

10. Ducts shall have no openings other than those required for the proper operation and maintenance of the system.

11. Tape used for sealing joints shall be of an approved type.

(e) **Installation of Ducts.**

1. Ducts shall not impair the effectiveness of the fireproofing surrounding structural members.

2. Ducts which pass through walls, floors, or ceilings required to be of fire-resistive construction shall be enclosed as specified in Chapter 17. If fire-resistive enclosures are not provided, approved fire dampers shall be installed at the point where the ducts penetrate the fire-resistive walls, floors or ceilings.
3. Approved fire dampers shall be installed in required fire-resistant walls, floors, or ceilings at the point of penetration. Dampers shall be installed in accordance with the provisions in Section 5219.
4. Supports and hangers for ducts shall be securely fastened to ducts and attached to structural members at intervals of not more than 8 feet.
5. The use of dual-type stackheads in bathrooms or toilet rooms is prohibited.
6. Electrical fixtures, conduit, piping, ceilings, walls, or wall supports shall not be attached to any duct or duct support. Supports shall not penetrate duct-work.

(f) Clearance from Warm Air Ducts, Plenums, or Bonnets.
1. Warm air ducts, plenums, or bonnets shall be installed with clearance to combustible material as follows:
   A. When a metal duct penetrates a partition or enclosure constructed of combustible material, the space around the duct providing the required clearance may be closed with a thimble or collar, or the wall surface may be extended to the duct with non-combustible materials.
   B. In Type I or II buildings, clearance shall not be required for bonnets, plenums or ducts.
   C. In Type III, IV or V buildings, bonnets or plenums shall have a clearance to combustibles as specified in Table 52-E.

(g) Outside Openings.
1. Location.
   A. Outside air intake openings in exterior walls shall be located at least ten feet, measured in any direction from any plumbing vents, flues, vents, chimneys, and gas regulator vents, hazardous, or noxious sources.

2. Mounting Height.
   A. Outside air intake and exhaust openings shall be located at least 12 inches above the outside grade or roof.
   B. Where outside air intake and exhaust openings are located in an areaway below grade, the top of the areaway shall be at least 12 inches above the grade level.

3. Screens. Outside air intake and exhaust openings shall be protected by screens of corrosion-resistant metal of minimum 1/2 inch mesh.

4. Weather Protection. Outside air intake and exhaust openings shall be protected against weather and water with a weather-proof hood or louvers. Outside openings for exhaust air shall be equipped with a backdraft or motorized damper.

5. Accessibility. All outside air intakes shall be accessible for cleaning.

(h) Controls. Each air handling system shall be equipped with a manual disconnect switch located adjacent to and within sight of the motor for shutting the fan down.

(i) Negative Pressure from Ventilation Systems. Ventilation systems shall be designed, constructed, and arranged so that negative pressure from the ventilation system cannot affect the air supply for combustion, or draw products of combustion from appliances, vents, or fireplaces.
SECTION 5204. AIR HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS IN BUILDINGS OF GROUP I OCCUPANCY.

(a) Scope. This Section shall apply to central air heating and air conditioning systems in dwelling units.

(b) Supply and Return Ducts and Fittings.
   1. Ducts shall be constructed of incombustible or Class I material, except as otherwise provided in this Section, and shall be equivalent in structural strength and durability to the requirements of Table 52-B. Flexible duct connectors may be used in forced air supply ducting systems. Flexible ducts or connectors shall not be used on gravity furnaces or on any return air installation. Flexible duct connectors shall be continuous, and shall not exceed 10 feet in length or 16 inches in diameter.
   2. Ducts installed in floor slabs shall comply with Section 5212.
   3. Joints and seams of supply and return ducts shall be securely fastened and constructed to be substantially airtight. Round pipe slip-joints shall have a lap of at least 1 inch and each joint shall be individually fastened with a minimum of 3 metal screws or rivets.
   4. Supports and hangers for ducts shall consist of strips or rods of metal securely fastened to ducts with sheet metal screws, bolts, or rivets, and attached to joists or other framing members at intervals of not more than 8 feet. Tape used for sealing joints shall be an approved type.
   5. The panning of joists or studs for return air ducts shall be of the following gauge metal: At least No. 28 U.S. Gauge galvanized iron, No. 26 U.S. Gauge aluminum or tin. The interior of panned joists shall be lined with metal at points where there would be danger from incandescent particles dropping through the register, such as directly under floor registers, adjacent to outdoor intakes, and at the bottom of vertical ducts.
   6. Vertical stacks for return air shall not be connected to registers on more than one floor.
   7. The use of dual-type stackheads is prohibited.

(c) Furnace Settings and Controls. See Table 52-E.

(d) Combustion Air and Venting. See Chapters 51 and 37.

(e) Private Garage Heating. The discharge opening of warm air ducts extending from any dwelling to its attached garage shall be at least 66 inches from the floor of the garage. Outside air shall be supplied to the return air system through a duct having an area 10 percent greater than the area of the garage warm air supply.

(f) Negative Pressure from Exhaust Systems. Exhaust systems shall be constructed and arranged so that negative pressure from the system cannot affect the air supply for combustion, or draw products from of combustion from appliances, vents, or fireplaces.

(g) Installation.
   1. Gas-fired heating equipment shall not be located downstream from a cooling unit unless the equipment is approved for that use.
   2. Heating equipment shall not be located upstream from a cooling unit, unless the cooling unit is approved for that use.
3. Heating equipment installed in parallel with evaporative cooling units shall have an adjustable damper in the circulating air system to direct all of the air through the operating unit. The damper shall be electrically interlocked to insure proper damper position relative to the cycle of operation. In no case shall the cooled air pass over the heat exchanger of the furnace.

SECTION 5205. CLOTHES DRYERS. Make-up air shall be provided from the outside or from other portions of the building. Dryers shall not be permitted in furnace or boiler room except when approved by the Department. See Chapters 37 and 51.

SECTION 5206. RECESSED HEATERS.
(a) General. Recessed heaters shall not be installed as a substitute for a central heating system.
(b) Installation. Recessed heaters shall be installed in accordance with their approval and the manufacturer's instructions.
(c) Access. Panels, grilles, and access doors which must be removed for normal servicing operations shall not be attached to the building construction.
(d) Closed Rooms. Recessed heaters installed in rooms normally kept closed shall be equipped with a safety pilot, and the rooms shall be provided with combustion air.

SECTION 5207. SPACE OR ROOM HEATERS.
(a) Space of Room Heaters.
   1. Heaters shall not be installed as a substitute for central heating except when approved by the Department.
   2. Space heater locations shall not create a fire hazard to adjacent materials nor impede the movement of persons within the room.
   3. Space heaters shall be installed in accordance with their approval.
   4. All fuel-fired space heaters shall be vented.
(b) Through-the-Wall Heaters.
   1. Through-the-wall heaters shall not be installed as central heating in Groups A through H occupancies.
   2. Combustion air intakes or vent openings shall be located on the exterior of the building. The openings shall be at least 12 inches above the exterior finished grade.
   3. Heaters shall not be located in garages or accessory use buildings where motor driven vehicles or devices utilizing volatile liquids are housed or stored.
   4. Through-the-wall heaters shall not be located within 12 inches of any window, door, corner, projection or opening into a building.
      EXCEPTION: Heaters may be installed with lesser clearances when approved by a recognized testing laboratory.
   5. Through-the-wall heaters shall not extend into any public way or private walkway in a manner that would constitute a hazard.

SECTION 5208. SUSPENDED FUEL-FIRED UNIT HEATERS.
(a) General.
   1. Approved unit heaters may be installed in garages, enclosed loading
docks, and other occupancies. When heaters are installed in public
repair or storage garages, and suspended from the ceiling or roof,
they shall be at least 8 feet in height from the floor to the bottom
of the unit. In spaces where vehicular equipment in excess of 6 feet in
height is present, a minimum of 2 feet clearance shall be provided
between the bottom of the unit heaters and the top of the equipment.
2. Unit heaters to be installed in private garages shall be installed with
a clearance of at least 66 inches measured from the floor to the bot-

tom of the unit.
3. The location of heaters installed in Group E occupancies and
airplane hangers shall be approved prior to installation.

(b) Clearance. For clearance to combustible materials, see Table 52-E.
Heaters approved for lesser clearance may be installed accordingly.

(c) Venting. See Chapter 37.

(d) Supports. Suspended unit heaters shall be securely supported. Hangar
brackets and other supports shall be of non-combustible material.

(e) Combustion Air. See Chapter 51.

(f) High-Static Unit Heaters. When heaters are used in conjunction with
a duct system, they shall be installed in accordance with the require-
ments of Section 5203.

(g) Low-Static Unit Heaters.
1. Ducts shall not be used in conjunction with low-static unit heaters.
2. See Section 5201 (d).

SECTION 5209. HEATING EQUIPMENT IN ATTIC SPACES.

(a) Installation. Heating equipment in attics shall be an approved type.
(b) Access.
1. The space in which an attic furnace is installed shall be accessible by
an opening and passageway at least the size required to install or
remove the unit without disassembling, and in no case be less than
36 X 30 inches. The access opening to the attic shall be located so
that a clearance of 4 feet exists between the top of the ceiling joist
and the bottom of the rafters at the point of entrance.
2. The entrance to the passageway shall not be located more than 20
feet from the furnace.
3. There shall be an unobstructed catwalk at least 24 inches wide
securely fastened to the ceiling joists, and leading from the access
opening to the service side of the furnace.

(c) Furnace Setting.
1. All attic furnaces shall be set on an unobstructed platform, which
shall extend at least 12 inches on all sides of the furnace, except that
on the control side or other sides where access is necessary for ser-
vicing, the platform shall extend form the furnace. The entire plat-
form shall be covered with at least 1/4 inch asbestos millboard or its
equivalent.
2. When the platform is supported by the ceiling joists or suspended
from the roof construction, the structural integrity of the framing
shall not be exceeded. The furnace shall be provided with at least 1-
inch ventilated clearances from the bottom of the unit to the
asbestos millboard. For clearance to combustible materials, see Ta-
ble 52-E.
(d) **Illumination and Electrical.** See Chapter 53.
(e) **Filters.** See Section 5218.
(f) **Ducts.** See Section 5203.
(g) **Venting and Combustion Air.** See Chapters 37 and 51.

**SECTION 5210. HEATING EQUIPMENT LOCATED IN CRAWL SPACES.**

(a) **Crawl Space.** A minimum height of 36 inches between the ground level and the bottom of the floor joist shall be maintained throughout the entire crawl space area.

(b) **Clearance.** For clearance to combustible materials, see Table 52-E. A minimum distance of 6 inches between the bottom of the floor joist and the top of the equipment shall be maintained unless the equipment is approved for lesser clearance.

(c) **Installation.** Heating equipment shall be placed on a concrete slab at least 4 inches in thickness and such slabs shall be above the level of the surrounding ground in the crawl space. The slab shall extend at least 6 inches on all sides of the furnace.

(d) **Illumination and Electrical.** See Chapter 53.
(e) **Access.**
   1. An exterior access opening shall be provided and the furnace shall be located not more than 20 feet therefrom.
   2. The vertical and horizontal dimensions of the exterior access shall be large enough to remove the heating equipment without disassembly, but shall be at least 36 X 30 inches. The inside of the areaway shall extend at least 54 inches out from the outside face of the access opening. The walls shall be at least 6 inches in thickness of concrete or concrete block and the floor of the access shall be of washed gravel at least 4 inches in depth. The top of the access wall shall be extended to at least 4 inches above the exterior grade, and covered in a manner as to be weathertight.

**SECTION 5211. UNDERGROUND DUCT SYSTEMS.**

(a) **Installation.** Underground duct systems shall have duct joints securely fastened made air tight and conform to the following:
   1. Non-metallic materials may be installed in accordance with the requirements of the approval obtained.
   2. Underground duct systems installed in or below concrete floors or slabs shall be fully encased in at least 2 inches of concrete and shall be securely anchored to grade every 6 feet prior to encasement in the concrete. Other systems may be as approved by the Department.
   3. Metal duct shall be heavy enough to prevent collapse, but in no case shall be lighter than the weights shown in Table 52-A.

**SECTION 5212. GRAVITY HEATING SYSTEMS.**

(a) **Material.** Ducts shall be constructed entirely of noncombustible material equal in structural strength and durability to the requirements of Table 52-B.
(b) **Installation.** Heating systems shall be installed in the following manner:

1. Ducts and fittings shall be properly secured to the structure with metal lug or straps.
2. Supply runs in basement shall have a vertical rise of 1 inch for each horizontal run of 1 foot, or where the total rise is taken at the furnace, the rise shall be at least 1 1/2 inches per linear foot of the run.
3. Supply ducts shall afford a clearance of at least 1 inch from any combustibles.
4. Adhesive coverings for aluminum ducts, if used, shall be non-alkaline.
5. Supply ducts shall be provided with locking type dampers which shall be supported on both sides of the pipe, and which shall be located not more than 2 feet from the furnace casing.
6. Supply ducts which pass through combustible walls shall be equipped with a metal ventilated thimble at least 1 inch greater in diameter than that of the pipe.
7. The return air opening shall not extend higher than 14 inches from the bottom of the furnace.
8. Vertical stacks for return air shall not be connected to registers on more than one floor.
9. Gravity furnaces shall not be converted for use as forced air furnaces.

**SECTION 5213. APPLIANCES ON ROOFS.**

(a) **General.** Appliances shall be approved for out-door installation and shall be designed to withstand atmospheric and climatic conditions. Roofs on which appliances are to be installed shall be capable of supporting the additional load.

(b) **Installation.**

1. **General.** Appliances shall be installed in accordance with their approval.
2. **Set Back.** At least 6 feet clearance shall be maintained between the appliance and the edge of a roof or other hazard. Otherwise, rigidly fixed rails or guards at least 3 feet in height shall be provided on the exposed side except that parapets at least 3 feet in height may be utilized in lieu of rails or guards.
3. **Curbs and Flashings.** See Chapter 32.

(c) **Access to Appliances.**

1. Access to appliances located on roofs or other elevated locations shall be provided.
2. Buildings having an eave height of 20 feet or more, or 2 stories in height where appliances are located on the roof, shall have permanent inside means of access.
3. Permanent lighting shall be provided for the access. See Chapter 53.

**SECTION 5214. HEATING AND VENTILATING EQUIPMENT IN HAZARDOUS OCCUPANCIES.** Heating and ventilating installation in Group E occupancies shall be approved by the Department on an individual installation basis.
SECTION 5215. COMMERCIAL COOKING APPLIANCES.
(a) Installation.
1. All commercial cooking appliances shall be installed in an accessible location with clearances in accordance with their approval, and shall comply with Section 5114.
2. The use of liquified petroleum gas or liquid fuel is prohibited.

SECTION 5216. COMMERCIAL COOKING HOODS AND FANS.
(a) Required Locations. Commercial cooking appliances, cooking and industrial appliances in Groups A through H occupancies which present a fire hazard shall be provided with ventilating hoods and exhaust ducts. Domestic ranges used for commercial purposes shall meet the requirements of this Section, unless otherwise approved by the Department.
(b) Fire Protection. See Chapter 38.
(c) Electrical Equipment and Control. See Chapter 53.
(d) System Designs.
1. The hood or other portion of the system designed for primary collection of vapors and residues shall be constructed of steel or stainless steel with welded joints, and shall have a clearance of at least 18 inches to combustible material, unless otherwise approved.
2. Grease filters shall conform to Section 5218.
3. Grease filters or other means of grease extraction shall be of noncombustible construction designed for the specific purpose. The height of lowest edge of grease filters located above the cooking surface shall not be less than:
   A. No exposed flame (grills, french-fryers, etc.) ........ 30 inches.
   B. Exposed charcoal and charcoal type fires .............. 48 inches.
   C. Exposed fire other than Item B ......................... 42 inches.
(e) Exhaust Ducts and Hoods.
1. Ducts and hoods, or other primary collection devices, shall be constructed of No. 18 U.S. Gauge or heavier steel, or No. 20 U.S. Gauge stainless steel, with welded joints.
2. Ducts from grease hoods shall constitute an independent system and shall lead as directly as possible to the outside, and be constructed to provide drainage of grease to a collection point.
3. Hand-holes for inspection and cleaning purposes, equipped with tight fitting metal doors and latches, shall be provided in horizontal sections of exhaust ducts. Openings shall be at the sides of the horizontal run in order to prevent dripping of residue. Spacing of openings shall not exceed 20 feet. Openings shall have a minimum dimension of 12 inches.
4. Vertical risers shall be located outside the building, and shall be supported with noncombustible supports. When approved by the Department, a riser may be located inside the building. The riser shall be enclosed in a fire-resistant shaft in accordance with the provisions of Chapter 43. Access openings shall be provided at the base of each vertical riser.
5. Termination of Ducts. Ducts shall extend above the building in which located and shall terminate as follows:
A. With at least 40 inches clearance from the outlet to the roof surface.
B. With a minimum of 10 feet of clearance from the outlet to adjacent buildings, property lines, air intakes and adjoining grade levels.
C. With the direction of flow of exhaust air away from the surface of the roof. If such is not possible, a metal pan shall be provided on the roof surface to catch residues that pass through the system. The pan shall have a minimum one inch lip at all edges to retain residues.

(f) **Exhaust Fans.**
1. Exhaust fans shall be located outside the building.
2. Fans shall be provided with a backward-inclined non-overloading wheel, and the fan motor shall be located outside the air stream.

(g) **Ventilation for Commercial Cooking Equipment.**
1. Duct systems shall be designed to create a conveying air velocity in the exhaust ducts of at least 1500 feet per minute.
2. Hoods shall be equipped with mechanical exhaust blowers which exhaust a minimum of 75 CFM per square foot of hood area when the hood is attached to a wall. When the hood is located with all four sides exposed, a minimum of 100 CFM of air per square foot of hood area shall be exhausted. Minimum over-hang shall be 3 inches per foot of height from the top of the appliance, but in no case shall the total be less than 6 inches.
3. Low sidewall range hoods, when the intake is within 3 feet of the cooking surface, shall have a minimum volume of 300 CFM per lineal foot of cooking surface. The maximum setback from the face of the hood to edge of cooking equipment shall be one foot.
4. **Makeup Air.**
   A. A positive means of introducing makeup air, equal to 90 percent of the quantity of air being exhausted by all exhaust systems, shall be provided for the space.
   B. The supply of air for exhaust may be makeup air or infiltration, but shall not be dependent upon the opening of windows, doors, etc.
   C. When fuel-burning appliances directly vented to outdoors are located in the same room as the hood, the makeup air quantity shall prevent negative pressures in the room from exceeding 0.02 inches water column.
   D. All systems shall be submitted for approval prior to installation.

**SECTION 5217. FILTERS.**

(a) **Scope.** This Section shall apply to filters used for the filtering of air for cooling, heating, ventilating, range hood and exhaust systems. This Section shall not apply to either absorption, ionizing, or collecting type.

(b) **Filters.** Filters installed in heating, ventilating, or cooling systems shall meet the following requirements:
1. Air filters shall be readily accessible for inspection and removal for cleaning and replacement. Duct connections shall be constructed to allow even distribution of air over the entire filter bank.
2. Filters installed near outside air inlets shall be protected from the weather by louvers and 1/2 inch wire mesh screen installed on the inside of the louvers, which shall be accessible for cleaning.
3. Filters installed near outside air inlets shall be Class 1.
4. Liquid adhesive coating used on air filters shall have a flash point of at least 325 degrees F., Cleveland Open-Cup Test.

(c) **Filters in Commercial Range Hoods.** Filters shall meet the following requirements:
   1. Commercial range hoods shall contain a grease retention element or filter placed inside the hood so that all air passing from the hood to the duct shall pass through the element or filter.
   2. Grease retention elements or filters shall be approved by a nation nationally recognized testing laboratory. There shall be 1 square inch minimum of filter area for each 2.0 CFM exhausted.
   3. All filter assemblies shall be accessible for easy removal of the filters for servicing or replacement.
   4. The filter media shall be constructed of specially formed metal, and shall be packed for grease retention. The filter media shall be encased in metal channel with drain holes to facilitate servicing. Each filter shall be identified by the manufacturer of the filter, indicating that the filter is suitable for grease retention.
   5. Grease filters shall be set at minimum 45 degrees, maximum 60 degrees, from horizontal. A cleanable grease drip-pan shall be provided below the filter bank.

(d) **Filters, Special.** Filters used in conjunction with spray-painting or dipping operations shall be non-flammable.

(e) **Filters, Other.** Filters used for purposes other than provided for in this Section shall be approved by the Department.

**SECTION 5218. FIRE, SMOKE, AND HEAT SHIELD DAMPERS.**

(a) **Requirements.** Fire dampers shall be required in air passages which penetrate walls, floor, or ceilings having a required fire-resistive rating, or as required by other portions of this Building Code. Ceiling openings in rated floor/roof and ceiling assemblies shall be protected with a fire damper or heat shield which complies with the design of the fire-rated assembly. Smoke dampers shall be required in air passages which penetrate smoke barriers and smoke partitions, and in smoke removal systems. Access doors shall be provided at all damper or door locations. Access doors in rated assemblies shall be rated doors. Access doors shall be labeled “Fire Damper Access”, or “Smoke Damper Access.”

(b) **Fire Damper Construction.** Fire dampers shall be constructed in accordance with SMACNA standards and have Department approval, or contain a label from a recognized testing laboratory stating its rating classification.

(c) **Smoke Damper Construction.** Smoke dampers shall be designed and constructed to be smoke-tight. Dampers used for the prevention of smoke passage shall be approved by the Department.

(d) **Damper Control.** Fire dampers, shall close automatically upon the operation of a fusible link at a temperature of 165 degrees F., or 50 degrees F. above the maximum temperature normally encountered in the system. Smoke dampers shall operate automatically and shall be
opened or closed by a smoke detector sensing products of combustion.

(e) **Duct Failure.** Fire damper assemblies in fire separations shall remain intact in the opening (in the event of failure of the duct). A duct joint shall not be more than 12 inches from the separation. When branch ducts are taken off of a riser in a shaft, the joint shall be provided not more than 12 inches from the shaft wall housing the fire damper assembly.

(f) **Special Requirements.** Transfer grilles shall not be installed in corridor doors. Transfer grilles may be installed in corridor walls if they are provided with a fire damper meeting the requirements of this Section.

(g) **Design.** It shall be the responsibility of the architect, designer or engineer of the building or structure to schedule classification of construction of walls, floor, ceilings, partitions, where duct penetrations are made, and indicate fire damper locations.

**SECTION 5219. EVAPORATIVE COOLING.**

(a) For installation on roofs, see Chapter 32.

(b) Water overflow openings and lines shall be not less than the size of the discharge outlet of the appliance. Lines shall be of galvanized steel, or copper, pitched to drain into a trapped and vented plumbing fixture with a minimum air gap of at least 1 inch.

(c) Wiring shall meet the requirements of Chapter 53.

(d) In addition to the requirements of this Section, duct weights shall conform to Tables 52-A or 52-B.

**SECTION 5220. SERVICE STATIONS.**

(a) **Service Stations Defined.** See Chapter 4.

(b) **Location of Heating Equipment.** Fuel-burning or electric heating equipment shall be located at least 66 inches from the floor to the bottom of the unit, and at least 8 feet in height in lubrication areas. Heating equipment shall not be located below grade.

(c) **Clearance.** Suspended horizontal furnaces shall be installed with clearances as shown in Table 52-E.

(d) **Ducts.** Return air and supply air shall be provided to the furnace through approved ducts. Duct weights shall conform to the requirements of Table 52-A, and installations shall meet the requirements of Section 5203.

(e) **Additional Requirements.** In addition to the requirements of this Section, furnaces shall meet the requirements of Section 5203.

**SECTION 5221. BLOWER AND EXHAUST SYSTEMS FOR REMOVING DUST, STOCK AND VAPORS.** (Excluding paint spray rooms and booths, and Group I occupancy.)

(a) **General.** Blower and exhaust systems for dust, stock or vapors shall be constructed and installed in accordance with NFPA Pamphlet 91. Air exhausted shall be replaced with air of equal volume.

(b) **Separating and Collecting Equipment.**

1. Shall include cyclones, condensers, cloth screen and stocking arrestors, centrifugal collectors, and other devices used for the purpose of separating solid material from the air stream in which it is carried; and hoppers, bins, silos and vaults for collecting the solid material.
2. Separating and collecting equipment shall be designed and constructed to withstand potential explosion pressures.

3. Separating or collecting equipment shall be located to prevent a hazard to adjacent structures. Supports shall be of metal, masonry, or concrete; and the structure shall be securely anchored to resist anticipated loads. Cleanout doors shall be provided. Separating or collecting equipment shall be located at a safe distance from combustible construction, or from unprotected openings.

4. Discharge ducts shall not come in contact with nor expose combustible material. Ducts shall terminate above the roof if within 10 feet of buildings of combustible construction, or unprotected openings.

5. Delivery ducts from cyclone collectors shall not convey refuse directly into the fireboxes of boilers, furnaces (including Dutch ovens), refuse burners, incinerators, etc.

(c) **Explosion Relief Vents.** Explosion relief vents on duct systems shall have a cross-sectional area at least that of the duct vented, and shall lead to the outside of the building. Explosion relief vent openings shall be provided with rupture diaphragms fitted with cutters to accelerate rupture. Other equivalent means of relieving pressure may be used, when approved by the Department.

1. Explosion relief vents shall not be connected to chimneys or duct systems used for other purposes.

2. Ducts other than vertical ducts shall be constructed so that the interior is accessible for other purposes.

3. Cleanout openings shall be provided at a maximum of 20 foot intervals in ducts when the smallest dimension is less than 18 inches. Cleanouts shall be not less than 2 inches smaller in diameter than the smallest dimension of the duct in which they are installed.

**SECTIN 5222. VENTILATION.**

(a) **General.** In addition to the provisions of other portions of this Building Code, the following ventilation requirements shall apply. See Table 33-A for occupant loads.

(b) **Installation.**

1. Ventilating requirements shall apply to every room designed, erected, altered, or converted to a different use, regardless of building type.

2. The method of producing ventilation and the minimum quantities of air to be supplied and exhausted by mechanical ventilating systems shall be as stated in the Standards.

3. All rooms which house sources of odors, fumes, noxious gases, smoke, steam, dust, spray, or other contamination shall be ventilated to prevent spreading of the contaminates to other occupied portions of the building.

4. Air exhausted from bath, toilet, locker, or coat rooms, kitchens, boiler rooms, or rooms of similar use shall not be recirculated unless approved by the Department.

5. When a mechanical ventilation system is provided, supply and exhaust quantities of air shall be equalized.

6. The air removed by mechanical ventilating exhaust systems shall be
discharged to the outside at a point where it will not create a nuisance, and from which it cannot again be readily drawn in by a ventilating supply system, except for air to be reused as part of a recirculation system. The minimum separation of discharge and intake openings shall be 10 feet.

7. Ventilating systems shall be of sheet metal or other approved materials. Materials shall be non-absorbent and moisture and corrosion resistant. The construction of all equipment and duct work shall function under normal conditions without excessive vibration. Ducts and linings shall conform to the Standards.

8. **Atrium Ventilation.** See Chapter 17).

(c) **Motion Picture Booth.** This classification shall include all motion picture booths housing projection equipment using carbon arc or xenon lamps.

1. When carbon arc lamps are used, fumes, gases, and other contamination shall be removed and discharged to the outside air by means of an exhaust system. Dampers shall not be installed in systems serving arc lamp projectors and the system shall be independent of any other system serving the building.

2. The capacity of the exhaust system shall be at least 200 cubic feet per minute for each arc lamp, and 300 CFM for each xenon lamp. Provisions shall be made for makeup air equal to the air exhausted. The exhaust air quantity shall be increased, if necessary, to provide a minimum of 20 AC/hr.

(d) **Toilets, Janitor Closets, Sterilizing, and Swimming Rooms.** This classification shall include all toilet, shower and bath rooms, swimming pool rooms, janitor closets, and similar rooms.

1. When mechanical exhaust systems are used, a negative room pressure shall be maintained for all areas of this classification.

2. Every toilet room shall be provided with natural or mechanical exhaust ventilation.

(e) **Garages.**

1. Repair garages, service stations, body shops, and all storage garages housing 6 or more vehicles driven by internal combustion engines shall be provided with a supply and exhaust ventilation system. A storage area is defined as any area within a building used for storage of fire trucks, tractors, automobiles, trucks, and other self-propelled vehicles. The outside air supply and exhaust ventilation shall be provided and maintained for all occupied areas during periods of occupancy. In lieu of continuous ventilation system operation, carbon monoxide detectors located as approved by the Department may be used to energize the system at a predetermined maximum carbon monoxide concentration.

2. A mechanical exhaust system shall be provided in all repair areas of 4 vehicle capacity or more to remove the exhaust fumes from the internal combustion engines. The duct system shall be designed to provide at least one outlet for each vehicle in the repair area.

(f) **Ventilation of Dry Cleaning Plants Utilizing Non-Flammable Solvents.** In addition to the requirements of this Chapter, dry cleaning plants utilizing non-flammable solvents shall provide ventilation in accordance with the following:
1. Dry cleaning equipment shall be provided with an exhaust system capable of maintaining a minimum of 100 feet per minute face velocity through the loading door whenever the door is in the fully open position. Ductwork connections of the system shall be sealed (soldered or taped), and the discharge stack shall extend through the roof to a height of at least 6 feet above the roof. The exhaust stack discharge shall be a minimum of 10 feet from a window, opening, fresh air intakes, or adjacent buildings.

2. **Coin-operated Plants.** Air-flow volume shall be at least that required by the Standards, with air movement through a separation between the public area and the service area. The direction of air flow shall be from the public area to the service area.
   A. Air flow openings shall be provided in the separation or in the machines at or near the floor level. Additional openings may be provided. If the equipment as installed cannot maintain the required volume, an auxiliary fan shall be provided in the service area.

3. **Other Type Cleaning Plants.** Air supply shall be provided to the public area and mechanically exhausted from the working or service area. The minimum requirements shall be as required by the Standards.

(g) **Range Hoods and Fans in Group I Occupancies.**

1. When range hoods and fans are provided, air shall be exhausted from kitchens by a range hood or a wall or ceiling fan.

2. Ducts from exhaust fans shall discharge to outdoor air, and shall be designed for the shortest practicable run to the exterior.

3. When the kitchen is not provided with required natural ventilation, mechanical ventilation shall be provided as follows:
   A. In the ceiling or wall close to the range, and not more than 4 feet from the center line of the range to the side or front of the range.
   B. In the wall directly above the range, between the bottom of the wall cabinets and the range, with a metal collector installed.
   C. Hoods using charcoal for filtering are prohibited.
   D. Unvented and electro-static type hoods are prohibited.

4. When the kitchen is provided with required natural ventilation, and a wall or ceiling fan is installed as an optional item of equipment, the fan grilles shall be located in accordance with Item 3 of this Section.
   A. Ceiling or high wall fans shall be located not more than 6 feet from center line of range to the side or front of the range.
   B. Metal collector hoods for wall fans between the range and the wall cabinets shall not be required.

(h) **Spray-Painting and Dipping Rooms and Booths.**

1. Spray-painting and dipping rooms and booths shall be provided with ventilation in the following manner:
   A. The minimum cross section velocity measured across direction of air-flow for spray-painting and dipping rooms and booths shall be 100 square feet per minute. Drive-in or drive-through vehicle spray rooms and booths shall be 100 feet per minute with the vehicle in place. The air supply opening shall be electrically interlocked to prevent operation of spray equipment.
until the openings are closed. Air exhausted from the room or booth shall be replaced with air of equal volume. If air supply is taken from an adjoining space, the air in the adjoining space shall be replaced with an equal volume. The compressed-air supply to spray-painting equipment shall be interlocked with the ventilating and make-up air equipment, and shall also be interlocked with water-wash equipment, if any, to assure the operation of the ventilation system during spraying operations. The air inlet opening shall be located to provide uniform sweep of air throughout the entire room or booth toward the exhaust opening or openings. When the fan discharge is directed down to the roof, a metal pan 3 inches deep and extending 12 inches on all sides of the outlet, shall be installed on the roof. The discharge end shall be not less than 12 inches or more than 36 inches above the metal pan. The method of exhaust venting shall not constitute a nuisance or hazard to adjoining property or to the public.

B. Freshly sprayed items shall be dried only in spaces provided with ventilation in order to prevent formation of explosive vapors.

SECTION 5223. CLEARANCE AND CONTROLS. See Table 52-E.

SECTION 5224. INFRA-RED SPACE HEATERS (GAS FIRED: UNVENTED).

(a) Commercial, Industrial.

1. For full building heating, the units shall be mounted as high as practicable and in strict adherence to clearances to combustibles as determined by a nationally recognized laboratory, as indicated on the listing plate, and in accordance with the manufacturer’s recommendations. Units for spot heating applications may be at a lower mounting height than that for full building heat.

2. Natural or mechanical ventilation shall be provided for the space to be heated. Provision shall be made for both outside air supply and exhaust.

A. Natural ventilation shall consist of outlets distributed above the units to provide the capacity as determined by the following formula:

$$ V = 9.4A \sqrt{H (t_i - t_o)} $$

Where:

- $V$ = Volume of air exhausted -CFM = 3.8 & 4.55 CFM/1000 Btu/hr for natural gas and propane gas, respectively.
- $A$ = Free area of outlets: sq. ft.
- $H$ = Height from inlets to outlet: ft.
- $t_i$ = Average temperature of indoor air in height $H$: degrees F.
- $t_o$ = Outdoor air temperature: degrees F.

B. Inlet air area shall be fixed, and shall be equal in amount to the outlet area determined in Subsection 2A. Infiltration area may be included in the inlet area.

C. If a negative pressure occurs in the building space (due to other
mechanical exhaust equipment) positive mechanical supply of air shall be provided.

D. Mechanical ventilation systems, when used, shall provide a positive pressure in the space. Fixed exhaust openings shall be provided at the high point of the space. Exhaust area shall be in an amount sufficient to reduce carbon dioxide concentrations to 5000 ppm and carbon monoxide concentrations to 50 ppm. The mechanical ventilation system shall be interlocked with the heaters so that the heaters cannot operate unless the ventilation system is operating.

(b) **Semi-Hazardous Occupancy (Garages and Aircraft Hangers)**

1. Heater units shall be listed for use by a recognized testing laboratory and shall be installed and located in accordance with Standards.
2. The ventilation system shall be mechanical, designed to maintain a positive pressure in the space at all times.
3. Auxiliary positive air supply and fixed exhaust openings in the high point of the space shall be provided in order to reduce the carbon dioxide and carbon monoxide produced by the heaters to 5000 ppm and 100 ppm of air respectively. The auxiliary system shall be interlocked with the main ventilation system so that it will operate only when the main ventilation system is not operating, and the heaters are operating.

SECTION 5225. DIRECT GAS-FIRED MAKE-UP AIR HEATERS.

(a) **General.** Direct gas-fired make-up air heaters installed in Groups E and G occupancies only, shall be installed in a separate furnace room, and shall be in accordance with 5203(c)3 unless otherwise approved by the Department.

(b) **Discharge.** The total discharge of the equipment shall not exceed 110 percent of the capacity of the exhaust system with which it is used.

(c) **Air.** All air handled by the equipment shall be brought in from outside.

(d) **Controls.** Heaters shall be interlocked with its corresponding exhaust system so that it can operate only when the exhaust system is in operation.

1. Exhaust equipment shall be provided with air-flow sensing devices to shut off the gas burner upon failure of either the main air supply or exhaust air flow.
2. Heating equipment shall be provided with combustion safeguards as required in Chapter 51.
3. Heating equipment shall be provided with both a thermostatic device for normal operation of the gas burner component, and a high-temperature limit control. The limit control shall be set at a temperature not to exceed 120 degrees F.

(e) **Clearance.** Equipment shall be installed with clearances not less than those required in Table 52-E for suspended unit heaters.

(f) **Approval.** New equipment to be installed in existing buildings shall be examined by the Department prior to installation, with approval granted prior to the issuance of a permit.

SECTION 5226. SOLAR ENERGY SYSTEM.

(a) **Solar Energy Collectors.** Solar collection systems may be installed as
free standing, roof, wall, or deck-supported structures or devices incorporated in or attached to building construction. Solar collection systems shall conform to ERDA and NBS Standards.

(b) **Solar Thermal Components.** Open, closed, or sealed vessels, containers, enclosures, spaces, and collectors shall comply with the requirements of this Building Code.

**SECTION 5227. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH</td>
<td>Industrial Ventilation - 1958</td>
</tr>
<tr>
<td></td>
<td>Dust Explosion Prevention in Feed Mills - Pamphlets 61B 61C - 1973.</td>
</tr>
<tr>
<td></td>
<td>Warm Air Heating and Air Conditioning Systems - Pamphlet 90B - 1973.</td>
</tr>
<tr>
<td></td>
<td>Blower and Exhaust Systems, Dust, Stock and Vapor Removal or Conveying. - Pamphlet 91 - 1973.</td>
</tr>
</tbody>
</table>

**LEGEND**

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH</td>
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<tr>
<td>ASHRAE</td>
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<td>NFPA</td>
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<tr>
<td>SMACNA</td>
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<td>UL</td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### TABLE NO. 52-A

**REQUIRED WEIGHTS OF DUCTS FOR A-H OCCUPANCIES**
(This Table Does Not Include Special Exhaust Systems in Table 52-C)

<table>
<thead>
<tr>
<th>Round Ducts Diameter (Inches)</th>
<th>Rectangular Duct Max Side (Inches)</th>
<th>Min. Thickness Steel (U.S. Ga.)</th>
<th>Min. Thickness Aluminum (B &amp; S Ga.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 13</td>
<td>Up to 12</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>14 to 33 1/4</td>
<td>13 to 30</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>34 to 67 1/4</td>
<td>31 to 60</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>61 to 90</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>91 and above</td>
<td>18</td>
<td>16</td>
</tr>
</tbody>
</table>

### TABLE NO. 52-B

**REQUIRED WEIGHTS OF DUCTS FOR I OCCUPANCY**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (Inches)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 12</td>
<td>30</td>
<td>26</td>
<td>IC(112 lb.)</td>
</tr>
<tr>
<td>12 or more</td>
<td>28</td>
<td>26</td>
<td>IX(135 lb.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rectangular Ducts</th>
<th>Width (Inches)</th>
<th>Min.Thickness</th>
<th>Minimum Weight Tin Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 14</td>
<td>28</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>14 or more</td>
<td>26</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE NO. 52-C

**REQUIRED WEIGHT OF DUCTS FOR BLOWER AND EXHAUST SYSTEMS FOR DUST, STOCK AND VAPORS**

<table>
<thead>
<tr>
<th>Diameter of Duct (Inches)</th>
<th>Non-Abrasive Materials</th>
<th>Abrasive Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 8, inclusive</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Over 8 to 18, inclusive</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Over 18 to 30, inclusive</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Over 30</td>
<td>18</td>
<td>14</td>
</tr>
</tbody>
</table>

### TABLE NO. 52-D

<table>
<thead>
<tr>
<th>Duct Gas Temperature</th>
<th>Largest Duct Dimension</th>
<th>Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 600° F., inclusive</td>
<td>8 in.</td>
<td>9 in.</td>
</tr>
<tr>
<td>Over 8 in.</td>
<td>12 in.</td>
<td></td>
</tr>
<tr>
<td>Over 600° F. to 900° F., inc.</td>
<td>8 in.</td>
<td>18 in.</td>
</tr>
<tr>
<td>Over 8 in.</td>
<td>24 in.</td>
<td></td>
</tr>
<tr>
<td>Over 900° F. to 1000° F., inc.</td>
<td>All sizes</td>
<td>24 in.</td>
</tr>
<tr>
<td>Over 1000° F. (Ducts shall be lined with refractory)</td>
<td>All sizes</td>
<td>24 in.</td>
</tr>
</tbody>
</table>
TABLE NO. 52-E
CLEARANCES AND CONTROLS
(For Explanatory Notes (a) through (l) see following pages.)

<table>
<thead>
<tr>
<th>Type of Furnace</th>
<th>Standard or Reduced Clearance Furnace</th>
<th>Type of Fuel</th>
<th>High Limit Required</th>
<th>Max. Outlet Air Temp.</th>
<th>High Limit Integral</th>
<th>Minimum Clearance Requirements (Inches to combustibles) for Approved Warm Air Heating Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Above and Sides of Bonnet Planum</td>
</tr>
<tr>
<td>Upflow Forced Air</td>
<td>Standard</td>
<td>Liquid</td>
<td>Yes</td>
<td>250°F</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>Gas</td>
<td>Yes</td>
<td>250°F</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
<td>Liquid</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
<td>Gas</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>Downflow Forced Air</td>
<td>Standard on Non-Combustible Floors</td>
<td>Liquid</td>
<td>Yes</td>
<td>250°F</td>
<td>Yes</td>
<td>2(d)</td>
</tr>
<tr>
<td></td>
<td>Standard on Combustible Floors</td>
<td>Gas</td>
<td>Yes</td>
<td>250°F</td>
<td>Yes</td>
<td>2(d)</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
<td>Liquid</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>2(d)</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
<td>Gas</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>2(d)</td>
</tr>
<tr>
<td>Horizontal Forced Air</td>
<td>Standard</td>
<td>Liquid</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>Gas</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>Gas</td>
<td>Yes</td>
<td>200°F</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>Type of Furnace</td>
<td>Standard or Reduced Clearance Furnace</td>
<td>Type of Fuel</td>
<td>High Limit Required</td>
<td>Max. Outlet Air Temp.</td>
<td>High Limit Integral</td>
<td>Minimum Clearance Requirements (Inches to combustibles) for Approved Warm Air Heating Equipment</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------</td>
<td>--------------</td>
<td>---------------------</td>
<td>-----------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Gravity        | Standard                             | Liquid       | Yes                 | 250° F                | Yes*                | 2  
|                | Standard                             | Gas          | Yes                 | 250° F                | Yes*                | 2  
|                | Reduced                              | Liquid       | Yes                 | 200° F                | Yes                 | 1  
|                | Reduced                              | Gas          | Yes                 | 200° F                | Yes                 | 1  
| Room (Space) Heaters | .....                              | Liquid       | .....               | .....                 | .....               | 18  
|                | .....                                | Gas          | .....               | .....                 | .....               | 6   
| Unit Heater Suspended | Standard                          | Liquid       | Yes                 | 250° F(g)             | Yes                 | 18  
|                | Standard                             | Gas          | Yes                 | 250° F                | Yes                 | 18  
|                | Reduced                              | Liquid       | Yes                 | 250° F(g)             | Yes                 | 18  
|                | Reduced                              | Gas          | Yes                 | 250° F                | Yes                 | 18  
| Unit Heater Floor Mounted | Standard                        | Liquid       | Yes                 | 250° F(g)             | Yes                 | 18  
|                | Standard                             | Gas          | Yes                 | 250° F                | Yes                 | 18  
|                | Reduced                              | Liquid       | Yes                 | 250° F(g)             | Yes                 | 18  
|                | Reduced                              | Gas          | Yes                 | 250° F                | Yes                 | 18  |
### TABLE NO. 52-E

**CLEARANCES AND CONTROLS**
(For Explanatory Notes (a) through (l) see following pages.)

<table>
<thead>
<tr>
<th>Type of Furnace</th>
<th>Type of Fuel</th>
<th>High Limit Required</th>
<th>Max. Outlet Air Temp.</th>
<th>High Limit Integral</th>
<th>Minimum Clearance Requirements (Inches to combustibles) for Approved Warm Air Heating Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct Heaters</td>
<td>Standard</td>
<td>Liquid</td>
<td>Yes</td>
<td>250° F (g)</td>
<td>Above and Sides of Bonnet or Planum</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>Gas</td>
<td>Yes</td>
<td>250° F</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
<td>Liquid</td>
<td>Yes</td>
<td>250° F (g)</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Reduced</td>
<td>Gas</td>
<td>Yes</td>
<td>250° F</td>
<td>18</td>
</tr>
</tbody>
</table>

* Furnace may have integral or separate limit control. See Note (a) for requirements.

1. The distance may be reduced 1 inch if the limit control to be used has been tested by an approved testing agency and cannot be set higher than 250 degrees F., installed not more than 10 inches above the top of the heat exchanger in a supply plenum that extends at least 12 inches above the top surface of the heat exchanger. The distance shall be increased to 6 inches if the specified distance herein cannot be adhered to.

2. A minimum of 6 inches from combustible material shall be maintained for a distance of at least 12 inches from the downstream side of the heat exchanger.

3. This clearance may be reduced to zero if 5/8-inch gypsum board is provided over the plenum and extends 6 inches beyond the plenum on all sides.

4. Sides and bottom of bonnet or plenum.

5. When a door is provided on the service side of the furnace, the clearance on this side may be reduced to 12 inches.

6. At least 1-inch ventilated clearance from the bottom of the unit to the asbestos millboard below.

7. If connected to the ductwork.

8. 18 inches at sides, 12 inches at bottom, 6 inches above top when unit has internal draft hood.

9. 1 inch above top of sloping side of a vertical draft hood.

10. 6 inches from ell on diverter.

11. 6 inches from relief opening of draft hood.

12. Back and one side only at least 6 inches.
CHAPTER 53
ELECTRICAL

SECTION 5301. GENERAL REQUIREMENTS.

(a) **Scope.** In addition to the other requirements of this Building Code, the provisions of this Chapter shall apply to all electrical installations, electrical systems, and their component parts. Where a conflict exists between this Chapter and the Standards indicated herein, the requirements of this Chapter shall govern.

(b) **N.E.C.** Where the abbreviation N.E.C. appears in this Chapter, this shall mean National Electrical Code, NFPA Pamphlet No. 70. See Standards.

(c) **Approval.** All electrical materials and equipment required or permitted by this Chapter shall be acceptable only if approved and listed by a nationally recognized testing agency (e.g. Underwriters Laboratories, Factory Mutual) or by the Department. See Chapter 4.

(d) **Weather Protection.** Electrical equipment and/or conductors shall not be installed inside of any building, structure or utility until the interior has been protected from the weather.

(e) **Release.** The Public Utility Company shall not provide electrical service to a building, structure, or utility until electrical inspection has been completed; and the building, structure, or utility has been released for electrical service to such agency by the Department.

**EXCEPTION:** Electrical meters installed in temporary locations for temporary heat and construction purposes may be released by the Department.

(f) **Testing.** Electrical systems shall be temporarily energized for final inspection or inspection for occupancy.

SECTION 5302. BRANCH CIRCUITS.

(a) **Maximum Number of Outlets.** In Group I occupancies, and in the dwelling units of Group H occupancies, no more than 10 current consuming outlets shall be connected to a 20 ampere branch circuit. No more than 8 current consuming outlets shall be connected to a 15 ampere branch circuit. All other occupancies shall conform to requirements of Article 220, N.E.C. for calculations of branch circuit loads.

(b) **Appliance Outlets.** In Group I occupancies and in dwelling units of Group H occupancies, receptacle outlets supplied by at least two small appliance branch circuits shall be installed in the kitchen. Small appliance branch circuits shall have no more than 3 receptacle outlets per circuit.

SECTION 5303. SERVICES.

(a) **Service Drop.** The method of attachment of electrical services to any building, structure, or utility shall be designated by the Public Utility Company, and shall comply with the requirements of the N.E.C.

(b) **Service Masts.**

1. **Mast Height.** Where a mast is required to maintain the required height, the mast shall be at least 2 inch galvanized rigid steel conduit, or intermediate metal conduit. Masts shall be of sufficient
height to maintain a clearance of at least 8 feet above the highest point of the roof over which the service wires pass. All masts over 48 inches in height shall be guyed.

EXCEPTIONS:

A. The vertical clearance shall be a minimum of 3 feet when the voltage between conductors does not exceed 300 volts, the roof is not accessible by a permanent ladder, stairs or doorways; and the service mast is within 3 feet from the edge of the roof.

B. In Group I and J occupancies, when the voltage between conductors does not exceed 300 volts and the roof is not accessible by a permanent ladder, stairs, or doorway, clearance shall be a minimum of 3 feet.

C. For remodeling work only, and where it is physically impractical to use 2 inch rigid steel conduit for a service mast, 1 1/4 inch rigid steel conduit may be permitted, provided the mast is securely guyed at the point of attachment of the service wires by 2 backstays of 3/4 inch E.M.T. or by an approved mast guying kit. All fittings shall be galvanized or equivalent.

2. Independent Supports for Service. Conductors passing over any part of a building or structure shall be supported independent of the building by an approved mast. See Section 5303(b)1.

(c) Service Size. Service entrance conductors shall be at least number 6 AWG and shall have an ampacity of at least 50 amperes.

EXCEPTIONS:

1. For Group I occupancies with an area of less than 1600 square feet, the service entrance conductors shall have an ampacity of at least 100 amperes, 3 wire. Basements having a bath or kitchen shall be included when computing the areas of the building.

2. For Group I occupancies with an area in excess of 1600 square feet, the service entrance conductors shall have an ampacity of not less than 125 amperes, 3 wire. Basements having a bath or kitchen shall be included when computing the area of the building.

3. Individual service, when approved by the Department, shall be at least 3 number 8 AWG conductors and shall serve no more than 3 circuits.

4. Billboards with 30 ampere computed load or less may be served by three number 8 AWG conductors.

5. Installations serving limited loads on a single branch circuit, when approved by the Department, shall be no smaller than the conductors of the branch circuit, and shall be a minimum of two number 10 AWG conductors.

(d) Disconnecting Means.

1. Service entrance switches or any service distribution equipment, including branch circuit panels, shall not be installed within a bathroom, toilet room, clothes closet, storage closet, bedroom, or furnace or boiler rooms, or under or over stairways.
EXCEPTIONS:
A. Branch circuit panel boards or control centers serving furnace, boiler, or associated mechanical equipment may be installed in furnace or boiler rooms.

B. Furnace or boiler rooms in Group I occupancies.

2. Service disconnecting means shall consist of no more than 6 switches or 6 circuit breakers, exclusive of the emergency disconnecting means, in a common enclosure or in a group of separate enclosures. See Section 5310 for emergency systems.

3. The service disconnecting means shall be located at a readily accessible point nearest to the entrance of the service conductors, either inside or outside the building or structure. The total length of service conductors without overcurrent protection shall not exceed 50 feet within the building or structure, and conductors shall be installed in an approved raceway or busway system.

4. Circuit breakers installed on approved multwire circuits, and equipped with approved simultaneous trip tie handles, shall be counted as one circuit breaker when used as service disconnect means.

SECTION 5304. GROUNDING.

(a) Grounding Electrode. A made electrode conforming to the requirements of Article 250-83 N.E.C., or other electrode conforming to Article 250-82 N.E.C., shall be installed for grounding of service equipment.

EXCEPTIONS:
1. Gas piping systems shall not be permitted as a grounding electrode.
2. Rod electrodes of iron or steel shall be protected by a conductive coating other than galvanizing.
3. Pipe or conduit electrodes shall not be permitted.

(b) Interior Water Piping. The interior metal cold water piping system shall, in addition to the above requirements, be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor if of sufficient size, or to the one or more grounding electrodes used. The bonding conductor shall be sized in accordance with Table 250-95 of the N.E.C.

(c) Metal Boxes.
1. Metal boxes when used with nonmetallic wiring systems shall be grounded to the grounding conductor by means of separate bonding screw, lug or clip in box.
2. Screws shall be installed in a tapped hole in the box.
3. When more than one grounding conductor enters metal box, joints shall be made up with approved pressure connectors with a single wire under the bonding screw, lug, or clip.
4. All joints, connections, lugs, screws, or clips shall be accessible after building finish is applied.
5. Connection of grounding conductors to clamp screws, cover screws, or nails is prohibited.
6. All grounding of metal boxes shall be performed prior to a rough-in inspection as required by the Department.

(d) Grounding Conductors. Grounding conductors running to a cold
water pipe shall be secured with an approved grounding clamp. Grounding
conductors shall not be secured to any plumbing fixture or fitting.

(e) Liquidtight Flexible Metal Conduit and Flexible Metal Conduit.
Flexible metal conduit and liquidtight flexible metallic conduit shall not
be permitted as a grounding means. A grounding conductor, sized per
N.E.C. Table 250-95, shall be included in all liquidtight flexible metal
conduit and flexible metal conduit.

SECTION 5305. TEMPORARY INSTALLATIONS.

(a) Electrical services and wiring installed for temporary purposes shall
comply with all applicable requirements of this Chapter and Articles
210-8, 230, and 305 N.E.C.

(b) For Group I occupancies, one temporary service shall be permitted to
serve not more than 3 consecutive sites for construction purposes.

(c) Temporary construction meters shall be located on the same side of the
alley, street, or driveway as the construction for which the meter is re-
quired.

(d) Outside temporary electrical wiring shall be installed at a minimum
height of 8 feet above ground level. Conductors or cables shall not be laid
upon the earth.

   EXCEPTION: Cords rated for hard usage as listed in N.E.C. may
   be used for portable tools and extension cords, provided the cords are
   removed at end of each working day.

(e) Underground. Temporary conductors installed underground shall be
of a type approved for the purpose and use, such as UF and USE. If in-
stalled without supplemental protection, such as conduit or duct, a
minimum burial depth shall be 12 inches. Routes of buried conductors
shall be plainly marked with flags or stakes to prevent accidental ex-
cavation.

(f) Barricades and Covered Walkways. Covered walkways shall be pro-
vided with lighting consisting of a minimum of one 60 watt lamp every
10 feet. In addition, a flashing amber light, with a capacity of at least 100
watts, shall be provided on the exterior of the walkway at both ends and
in the center. See Chapter 44.

SECTION 5306. TYPES OF WIRING.

(a) The method of wiring within or on buildings or structures shall be one or
more of the methods listed in Chapter 3, N.E.C.

   EXCEPTIONS: The following wiring methods shall not be permit-
ted in Group A through H occupancies, except as in Item (b).
   1. Open wiring on insulators.
   2. Concealed knob and tube wiring.
   3. Type AC cable.
   4. NM and NMC cable.
   5. Type SE and USE cable.
   6. Type UF cable.
(b) The following occupancies or uses shall be permitted to use any wiring method listed in Chapter 3, N.E.C.:
1. Group I occupancies.
2. Group H-3 occupancies.
3. Group H-2 occupancies of 3 stories or less.
4. Temporary buildings.
5. Trailers and mobile units.
7. Temporary wiring.

SECTION 5307. WIRING METHODS.

(a) Connection of Cable Assemblies. Cables connected to panel boards, junction boxes, outlet boxes, and other enclosures shall enter the enclosures through a separate opening for each cable, and shall be secured to the enclosure by means of an approved fitting, clamp, or connector.

EXCEPTIONS:
1. Non-Metallic Boxes. Fittings, connectors, or clamps shall not be required when nonmetallic cable is used with non-metallic boxes, if each cable is secured within 8 inches of the box.
2. Exterior Panel Board. Cables shall enter an exterior panel board through a nipple extending completely through the outer wall structure into the hollow space within the wall. The nipple shall be secured to the panel board by locknuts or connector, and insulated bushings shall be provided at each end of the nipple. The cable sheath shall extend completely through the nipple into the panelboard.
3. Conduit. Short sections of conduit, of lengths not exceeding 5 feet and with fill not to exceed 60 percent, may be installed for mechanical protection. Conduit shall have insulated bushings at both ends.

(b) Box Supports. Outlet boxes shall not be supported by nails alone, unless boxes are specifically designed and approved for the purpose.

(c) Raceway.
1. Raceway installed directly in or on the earth, or in concrete which is placed in or on the earth, shall be one of the following types:
   A. Rigid nonmetallic conduit.
   B. Rigid steel conduit covered with:
      An approved factory applied Poly-vinyl Chloride (PVC) or bituminous-base tape. Field applied tape is not acceptable.
      An approved extruded or bonded PVC coating.
      An approved coat of bituminous-base paint.
      An approved “Special” coating, e.g. double galvanizing, etc.
2. Raceway installed in concrete not in contact with the earth may be electrical metallic tubing or intermediate metal conduit (I.M.C.), in addition to the types listed above.
3. Aluminum conduit shall not be installed in or on the earth or embedded in concrete.

1) Roof Penetrations. Conduits penetrating a roof, shall preserve the integrity of the roof as required in Chapter 32.
(e) **Conduits on Roofs.** When conduits are installed on roofs, they shall be as required in Chapter 32.

SECTION 5308. APPLIANCES.

(a) **Electric Cooking Units.** Each wall mounted oven, or counter mounted cooking unit not grouped to form a single appliance, shall be connected to a separate individual circuit.

(b) **Clearances.** Minimum distances between electric cooking units and structural materials shall be as defined in Chapter 17.

SECTION 5309. MECHANICAL EQUIPMENT.

(a) **Furnaces, Unit Heaters, and Boilers.** All motors for furnaces, unit heaters and boilers, either new installations or replacements, shall have a separate overcurrent device which shall open the circuit when the motor current exceeds 125 percent of the rated full-load amperage. A thermal protector integral with the motor is not acceptable as the overcurrent device for motors on furnaces, unit heaters, or boilers. Each motor shall be provided with a disconnecting means located on or adjacent to the unit. All motors for furnaces and boilers, either new installations or replacements, shall be on a separate circuit.

   **EXCEPTION:** In Group I occupancies, lighting fixtures and receptacles, required by 5309(b), may be installed on the furnace circuit.

(b) **General Lighting and Power Requirements.** In all rooms containing mechanical equipment, adequate lighting and receptacle outlets shall be provided for servicing of the equipment. In addition, when equipment is installed in attics, crawl spaces, or on roofs, the following shall be required:

   1. **Attics and Crawl Spaces.** A lighting fixture shall be installed at the access opening, and a lighting fixture and receptacle shall be installed on the service side of the equipment. Fixtures shall be switched at the access opening.

   2. **Roofs.** A duplex receptacle shall be installed within a 50 foot radius of the equipment.

SECTION 5310. EMERGENCY SYSTEMS.

(a) **Scope.** Emergency systems shall include all required electrical wiring equipment which is essential to life safety, such as:

   1. Emergency Illumination.
   2. Fire Alarm and Detection System.
   5. Elevators.
   7. Communications Systems.

(b) **Emergency Circuits.** All emergency circuits shall be energized from the Emergency Power Source of the building.

   1. **Emergency Illumination.**

      A. **Exit Illumination.** Exit ways, which are continuous and unobstructed means of egress to a public way, shall be illuminated to an intensity of one foot candle at floor level during all
times the building is occupied. See Chapter 33 for further
definition of required areas.

B. **Exit Signs.** An exit sign with illuminated letters at least 5 in-
ches in height shall be provided at each required exit doorway
and elsewhere, as required, to clearly indicate the direction of
egress. See Chapter 33 for further location requirements. The
letters shall be white on a green field and shall be illuminated
with at least 2 lamps.

2. **Fire Alarm and Detection System.**
   A. A complete fire alarm system shall be installed in all occupan-
cies required by Chapter 38.
   B. The fire alarm system, when supplied thru an emergency panel-
      board, shall have “lock-on” devices installed on the circuit
      breakers.
   C. Wiring for fire alarm and detection systems shall be separate
      and distinct from all other wiring and raceway systems.
      **EXCEPTION:** Wiring may be combined with an emergen-
      cy communication system when installed for Fire Depart-
      ment use or the building emergency alarm.

3. **Sprinkler Alarm System.** Audible and visual alarm devices shall
be installed on every fire sprinkler system as required by Chapter
38.

4. **Fire Pumps.** Fire pump motors shall be installed in accordance
with the N.E.C. and N.F.P.A. Pamphlet No. 20, and shall be con-
nected to the emergency power source for the building.

5. **Elevators.**
   A. When required by Chapter 55, elevators shall be energized from
      the emergency power source of the building.
   B. The lighting in each elevator shall be energized by a separate
      circuit connected to the emergency power source.

6. **Ventilating Systems.** All motors and controls that operate ven-
tilating equipment essential to life safety shall be energized from
the emergency power source of the building. See Chapters 18, 38

7. **Communication Systems.** The voice alarm and/or communication
system for Fire Department use, shall be energized from the
emergency power source of the building. See Chapters 18 and 38.

(c) **Emergency Power Sources.** Equipment installed for use with
emergency power sources shall be approved for the purpose, and shall
meet all requirements of Article 700 of N.E.C. and of this Building Code.
Emergency power sources shall be of the following types:

1. **Standby Electrical Power Equipment.** In occupancies requiring
a standby electrical power source, the source shall be one or both of
the following:
   A. Generator driven by an independent powered prime motor.
   B. Storage batteries approved for emergency service, including
      unit equipment as defined in Article 700 N.E.C. When unit
equipment is used for exit lights, it shall be connected to an independent branch circuit ahead of the main service disconnecting means. When the unit equipment is used for exit illumination it shall be connected per article 700 N.E.C.

Transfer to the standby electrical power source shall be automatic in the event of normal power interruption. All emergency systems shall be connected to the standby electrical power source.

2. **Connection Ahead of the Main Service Disconnecting Means.**
   In all other occupancies when emergency equipment is required, the power source shall be derived from a connection ahead of the main service disconnecting means.

   A. Emergency service conductors shall be a minimum of No. 8 AWG copper.
   B. Approved connectors or lugs shall be provided at the point of connection to the supply.
   C. A maximum of 6 main disconnecting means, in addition to the 6 main disconnecting means for the main service, may be used for the emergency service.
   D. The emergency main disconnecting means and the emergency branch circuit panelboards shall be physically separated from the main service equipment, shall be painted red, and shall be clearly identified as “Emergency.”
   E. The emergency disconnecting means shall be accessible to qualified persons only.
   F. For installations consisting of one branch circuit, a 15 or 20 ampere circuit breaker may be used as a disconnecting means and branch circuit protection.

(d) **Wiring Methods.** Wiring for emergency systems shall be installed in approved metal raceways, Type MI cable or Type ALS cable.

**EXCEPTIONS:** Approved cables may be installed for fire alarm and fire detection systems when all of the following conditions are met:

1. Cable shall meet requirements of Article 760, N.E.C., and shall be approved for fire alarm service.
2. Cables shall be installed only for limited energy or power limited circuits defined by N.E.C.
3. Cables shall have 300 volt insulation rating, and a temperature rating of 105 degrees C.
4. Conductors shall be solid copper and shall be no smaller than Number 16 AWG for single conductor cable, Number 19 AWG for 2 or more conductors, and Number 22 AWG for 5 or more conductor cables.
5. Cables shall not penetrate walls, floors, or ceilings required to be fire rated unless enclosed in a metallic raceway. Cable passed through a floor or located on a sidewall within 7 feet of the floor shall be installed in a metallic raceway. See Article 300 of N.E.C.
6. Cables shall be installed and supported as required for non-metallic sheathed cable, and shall be protected from mechanical injury.
7. Cables shall be spliced only in equipment enclosures or junction
boxes, and junction box covers shall be marked "Fire Alarm" or painted red color.

(e) **Group D Occupancies.**

1. In all Group D occupancies a standby emergency power source shall be installed. This source shall be a generator having a capacity and rating for the emergency operation of the following equipment:
   A. Heating Equipment.
   B. Emergency Illumination.
   C. Fire Alarm and Detection Systems.
   D. Sprinkler Alarm Systems.
   E. Elevators as required by Chapter 55.

2. The requirements of Article 517 of N.E.C. shall apply to all health care facilities.

(f) See Chapters 33 and 38 for other required standby (emergency) power equipment.

**SECTION 5311. DATA PROCESSING SYSTEMS.**

(a) **Disconnecting Means.** In accordance with Article 645-3a of N.E.C., the disconnecting means shall be provided at each exit from the room. See Chapter 33 for required exits.

**SECTION 5312. SIGNS AND OUTLINE LIGHTING.**

(a) **Disconnect.** The disconnect switch shall be located within 50 feet and within sight of the sign or outline lighting. A switch capable of being locked in an open position shall not be approved as a disconnecting means when over 50 feet or out of sight of the sign.

(b) **Signs.** All signs and outline lighting shall be wired to comply with Article 600 of N.E.C. and shall provide an Underwriters’ Laboratories label of approval on each sign prior to installation on any building or structure.

1. All new signs or outline lighting shall be inspected by the Department prior to connection to any electrical supply source. Temporary connections shall not be permitted. See Chapter 3.

**SECTION 5313. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply.

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
</table>
C24-1972 - Rules for the Operation of Electric Supply and Communications Lines and Equipment.

ORGANIZATION
National Fire Protection Association
470 Atlantic Avenue
Boston, Massachusetts 02210
American National Standards Institute
1430 Broadway
New York, New York 10018
CHAPTER 54
GLASS AND GLAZING

SECTION 5401. GENERAL.
(a) Scope. This Chapter and Standards shall govern glass and glazing installed in buildings or structures as defined herein.
(b) Additional Requirements. For additional glass requirements where openings are required to be fire protected, see Chapters 17, 33, 38 and 43 of this Building Code. See Chapter 60 for openings glazed with plastics.
(c) Solar Collectors. Glass and glazing for solar collectors shall be excluded from the provisions of this Chapter when the installation does not present a hazard.

SECTION 5402. IDENTIFICATION.
(a) General. Each light shall bear the manufacturer’s label designating the type and thickness of glass. Each light, with special performance characteristics such as laminated, heat-strengthened, fully tempered, insulated, or coated shall bear the manufacturer’s identification showing the special characteristic and thickness by etching or other permanent means, and shall be considered labeled.

EXCEPTION: When approved by the Department, labels may be omitted from other than special-performance glass provided an affidavit is furnished to the Department by the installing contractor certifying that each light is glazed in accordance with the approved drawings and specifications.
(b) Safety Glazing. Each light of safety glazing material sold for use in hazardous locations or installed in a hazardous location shall be permanently labeled by means as etching, sandblasting, firing of ceramic material on the safety glazing material, or by other approved method. The label shall identify the labeler, whether manufacturer, fabricator, or installer; the nominal thickness and the type of safety glazing material; and a statement that the material meets the test requirements of ANSI Z-97.1. Safety glazing labeling shall be legible and visible after installation.

SECTION 5403. AREA LIMITATIONS. Exterior glass and glazing shall be capable of withstanding the loads set forth in Section 2307 (c) of Chapter 23, acting inward and outward. The maximum area of individual lights shall be those set forth in Tables 54-A and 54-B.

EXCEPTION: Where firm support is not provided at 4 edges, the area design and the means of installation shall be submitted to the Department for approval.

SECTION 5404. GLAZING. Glass firmly supported on 4 edges shall be glazed with minimum laps and edge clearances as set forth in Table No. 54-C. Glass supports shall be considered firm when deflection of the support at design load does not exceed 1/175 of the span.

SECTION 5405. JALOUSIES AND LOUVERED WINDOWS. Regular plate, sheet, or patterned glass in jalousies and louvered windows shall not be thinner than nominal 7/32 inch and not more than 36 inches in length.
When other types of glass are used, the design shall be submitted to the Department for approval. Exposed glass edges shall be smooth. Wired glass with wire exposed on longitudinal edges shall not be used in jalousies or louvered windows.

SECTION 5406. HAZARDOUS LOCATIONS AND SAFETY GLAZING MATERIALS.

(a) **General.** Glass lights installed in hazardous locations defined herein shall be glazed with safety glazing materials as specified herein and the Tables 54-D and 54-E.

(b) **Safety Glazing Defined.** Safety glazing material shall mean any glazing material such as tempered glass, laminated glass, wire glass, or rigid plastic which meets the test requirements of ANSI Z-97.1.

(c) **Hazardous Locations Defined.**

1. Framed or unframed glass entrance doors and fixed glass panels adjacent to entrance and exit doors. For purposes of this Chapter the term adjacent shall mean the edge of the fixed glass panel nearest the door which is 18 inches or less from the inside of the door jamb. Glazing located 18 inches or more from the door jamb and in excess of 6 square feet in area shall be considered to be a fixed glazed panel and shall meet the requirements of Table 54-D and 54-E.

2. Sliding glass doors, storm doors, shower doors, and bathtub enclosures.

3. Fixed glass panels more than 18 inches in width, and over 6 square feet in area, when the bottom edge is less than 18 inches above the adjacent walking surface.

**EXCEPTION.** Fixed glass panels, glass in corridor walls, and other glass walls, when the bottom edge is 18 inches or more above the adjacent finished walking surface, shall not require horizontal rails or safety glazing material. See Chapters 33 and 43 for the protection of openings in corridors.

SECTION 5407. SKYLIGHTS.

(a) **General** Glazing installed at an angle greater than 15 degrees from vertical over lobbies, reception areas, office areas, walkways, and other areas accessible to the public shall be laminated glass, wire glass, rigid plastic, fully tempered glass, or shall be provided with protective wire screens immediately beneath the glass.

(b) **Skylight Frames.** In other than Type III and Type V buildings, all skylight frames shall be constructed of noncombustible materials, and shall be designed to carry roof loads as specified in Chapter 23. All skylights with glazing of less than 45 degrees from the horizontal, shall be mounted on a curb at least 6 inches above the plane of the roof. The curb shall be constructed as required for the frame.

(c) **Glazing Installation.**

1. Spacing between supports in one direction for flat wired glass in skylights shall not exceed 25 inches. Corrugated wired glass may have supports 5 feet apart perpendicular to corrugation. All glass installed in skylights shall be wire or tempered glass with minimum thickness of 7/32 of an inch.
EXCEPTION: Skylights over vertical shafts, including stair enclosures, extending through 2 or more stories, may be glazed with sheet glass as specified in this Section. This glass shall be protected above and below with a wire screen not lighter than No. 12 U.S. gauge with mesh no greater than one inch.

2. Sheet glass may be used in the roofs and skylights for greenhouses, provided the height of the greenhouse at the ridge does not exceed 20 feet above grade. The use of wood frames for skylights shall be permitted in greenhouses outside of Fire Zones No. 1 and No. 2, if the height of the skylight does not exceed 20 feet above the grade; in all other cases, metal frames and metal sash bars shall be used.

3. Glass used for the transmission of light, if placed in floors or sidewalks, shall be supported by metal or reinforced concrete frames, and the glass shall be at least 1/2 inch in thickness. Any glass over 16 square inches in area shall be wire glass or shall be provided with a wire screen underneath as specified for skylights in this Section. All portions of the floor lights or sidewalk lights shall be designed for the floor load requirements of Chapter 23, except in cases where the floor is surrounded by a railing at least 3 feet 6 inches in height, in which case the construction shall be designed for not less than roof loads. For additional requirements for plastic skylights, see Chapter 60.

SECTION 5408. STANDARDS. Unless provided for in other portions of this Building Code, the following standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>ORGANIZATION</th>
</tr>
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<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td></td>
<td>1430 Broadway</td>
</tr>
<tr>
<td></td>
<td>New York, N.Y. 10018</td>
</tr>
</tbody>
</table>
### TABLE NO. 54-A

**MAXIMUM ALLOWABLE AREA OF GLASS**

(In Square Feet)

<table>
<thead>
<tr>
<th>Plate or Float Glass Thickness (In Inches)</th>
<th>Wind Load (In Pounds per Square Foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>$\frac{1}{8}$</td>
<td>41</td>
</tr>
<tr>
<td>$\frac{3}{32}$</td>
<td>72</td>
</tr>
<tr>
<td>$\frac{1}{4}$</td>
<td>81</td>
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<tr>
<td>$\frac{3}{32}$</td>
<td>89</td>
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<tr>
<td>$\frac{1}{8}$</td>
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<td>$\frac{3}{8}$</td>
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<tr>
<td>$\frac{1}{2}$</td>
<td>656</td>
</tr>
<tr>
<td>$1\frac{1}{4}$</td>
<td>956</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sheet Glass Thickness (In Inches)</th>
<th>Wind Load (In Pounds per Square Foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>41</td>
</tr>
<tr>
<td>DS</td>
<td>56</td>
</tr>
<tr>
<td>$\frac{3}{8}$</td>
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<td>$\frac{1}{2}$</td>
<td>109</td>
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<td>$\frac{3}{8}$</td>
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<td>243</td>
</tr>
<tr>
<td>$\frac{1}{2}$</td>
<td>311</td>
</tr>
</tbody>
</table>

*a Maximum areas apply for rectangular lights of annealed glass firmly supported on all 4 sides in a vertical position. Glass mounted at a slope not to exceed one horizontal to five verticals may be considered vertical.*
### TABLE NO. 54-B

**ADJUSTMENT FACTORS - RELATIVE RESISTANCE TO WIND LOAD**

<table>
<thead>
<tr>
<th>GLASS TYPE</th>
<th>Approximate Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laminated</td>
<td>0.6</td>
</tr>
<tr>
<td>Wired</td>
<td>0.5</td>
</tr>
<tr>
<td>Heat-Strengthened</td>
<td>2.0</td>
</tr>
<tr>
<td>Fully Tempered</td>
<td>4.0</td>
</tr>
<tr>
<td>Factory-Fabricated Double Glazing(^b)</td>
<td>1.5</td>
</tr>
<tr>
<td>Rough Rolled Plate</td>
<td>1.0</td>
</tr>
<tr>
<td>Sandblasted</td>
<td>Varies(^c)</td>
</tr>
<tr>
<td>Regular Plate or Sheet</td>
<td>1.0</td>
</tr>
</tbody>
</table>

\(^a\) To determine the maximum allowable area for glass types listed in Table No. 54-B, multiply the allowable area established in Table No. 54-A by the appropriate adjustment factor. Example: For one-fourth inch heat-strengthened glass, determine the maximum allowable area for a 30-pound per square foot wind load requirement. Solution procedure: Use Table No. 54-A to determine the established allowable area for one-fourth inch annealed glass. Answer: 36 square feet, then multiply 36 by 2 — the heat-strengthened glass adjustment factor. Answer: 72.

\(^b\) Use thickness of the thinner of the 2 lights, not thickness of the unit.

\(^c\) To be approved by the Department, since adjustment factor varies with amount of depreciation and type of glass.
# TABLE NO. 54-C

## MINIMUM GLAZING REQUIREMENTS

### FIXED AND OPERABLE WINDOWS OTHER THAN HORIZONTAL SLIDING

<table>
<thead>
<tr>
<th>Glass Area (Square Feet)</th>
<th>Up to 6</th>
<th>6 to 14</th>
<th>14 to 32</th>
<th>32 to 50</th>
<th>Over 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Frame Lap........</td>
<td>1/4&quot;</td>
<td>1/4&quot;</td>
<td>5/32&quot;</td>
<td>3/8&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Minimum Glass Edge Clearance</td>
<td>1/8&quot;a,b</td>
<td>1/8&quot;a,b</td>
<td>3/16&quot;a</td>
<td>1/4&quot;a</td>
<td>1/4&quot;a</td>
</tr>
<tr>
<td>Continuous Glazing Rabbet and Glass Retainerc</td>
<td>Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resilient Setting Materiald</td>
<td>Not Required</td>
<td>Required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SLIDING DOORS AND HORIZONTAL SLIDING WINDOWS

<table>
<thead>
<tr>
<th>Glass Area (Square Feet)</th>
<th>Up to 14</th>
<th>14 to 32</th>
<th>32 to 50</th>
<th>Over 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Glass Frame Lap</td>
<td>1/4&quot;</td>
<td>5/32&quot;</td>
<td>3/8&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Minimum Glass Edge Clearance</td>
<td>1/8&quot;b</td>
<td>3/16&quot;</td>
<td>1/4&quot;</td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>Continuous Glazing Rabbet and Glass Retainerc</td>
<td>Required above third story</td>
<td>Required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resilient Setting Materiald</td>
<td>Not Required</td>
<td>Required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*a* Glass edge clearance in fixed openings shall not be less than required to provide for wind and earthquake drift.

*b* Glass edge clearance at all sides of pane shall be a minimum of 3/16 inch, where height of glass exceeds 3 feet.

*c* Glass retainers such as metal, wood, or vinyl face stops, glazing beads, gaskets, glazing clips, and glazing channels shall be of sufficient strength and fixation to serve this purpose.

*d* Resilient setting material shall include preformed rubber or vinyl plastic gaskets, or other materials which are proved to the satisfaction of the Department to remain resilient.
### TABLE NO. 54-D

**IMPACT LOADS -- GLAZING**

<table>
<thead>
<tr>
<th>Specific Hazardous Locations</th>
<th>Size of Individual Glazed Area</th>
<th>Requirements&lt;sup&gt;a,b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glazing in exit and entrance doors, and fixed glazed panels.</td>
<td>Over 6 Sq. Ft.</td>
<td>Each glazed area shall pass the test requirements of ANSI Z 97.1, if not protected by a protective grill or bar.&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Glazing in storm doors.</td>
<td>Over 2 Sq. Ft.</td>
<td>Each glazed area shall pass the test requirements of ANSI Z 97.1, if not protected by a protective grill firmly attached to stiles on each exposed side.</td>
</tr>
<tr>
<td>Glazing in sliding doors (both fixed and sliding panels).</td>
<td>Over 6 Sq. Ft.</td>
<td>Each glazed area shall pass the test requirements of ANSI Z 97.1.</td>
</tr>
<tr>
<td>Glass in all unframed doors (swinging).</td>
<td>All Sizes</td>
<td>Shall be fully tempered glass and pass the test requirements of ANSI Z 97.1.</td>
</tr>
<tr>
<td>Glazing in shower doors and tub enclosures</td>
<td>All Sizes</td>
<td>Shall conform to the requirements of Chapter 17 and shall pass the test requirements of ANSI Z 97.1.</td>
</tr>
</tbody>
</table>

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<sup>a</sup> Annealed glass less than single strength (SS) in thickness shall not be used.

<sup>b</sup> If short dimension is larger than 24 inches, annealed glass must be double strength (DS) or thicker.

<sup>c</sup> Bar or push-bar shall be constructed with a rail 36 to 42 inches above the adjacent walking surface. The rails shall be 4 inches in width and shall be securely fastened to the stiles on each exposed side of the glass so as to limit or prevent human impact from being delivered to the glass surface.
<table>
<thead>
<tr>
<th>Glazing Materials</th>
<th>Size of Individual Glazed Area</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annealed glass (regular plate, float, sheet, rolled, or obscure)</td>
<td>Over 6 Sq. Ft.</td>
<td>Not less than 3/16 inch nominal thickness. Each glazed area shall be</td>
</tr>
<tr>
<td></td>
<td></td>
<td>protected by a protective grill or bar.</td>
</tr>
<tr>
<td>Annealed glass regular plate, float, sheet, rolled, or obscure, face sandblasted,</td>
<td>Over 6 Sq. Ft.</td>
<td>Not less than 3/16 inch nominal thickness. Each glazed area shall</td>
</tr>
<tr>
<td>etched, or otherwise depreciated.</td>
<td></td>
<td>be protected by a protective grill or bar.</td>
</tr>
<tr>
<td>Fully tempered glass.</td>
<td>All Sizes</td>
<td>Shall pass the test requirements of ANSI Z 97.1.</td>
</tr>
<tr>
<td>laminated glass.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wired glass, obscure, patterned, or transparent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparent rigid plastic.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a* See note c, Table No. 54-D.
CHAPTER 55
VERTICAL AND HORIZONTAL TRANSPORTATION

SECTION 5501. GENERAL.

(a) **Scope.** In addition to other requirements of this Building Code, this Chapter shall govern the design, construction installation, testing, inspection, maintenance, alteration, repair and approval of all vertical and horizontal transportation as defined in this Chapter.

(b) **Vertical and Horizontal Transportation Defined.** For purposes of this Chapter and Building Code, vertical and horizontal transportation shall include the following:
1. Elevators
2. Escalators
3. Moving Walks
4. Dumbwaiters
5. Private Residence Elevators
7. Stage Lifts
8. Man Lifts
9. Inclined Passenger Lifts
10. Personnel Hoists
11. Powered Platforms and Powered Scaffolds

(c) **Prohibitions.**
1. The equipment included in this Chapter shall not be operated until inspected and approved by the Department.
2. Mast tower cantilevered platform type automatic hoists are prohibited when the height exceeds 25 feet unless operated by a certified operator. The tower shall be guyed and provided with safety barricades and gates approved by the Department.
3. Stacking machines shall not be used as an elevator.
4. The installation or use of private residence elevators or inclined lifts is prohibited in all buildings except Group I and H-3 Occupancies.
5. Hand-powered elevators are prohibited in new construction.
6. Man lifts are prohibited. Existing man lifts may be permitted to operate when controlled by the owner for operating personnel only.
7. Sidewalk elevators are prohibited on public property.

(d) **Accidents and Reports.**
1. Any accident involving a person or damages to the transportation equipment or its enclosures shall be reported to the Department within 24 hours after the accident, by the owner or operator of this equipment. (See Chapters 1 and 2.)
2. When an accident involves injury to a person or damage to any portion of the equipment, the equipment shall not be operated until approved by the Department. The Department may order the discontinuance of service until a new Certificate has been issued.
3. Portions of the damaged construction or operating mechanism shall not be removed from the premises until approval has been granted by the Department.
(e) **Emergency Side Exits.** Except in hospitals and in blind hoistways, emergency side exits shall not be required for elevators equipped with safety devices which do not require resetting from the car.

(f) **Emergency Top Exits.** Emergency top exits, when required by the City of New York or the Department for new and existing elevators, shall be arranged so that they can be opened from the top of the car only.

(g) **Ventilation and Lighting** In addition to requirements of ANSI A17.1, all passenger elevators shall be equipped with an exhaust fan or blower with a minimum rating of 450 cubic feet per minute. The ventilation fan and elevator cab lighting shall be energized by a separate circuit connected to the emergency power source of the building.

   **EXCEPTION:** Enclosures designed with top and bottom louvered openings which permit natural ventilation.

(h) **Power Source.** Elevators serving 7 stories or 75 feet or more in height shall be connected to the power supply ahead of the main disconnecting means. At least one elevator in Group C, D, F-2, H-1, and H-2 Occupancies shall be connected to the power supply ahead of the main disconnecting means. See Chapters 38 and 53 for Emergency Power.

   **EXCEPTION:** Elevators connected to the building emergency power system.

(i) **Test and Inspections.**
   1. Elevator operation shall be inspected as required by Chapter 3. A metal plaque may be mounted in the car in lieu of the actual certificate of Inspection on file in the building office. See Chapter 3.
   2. In lieu of rule 1001.6b, of ANSI 17.1, pressure relief valves shall be tested, sealed, and tagged at 5 year intervals by an elevator contractor. Tag shall indicate testing company, relief valve setting and date of test.
   3. The elevator contractor shall notify the Department, at least one day in advance, of all 5 year safety, governor, and buffer tests, and 1 or 2 year reshackling of drum machine cables, and shall metal tag the equipment tested or reshackled indicating the date when work was accomplished and company accomplishing the work.
   4. Full load, full speed safety tests for elevators with wooden guide rails shall be performed at 5 year intervals. Damaged rail sections shall be replaced and an appropriate tag furnished by the contractor affixed to the equipment.

(j) **Special Provisions.**
   1. Sump pumps shall not be installed in an elevator pit.
   2. Carpeting may be installed only on the floor of the cab and may be covered to extend not more than 8 inches on the wall.

**SECTION 5502. DEFINITIONS.**

(a) **Powered Platform.** Equipment permanently installed for extended use to provide access to the exterior of a building for maintenance or window washing, consisting of a suspended power operated working platform, a roof car of other suspension means and the required operating and controlling devices.

(b) **Power Scaffold.** Similar to a powered platform but not affixed or stored on a building roof for extended use, and without a roof car.
(c) **Stage Lift.** Powered stage used for performing arts so it can be positioned for use at various elevations.

**SECTION 5503. OPERATION OF ELEVATORS UNDER EMERGENCY CONDITIONS.**

(a) **New Elevators.** Elevators shall conform to the Emergency Operation Requirements of this Chapter. See Item (c) 4, this Section.

(b) **Existing Elevators.** Existing elevators located in buildings exceeding travel of 75 feet in height above the main floor, shall conform to the Emergency Operation Requirements of this Chapter on or before January 1, 1980. See Item (c) 4, of this Section.

(c) **Revisions to Standards.** The following changes or additions to the Standards shall apply: See Section 5505.

   1. All requirements applicable to heights of 70 feet shall be changed to 75 feet.
   
   2. When the return switch, located at the main floor is in the “by-pass” position, it shall render the sensing devices inoperative and restore normal operation except that it shall not affect the operation of elevators that are operating on emergency service.
   
   3. Emergency operation switches located on the elevator shall have 2 positions only (off and on). Delete all references to “by-pass” position. Elevators shall be removed from emergency service by moving the emergency service key-operated switch in the car to the “off” position with the car at the main floor.
   
   4. Automatic elevator recall equipment, i.e., detectors, shall not be required in new or existing buildings. (ANSI A.17-1b 211.3a (2)).

(d) **Emergency Keys and Cabinet.**

   1. **Emergency Key Cabinet.** A cabinet shall be provided to contain the keys furnished by the elevator manufacturer and the fire protection contractor used to activate the operation of the elevators and master fire alarm panel and manual pull station during emergency conditions. The cabinet shall be located directly below and separate from the main call button fixture for each single elevator or group of elevators. The cabinet shall be provided with a tamper-proof door, equipped with a lock approved by the Fire Department which is keyed to a Fire Department issue key. All keys shall be identified to correspond to the instructions for use. The cabinet door shall be engraved “Fire Department” in letters at least 1/4 inch in height.
   
   2. **Instructions.** Instructions for the operation of the elevator(s) shall be typed on a plastic encased card and attached to the inside of the fire control key cabinet. Instructions for use of the hoistway door unlocking device keys and the use of the key(s) for the main fire alarm panel shall be incorporated as separate numbered items on the instruction card.

**SECTION 5504. PERMITS, DRAWINGS AND CERTIFICATES OF INSPECTION.**

(a) **General.** Permits shall not be required for repairs, replacement and testing for maintenance with parts of equivalent materials, strength and design unless correctional work is ordered by the Department. See Chapter 3 for Permit requirements.
(b) **Elevator Permit Information.** The elevator contractor shall submit the following information for approval prior to issuance of an elevator permit: shop drawings including hoistway plan and elevation; machine room plan locating all major equipment; clearances; and reactions on the building structure.

(c) **Certificate of Inspection.** See Chapter 3.

**SECTION 5505. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
</thead>
</table>
Safety Requirements for Personnel Hoists, A10.4-1973.  

<table>
<thead>
<tr>
<th>LEGEND</th>
<th>ORGANIZATION</th>
</tr>
</thead>
</table>
| ANSI  | American National Standards Institute  
1430 Broadway  
New York, New York 10018 |
CHAPTER 59
HOISTS, DERRICKS AND CRANES

SECTION 5901. GENERAL.

(a) **Scope.** In addition to the other requirements of this Building Code, this Chapter shall govern the installation, repair, maintenance and approval of all hoists, derricks, and cranes, when used in conjunction with the constrution or demolition of any building, structure, or utility.

(b) **Permit.** Prior to the erection or use of any hoist, derrick or crane, a permit shall be required and the fee shall be that indicated in Table 3-A.

(c) **Hoist Operator License.** See Chapter 2.

(d) **Prohibitions.**
   1. Hoists shall not be operated until it has been inspected and approved by the Department.
   2. Belted hoisting machines are prohibited.
   3. Platform hoists with more than 1 point suspension is prohibited.

(e) **Unsafe.** For installations found to be unsafe, See Chapter 1.

(f) **Accident Reports.** In the event of an accident involving a hoist, derrick or crane, the requirements pertaining to accidents in Chapter 55 shall apply.

(g) **Safety Barricades.** All hoistways shall be provided with safety barricades. Hoistway door or gate shall be provided and locking devices shall be installed.

SECTION 5902. DEFINITIONS The following definitions shall apply.

1. **Hoist.** A hoist is any apparatus by which a pulling and releasing action can be transmitted through ropes, wire ropes, or chains to bring about the raising or lowering of loads.

2. **Belt Driven Hoist.** A belt driven hoist is one in which the driving mechanism is connected to a prime mover by single or multiple belts, and where belts are used, the direction of the hoist car is changed without the reversal of the prime mover.

3. **Locking Device.** A device which secures a hoistway door or gate in the closed position and prevents opening from the landing side except under specific conditions.

4. **Mast Tower Platform.** A single vertical member on which a cantilevered platform suitable for carrying material, may be moved up and down.

5. **Hoistway Enclosure.** The fixed structure consisting of framing which isolate the hoistway from all portions of the building or from adjacent hoistway and in which the hoistway doors and assemblies are installed.

6. **Crane.** A boom-type machine for lifting, lowering, or swinging a load and moving it laterally, in which the hoisting mechanism is an integral part of the machine. This may be driven manually or by power and may be a fixed or mobile machine.

7. **Derrick.** An apparatus for hoisting or swinging loads, consisting of a mast supported by guys or braces. Derricks generally are provided with a boom, hinged at the lower end, for carrying the load and may be power or hand-operated.
SECTION 5903. CONSTRUCTION TOWERS.

(a) General. Towers shall rest upon solid foundations. Towers constructed of material other than wood shall provide strength, stability, and durability at least equivalent to those built in accordance with Section 5903 (c).

(b) Hoppers. The hopper brackets on all towers shall be designed and constructed with a safety factor of at least 6. Bolts, or equivalent, shall be used for attaching all large hoppers or critical load bearing members, including all horizontal supporting members that are in contact with the hopper. For purposes of this Chapter, a large hopper is one having a capacity of 1/2 cubic yard or more.

(c) Wooden Towers. Wooden members for tower corner posts may be built up of 2 inch laminated material pursuant to the Table 59-A. The wooden members, such as splice pads, braces, etc., shall be bolted. Bolts, less than 1/2 inch in diameter, shall not be permitted.
   1. Lumber for tower construction shall be the equivalent of Douglas fir “selected lumber”.
   2. The nominal sizes of the various members in wooden towers shall be as specified in Table 59-A, or larger.
   3. Not more than 2 diagonal braces may be omitted or removed from a panel point in the tower, but if this is accomplished, braces are not to be omitted from the next panel above or below.
   4. The diagonal cross bracing shall be placed on each of the 4 sides of the tower and between horizontal cross-ties, except at loading and unloading station.
   5. Post Splices. The splices of corner posts, if one piece material, shall be provided with square butt joints and with at least 2 pads or scabs on the adjacent sides. The pads or scabs shall be of the same width as the corner posts and at least 2 inches in thickness, and shall extend at least 2 feet on each side of the joint.
   6. Guys. Whenever wooden towers are independent of the building, they shall be guyed at each corner post every 32 feet in height, by at least a 3/8 inch wire rope or galvanized steel strand. The anchor shall be designed to develop the strength of the guy.
   7. Extra Loads. Where spouting equipment or other load, in addition to that of loaded cage or bucket, is supported by the tower, the tower shall be built as to safely withstand any and all stresses.
   8. Tower Booms. Whenever a boom is supported by the tower, the boom anchor shall be located at a level where guy lines are attached; and the upper fastening of the falls which rise and lower the boom, shall be placed at a distance of at least 1/2 the length of the boom above the boom anchor and at a level supported by the guys. The guy lines and anchors supporting these 2 points shall be designed to carry the extra load caused by the boom and its load.
   9. Access. A safe means of access shall be provided to the top of each wooden tower. These may normally be accomplished by means of an attached side rail ladder, however, if a safe means of approach is provided from some point on the building or a ladder landing, the tower ladder need not extend below that point.

(d) Metal Construction Towers.
   1. Design. All metal construction hoisting towers, masts, etc., shall be
substantially constructed, and of such design that expected loads will not stress any members beyond the limits established by applicable engineering formula. The design shall also provide ample strength for loads imposed by the use of booms attached to a tower or mast. The maximum load, as specified by the manufacturers, shall not be exceeded.

2. **Foundation and Anchorage.** All metal construction hoisting towers, masts, etc., shall be placed on firm and substantial foundations and securely guyed or braced against swaying or tipping. Particular attention shall be given to the need for anchorage at the top of the towers and also at the bucket-dumping positions, where this equipment is used.

3. **Guying.** Metal construction hoisting towers, masts, etc., shall be supported by guys or anchored to a building or structure in accordance with manufacturer’s recommendations, provided, however, that such support or anchorage shall be installed at vertical intervals not exceeding 40 feet with at least 3/8 inch wire rope or equivalent. This interval of spacing may be increased and the number of guys reduced only if the design and method of construction provide adequate strength to resist all lateral forces.

4. **Assembled Towers.** Positive connections, as those made with bolts or pins, shall join the various segments from which assembled towers are constructed.

5. **Removal of Bracing.** When necessary to remove diagonal bracing from 2 or more adjacent panels of the tower, other type bracing or reinforcement of equivalent strength shall be provided.

**SECTION 5904. CONSTRUCTION ELEVATORS.**

(a) **Elevator Landing Gates and Barriers.** Standard railings and toeboards shall be placed on the open sides of runways connecting the elevator tower to the structure. If a gate is not required by this Chapter, a bar 42 inches high and set back at least 18 inches from the tower shall be installed at all openings into the tower.

(b) **Enclosures.** Except for entrance, towers shall be enclosed on all sides adjacent to or within 3 feet of any floor, landing, scaffold, or walkway to a height of at least 6 feet. The enclosure shall be by means of wire mesh, slatted partitions, planks or plywood. Wire mesh shall be at least No. 18 gauge, with openings not exceeding 1/2 inch in thickness and spaced not more than 2 inches apart.

(c) **Landing Gates.** Construction elevators with 3 or more landings (including the bottom one), shall have a slatted or solid gate of least 6 feet high at all landings. Vertical sliding gates shall be counterweighted. Hinged gates are acceptable. (See Section 5905 (d) for requirement).

(d) **Inside Building.** If cages are to be used in an elevator shaft inside a building, the shaft opening shall be enclosed with a solid partition.

1. If one elevator in a shaft is put into service before the others are completed, that part of the shaft in which it operates shall be separated from the other part of the shaft by a continuous partition of solid material or wire screen with 2 inch or smaller mesh.

**SECTION 5905. CONSTRUCTION MATERIAL ELEVATORS.**

(a) **General.** No employer shall permit any person to ride in an elevator
provided for hoisting material, except when oiling or repairing guides, unless such elevator is in compliance with the requirements of Section 5906.

**EXCEPTION:** Permanent elevators being used temporarily for hoisting shall have a Department certified operator in the car.

(b) **Cage Construction.** The cage sling frame shall be made of Douglas fir "Selected Lumber", or of structural steel and designed in accordance with accepted engineering practice to provide a factor of safety not less than 4. Main members shall be bolted or welded.

1. The cage platform shall be a solid floor built of wood at least 2 inches thick, or equivalent, and shall be securely attached to the frame.

(c) **Hoisting Loose Materials.** Cages for hoisting brick, tile or loose material shall have the unused sides enclosed to a height of 42 inches with boards or the equivalent of No. 16 U.S. Standard wire gauge screen, 2 inch or smaller, mesh to protect workmen from falling material.

1. When construction buggies or wheelbarrows are hoisted on the cage, provisions shall be made to prevent their movement on the cage, and if buggies or wheelbarrows are loaded with loose material, all unused open sides of the cage shall be enclosed at least to a height of 42 inches.

(d) **Signaling Device.** In addition to the signal arrangements called for in this Chapter, the following shall be provided to prevent unexpected movement of any cage that a worker could board at a landing: Each landing gate on construction material elevators with 3 or more landings (including the bottom one) shall be equipped with an adequate latching device and an electrical contract so designed and installed that a circuit which lights a green bulb is closed whenever all gates are closed. This bulb is to be in clear view of the operator, and the cage is not to be moved unless the bulb is glowing.

1. The following sign shall be placed on all cages or platforms of installations not designated for handling men and shall state as follows: "BUILDING DEPARTMENT OF THE CITY AND COUNTY OF DENVER PROHIBITS RIDING THIS CAGE OR PLATFORM." Size of letters shall be not less than 2 inches in height.

(e) **Sheave Beams and Bearings.** The overhead sheave beams shall be of sufficient size and strength to safely carry 4 times the maximum weight of cage and contents. They shall be Douglas Fir 'Selected Lumber,' or equivalent. They shall be bolted together. In all cases the sheave bearings shall be mounted on top of beams and securely bolted. Open bearings shall not be permitted.

1. All sheave bearings shall be lined with babbit, or other equivalent bearing metal, or have ball or roller bearings, and shall be provided with adequate means for lubrication.

(f) **Sheave Dimensions.** The minimum deminsions for all material elevator sheaves shall be as given in Table 59-B. Axles shall provide a minimum factor of safety of 8 based on the static load, a condition that will be fulfilled by following listed sizes indicated in Table 59-B, if the wire rope is not over loaded and the bearings abut against the sheave hub.

(g) **Wire Rope.** Hoisting rope shall be wire rope, plow steel, or equivalent,
providing flexibility at least equal to that of standard plow steel hoisting rope composed of 6 strands of 19 wires each.

1. All hoisting rope used in normal construction elevator service shall be wire rope providing a factor of safety of at least 5, when new; which shall be calculated by dividing the breaking strength of the rope, as given in the manufacturer's published tables, by the total load to be hoisted, including the weight of the wire rope when fully let out.

2. Defective or badly worn wire ropes shall not be permitted, and no rope shall be used in which more than 10 percent of the total wires are broken in any running foot of the rope.

(h) **Wire Rope Clips.** Rope fastenings shall be substantially and securely made and maintained. The minimum number of clips for wire rope and attachments shall be as indicated in the manufacturer's tables, and rope end attachments shall be as indicated in the manufacturer's tables, but in no case shall less than 3 such clips be permitted. All clips shall have the "U" side placed on the dead end of the rope. The clips shall be spaced at a distance equal to at least 6 times the diameter of the rope. All sharp edges shall be prevented from coming into contact with the rope.

(i) **Hoist Brake.** Every hoist shall be equipped with a brake capable of sustaining the maximum load in any position.

(j) **Hoist Operator.** Each hoist operator shall be provided with a covering as protection from falling material.

(k) **Hoisting Ropes.** Wire hoisting ropes in exposed locations within 7 feet of floor or ground shall be guarded by enclosure or fenced with standard railing.

(l) **Inspection and Maintenance.** Hoisting machinery shall be thoroughly inspected each day it is to be used, with special attention given to brakes and other safety appliances. All hazardous defects found shall be corrected prior to further use of the equipment.

(m) **Rope Marking.** Hoisting ropes shall be accurately marked, or equivalent steps taken, to indicate when the load has reached certain important positions, including top and bottom landings.

SECTION 5906. CONSTRUCTION ELEVATORS FOR HOISTING MEN (Other than permanent elevators on a temporary basis). Construction elevators on which people ride shall comply with the provisions of this Section and all of Section 5905 except for those parts of Section 5905 (c), (c-1), (d) and (d-1) which are inconsistent with this Section.

(a) **Car Attendant.** Each elevator on which people ride shall be controlled by a Department approved attendant in the cage.

(b) **Dead-man Control.** Every machine used to hoist men shall be equipped with a control that will return to the "stop" position when the hand of the hoist operator is removed from the control lever. The brakes shall be automatically applied and the power from the machine cut off whenever the control lever is in the "stop" position.

(c) **Brakes.** The hoist machine shall be equipped with 2 brakes, either of which is capable of stopping and holding a fully loaded cage. One shall be an automatic brake that will be applied whenever the power fails, is shut off, or when the power control lever is in the "off" position. The other brake shall be a hand or foot brake that operates on the hoist drum.
(d) **Broken-Rope Safety Device.** The car shall be equipped with a broken-rope safety device, or equivalent, that will hold the car and capacity load in its guides in the event the rope separates. This safety device shall be tested on every installation. If the hoisting rope is so long and heavy that, in the event of breakage near the hoist drum, its inertia would interfere with the proper operation of a broken rope safety device, a governor-actuated, or equivalent, safety device shall be installed as a substitute.

1. Rope shall not be used for the purpose of raising or lowering men, when more than 10 percent of the total wires are broken in any running foot of said rope, or when the wires on the crown of the strands are worn down to less than 60 percent of their original area, or when, by superficial inspection, the rope shows serious defects, such as marked reduction in diameter or excessive corrosion.

2. All hoists shall be provided with an efficient device which will bring the cage to a stop at the top and bottom limits of travel.

3. The speed of the “cage” shall not exceed 200 feet per minute.

(e) **Drum Flanges.** The drums of construction hoists used for hoisting men shall have flanges which extend at least 2 inches radially beyond the last layer of rope when all the rope is oiled on the drum.

1. Sheave and drum diameters shall not be less than the minimum recommended for this service by the manufacturer of the wire rope being used. The following table lists diameter dimensions that will not vary greatly from minimum values normally recommended.

   - 6-strand 19-wire rope: 40 times rope diameter.
   - 6-strand 27-wire rope: 27 times rope diameter.
   - 8-strand 19-wire rope: 32 times rope diameter.

2. Gages shall have the top covered with boards not less than 2 inches thick and the 3 sides enclosed to a height of 6 feet with 3/4 inch plywood, or some equivalent such as one inch boards or No. 16 U.S. Standard gauge wire screen, not over 2 inch mesh, fastened in a secure and substantial manner.

3. In lieu of a construction elevator, installations complying with the requirements for elevators may be used as construction elevators for hoisting men or materials, provided that such have car tops equivalent to that required by item 2 of this Sub-Section. Incomplete elevators in this category may also be used for construction services, provided that the major part of the installation is ready for service and the hazards that result from the incomplete items are controlled by measures at least equivalent to those in this Chapter.

**SECTION 5907. HOISTING.**

(a) **Operator.** Hoisting machines shall be operated only by regularly assigned and City certified operators.

(b) **Hoisting Operations.** Only those persons whose duties require their services shall be in the hoist room or station.

1. There shall be no conversation involving the hoist operator while the hoist is in motion, or while he is attending to signals, except to receive orders or instructions.

2. The hoist shall be operated with extreme caution when workmen are being hoisted or lowered.
3. The hoist operator shall be kept fully informed on any changes in conditions of the work that affect hoisting operations.

4. The hoist shall not be operated during oiling of parts.

(c) **Construction Hoisting Signals.** Bell, whistle, or electric signals shall be provided on all hoists, except hoists where the hoist operator has a clear and unobstructed view of the load or signal man, in which case a manual system (see Fig. 1) of signaling may be used. Wiring for electrical signal systems shall be so arranged that an electrical failure will not result in a false signal to move the load.

(d) **Posting Signals.** The employer shall post a copy of the hoisting signals in a conspicuous place at the operator’s place of duty and all landing levels of all elevators.

(e) **Bell Signals.** The following signals shall be used on all elevators and hoisting machines, unless manual signals (See Figure 1) or telephone are used:

- One bell or whistle, to stop
- Two bells or whistles, to go up
- Three bells or whistles, to go down
- Four bells or whistles, to go slow

(f) **Derrick Signals.** Whenever derricks are used for hoisting materials, the following signals shall be used unless manual signals are used. (See Figure 1).

   **Note:** The signals are given with 2 different sounding bells.

   - One bell, to hoist
   - One bell, to stop (if in motion)
   - 2 bells, to lower
   - One bell, to raise boom
   - 2 bells, to lower boom

   If swing lines are used on booms:

   - 2 bells or whistles, to the right
   - 3 bells or whistles, to stop
   - 4 bells or whistles, to the left

(g) **Crane Signals.** Manual signals shall be used where signals are needed for safe crane operation, unless for special reasons a bell or telephone system is appropriately used.

**SECTION 5908. MOBILE TOWERS, HOISTS, AND SIMILAR EQUIPMENT.** (Does not include cranes or earth moving machines).

(a) **General.** High lift truck, mobile hoist, or similar self-propelled equipment used in delivering materials to elevated platforms more than 12 feet high, shall not be in motion while the load is being hoisted. Hoisting shall not proceed beyond the height needed for ground clearance until travel is completed, except for the final, lateral motion of a few feet needed in placing the elevated load in its final position just above platforms.

(b) **Soil.** A substantial plank or steel matting shall be provided where the ground is uneven, loose, soft, or filled, and shall extend far enough beyond the width and length of the wheel base to provide a substantial foundation.

(c) **Transport.** The platform of a mobile hoist unit used to transport any
rolling equipment, such as wheelbarrows, concrete buggies, etc., shall be provided with an adequate means to hold such equipment and its load securely in place.

(d) **Other Requirements.** All mobile towers, hoists, and similar equipment shall comply with applicable provisions of this Chapter.

(e) **Canopy Guard.** The Department may require lift trucks, mobile hoists, or similar units to be equipped with canopy guards of strength adequate to withstand, without undue deformation, the impact of falling objects which are normally handled or stored.

SECTION 5909. MAST TOWERS AND HOISTS.

(a) **General.** Any mast tower that has a cantilevered hoisting platform operating on a vertical mast or mastlike structure shall be stationary when in use. They shall conform to Section 5905.

1. The area on the ground or bottom landing that is under the cantilevered platform shall be surrounded on at least 3 sides by the equivalent of a standard railing.

SECTION 5910. GIN POLES.

(a) **General.** Gin poles shall be of high-quality, defect-free material, such as selected timber, structural metal, or steel pipe. The pole and all component parts shall provide a factor of safety of at least 4.

1. Gin poles shall be held as nearly perpendicular as possible, with only enough slope to clear the load to be lifted. At least 3 guy wires or ropes shall be provided.

2. If a winding drum is provided such shall be equipped with a friction brake and positive pawl or dog.

3. Every gin pole shall be securely fastened at the bottom to prevent it from kicking out during operation.

SECTION 5911. SLINGS.

1. The slings used with derricks, or other hoisting apparatus, shall be made of wire rope, certified alloy steel chains, manila or sisal rope of sufficient strength to carry the imposed loads, with a safety factor of at least 6. The factor of safety, based upon the sling’s original strength, shall be increased to 8 or more if the sling is not reasonably new.

2. Slings shall be of proper size and type to handle the load without overstress or slipping. Double choker slings shall be provided on all horizontal loads over 12 feet in length that include 2 or more pieces of material.

SECTION 5912. RAILINGS AND TOEBOARDS. (See Standards).

SECTION 5913. SUSPENDED, POWER-DRIVEN SCAFFOLDS. (See Standards).

SECTION 5914. BOATSWAIN’S CHAIRS. (See Standards).

SECTION 5915. DERRICKS AND CRANES.

(a) **Derricks and Cranes.** Derricks shall be constructed of metal or select structural Douglas fir, with proper metal braces and fittings. Derricks shall be of proper strength and size for the work to be performed, and shall be anchored so as to prevent them from tipping or collapsing.
Guyed derricks shall have at least 6 guys. This number shall not be reduced, unless a study by the Department determines that the proposed guy arrangement will provide a safety factor of at least 3 1/2 under all circumstances.

1. Reinforcing steel shall not be permitted for guy line anchors.

(b) **Brakes.** The hoisting drum of all handpower hoists shall be equipped with an effective brake, and shall be provided with a safety dog of sufficient strength to hold the load in any position.
   1. All ropes, chains, and blocks shall be of sufficient size and strength to safely raise, lower, or sustain the load under all circumstances.
   2. The maximum allowable working load of new chains and ropes shall be based on manufacturer’s tables.
   3. Ropes shall be attached to drums in a manner that will not interfere with proper winding.

(c) **Wire Rope Clips.** Wire rope fastenings shall be substantially and securely made and maintained. The minimum number of clips for wire rope end attachments shall be as indicated in manufacturer’s tables, but in no case shall less than 3 clips be used. All clips shall have the “U” side placed on the dead end of the rope. The clips shall be spaced at a distance equal to at least 6 times the diameter of the rope. All sharp edges shall be prevented from coming into contact with the rope.

(d) **Moving Rope Guards.** Wire hoisting ropes and similar moving ropes in exposed locations within 7 feet of ground or floor, except for free end section, shall be guarded by an enclosure or fenced with standard railings.

(e) **Safe Derrick Load.** The load on any boom or extension to a boom on any derrick shall not exceed the safe load indicated by the manufacturer.
   1. Every derrick shall be plainly marked on the length of the boom, the rated load, and the corresponding radius.

(f) **Crane Capacity.** Every boom-type mobile crane shall have a legible capacity chart or data plate, conveniently located on or in the crane, containing manufacturer’s rated loads at the maximum and minimum radius and at least 2 other points for the various boom length, counterweight, and outrigger arrangements. This information shall be given for boom positions, both parallel and transverse to the line of travel.
   1. Any boom or extension to a boom, designed by other than a recognized manufacturer or structural engineer, shall be tested before use, and at any other time requested by the Department with a vertical load at least 25 percent greater than the load which it is intended to lift, and with a lateral load equal to 1/2 the load it is intended to lift vertically, or with a lateral load equal to the maximum efforts of the swinging device, if of a swing type.

(g) **Crane Boom Stops.** Devices to prevent the boom from falling over backward shall be provided on cranes and on other equipment with booms that present similar hazards.

(h) **Boom Dog.** Any crane boom that depends upon a dog and ratchet arrangement to hold it in position shall have the dog readily visible to the operator, or shall be provided with a visible, directly connected, positive telltale device.

(i) **Oiling Platform.** Crane booms with outrig blocks or similar equipment, requiring a man to climb out onto the boom for oiling or other regular service, shall be equipped with an oiler’s walkway, or platform and grab
irons for safe access, except for those booms that can be and are safely lowered to the ground for this purpose.

(j) **Safety Glass.** All glass in the cabs of cranes or derricks shall be of a shatterproof type. Wire glass or equivalent is acceptable except for those sections, like windshields, through which the operator must frequently view his operations.

**SECTION 5916. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply:

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<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
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<tbody>
<tr>
<td>ANSI</td>
<td>Safety Requirements for Workmen's Hoists, A 10.4-1963.</td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute 1430 Broadway New York, New York 10018</td>
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**SECTION 5917. TABLES.**
### TABLE NO. 59-A

<table>
<thead>
<tr>
<th>Cage or Bucket Capacity Up to</th>
<th>Vertical Distance Measured From Top Down</th>
<th>Post Sizes</th>
<th>Guide Sizes S &amp; S</th>
<th>Horizontal Tie Sizes</th>
<th>Diagonal Brace Sizes</th>
<th>Maximum Tie Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 lb.</td>
<td>Top to 62'</td>
<td>4x4</td>
<td>2 1/2 x 3 1/2</td>
<td>1x6</td>
<td>1x6</td>
<td>6'</td>
</tr>
<tr>
<td>500 lb.</td>
<td>72 to 108'</td>
<td>4x6</td>
<td>2 1/2 x 3 1/2</td>
<td>2x6</td>
<td>1x8</td>
<td>6'</td>
</tr>
<tr>
<td>1,000 lb. or 1/4 cu. yd.</td>
<td>Top to 7'</td>
<td>4x4</td>
<td>3 1/2 x 3 1/2</td>
<td>1x6</td>
<td>1x6</td>
<td>6'</td>
</tr>
<tr>
<td>1,000 lb. or 1/4 cu. yd.</td>
<td>72 to 128'</td>
<td>4x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>1x8</td>
<td>6'</td>
</tr>
<tr>
<td>1,000 lb. or 1/4 cu. yd.</td>
<td>128 to 208'</td>
<td>6x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>1x8</td>
<td>6'</td>
</tr>
<tr>
<td>2,000 lb. or 1/2 cu. yd.</td>
<td>Top to 80'</td>
<td>4x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>1x8</td>
<td>8'</td>
</tr>
<tr>
<td>2,000 lb. or 1/2 cu. yd.</td>
<td>80 to 128'</td>
<td>4x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>2x6</td>
<td>8'</td>
</tr>
<tr>
<td>2,000 lb. or 1/2 cu. yd.</td>
<td>128 to 208'</td>
<td>6x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>2x6</td>
<td>8'</td>
</tr>
<tr>
<td>4,000 lb. or 1 cu. yd.</td>
<td>Top to 80'</td>
<td>4x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>2x6</td>
<td>8'</td>
</tr>
<tr>
<td>4,000 lb. or 1 cu. yd.</td>
<td>80 to 128'</td>
<td>6x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>2x6</td>
<td>8'</td>
</tr>
<tr>
<td>4,000 lb. or 1 cu. yd.</td>
<td>128 to 208'</td>
<td>6x6</td>
<td>3 1/2 x 3 1/2</td>
<td>2x6</td>
<td>2x6</td>
<td>8'</td>
</tr>
</tbody>
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TABLE NO. 59-B

<table>
<thead>
<tr>
<th>Diameter of Hoisting Rope (in inches)</th>
<th>Diameter of Sheave (in inches)</th>
<th>Axle Diameter, inches (See Sub-Section (f) for information)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>7 1/2</td>
<td>11/16</td>
</tr>
<tr>
<td>3/8</td>
<td>9</td>
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<td>1 13/16</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>2 3/16</td>
</tr>
</tbody>
</table>

NOTE: Diameter of sheaves shall be measured at bottom of groove.

1. All sheaves shall be of iron or steel, and of sufficient strength to support the loads to which they will be subjected.
2. The grooves of all sheaves shall be matched and shall be concentric with the axis.
3. All sheaves shall have axles of a grade at least equal to cold rolled shafting.

FIGURE 1

STANDARD HAND SIGNALS FOR CRANES AND DERRICKS
CHAPTER 60
PLASTICS

SECTION 6001. GENERAL.

(a) Scope. The use of combustible plastic materials on interiors or exteriors of buildings shall conform to the flame spread and smoke contribution requirements of this Building Code, except as permitted by this Chapter. Refer to Chapters 5, and 16 through for exterior uses, and Chapter 42 for interior uses. Plastic materials are classified: incombustible, approved plastics, and plastics.

(b) Approval for Use. The Department shall require that technical data be submitted to substantiate the proposed use of any plastic material and, if it is determined that the evidence submitted is satisfactory for the use intended, it may approve its use subject to the requirements of this Chapter. This approval shall not be construed as meeting the access requirements of Chapter 38. Approval by the Department and the Fire Department shall be secured to meet the access requirements.

(c) Identification. Each full sheet, roll, or piece of plastic for which a permit is required shall be identified with a mark or decal indicating its intended use.

SECTION 6002. APPROVED PLASTICS DEFINED. Approved plastic materials shall be those which provides a flame spread rating of 225 or less when tested in accordance with ASTM E-84 in the manner intended for use; and a smoke density rating no greater than 450 when tested in accordance with ASTM E-84 in the manner intended for use; or a smoke density rating no greater than 75 when tested in the thickness intended for use by the chamber method of test under ASTM D-2843. The products of combustion shall be no more toxic than those of untreated wood when burned under similar conditions.

SECTION 6003. INSTALLATION.

(a) General. Plastics shall be approved and those used as interior finish and trim shall comply with the requirements specified in Chapter 42.

EXCEPTION: Approved plastics are not required to be used in occupancies not restricted by Table No. 42-B.

(b) Structural Requirements. All plastic materials and their assemblies and fastenings shall withstand the design loads as prescribed in Chapter 23. Technical data shall be submitted to the Department by an approved testing agency to establish stresses, maximum unsupported spans and other information as may be deemed necessary by the Department for the various thicknesses and forms used.

(c) Fastenings. Fastenings shall withstand design loads as prescribed in this Building Code. Provision shall be made for the expansion and contraction of plastic material and any material in conjunction with which it is employed.

SECTION 6004. GLAZING OF UNPROTECTED OPENINGS.

(a) Definition.

1. Exterior Plastic Light Transmitting Panels. Light transmitting
material glazed, set in frame or sash, or held by mechanical fasteners which pass through the material.

(b) **General.** In Type V-N construction, doors, sash, and framed openings not required to be fire protected may be glazed or equipped with approved plastic materials. In all types of construction having occupancies other than Groups A, B, Divisions 1 and 2; E, Divisions 1 and 2, and in all buildings equipped with an approved automatic fire sprinkler system, openings not required to be fire protected may be glazed or equipped with approved plastic materials subject to the following requirements:

1. The aggregate area of plastic light shall not exceed 30 percent of the area of any wall face of the story in which they are installed.
2. In stories above the first story, the area of a pane of glazing shall not exceed 12 square feet, and the vertical dimension of a unit or pane shall not exceed 3 feet. When the light transmitting panel is mechanically fastened, the maximum height of each panel shall not exceed 10 feet in buildings over one story in height.
3. Assemblies of transmitting materials shall be separated vertically by noncombustible wall surfacing material to a height of at least 4 feet, or a height equal to at least 50 percent of the height of the highest panel of the next lower assembly or run, whichever is greater.
4. Installations above the first story shall be of materials easily broken to permit venting of a fire or entry by firemen, i.e., acrylic sheet or fiberglass materials. Polycarbonate material may be used when approved by both the Department and Fire Department.

**EXCEPTIONS:**

1. Installation of approved plastic materials which will automatically vent a fire in the occupancy prior to ignition of the plastic materials may occupy a maximum of 50 percent of the area of the wall face and the story when installed in the first 3 stories. The area of the materials above the 3rd story shall not exceed 30 percent of the area of the wall face and story of which it is installed. These materials shall be subject to the installation requirements specified in Item 2 of this Section.

2. Plastic materials qualifying under Exception 1 of this Section may be installed in areas up to 50 percent of the wall area of each story in structures less than 150 feet in height which are provided, on each floor above the first floor, with continuous architectural projections meeting the requirements of Chapter 17, and extending at least 3 feet from the surface of the wall in which the light transmitting material is installed. The size and dimensions of individual units or panes shall not be limited to the installations, except as required to meet loading requirements.

**SECTION 6005. SKYLIGHTS.**

(a) **General.** Approved plastics may be used in skylights installed on roofs in accordance with the following provisions:

1. The plastic shall be mounted at least 9 inches above the plane of the roof on a curb constructed with materials consistent with the construction of the roof upon which the skylight is mounted. The curb
may be omitted in buildings of Types IV-N and V-N construction when approved by the Department.

2. Flat or corrugated plastic lights shall slope at least 4:12 when mounted above the plane of the roof on a curb.

3. Dome-shaped skylights shall rise above the mounting flange a minimum distance equal to 10 percent of the maximum span of the dome, but not less than 5 inches.

4. The edges of the plastic lights or dome shall be protected by metal or noncombustible material.

5. Each skylight unit may have a maximum area, within the curb, of 100 square feet.

6. The aggregate area of skylights and plastic roof panels shall not exceed 25 percent of floor area of the room or space sheltered by the roof in which they are installed.

7. Skylight units shall be installed on the roof with a minimum distance of 4 feet between units and, except for Group H and I occupancies, at least 4 feet from any exterior wall. Skylights shall not extend into yards beyond a vertical plane where fire protection of wall openings is required.

EXCEPTIONS:

1. Provision 5. of Section 6005 (a), need not be applied if the building on which the skylights are located is not more than one story in height; the building has an exterior separation from other building of at least 30 feet; the room or space sheltered by the roof is not classified in a Group D occupancy, or as a required means of egress or the plastic material meets the fire retardant requirements of the roof.

2. Except for Groups A, B, Division 1, D, and E occupancies, approved plastic materials may be used beyond the limitations specified in provisions 5 and 7, of Section 6005 (a), if serving as an approved fire venting system, or if used in a building equipped with an approved automatic fire sprinkler system.

(b) Combinations of Roof Panels and Skylights. Combinations of approved plastic used in roofs and skylights shall not exceed 25 percent of the floor area of the room or occupancy sheltered.

SECTION 6006. MONITORS AND SAWTOOTH ROOFS.

(a) General. Where a fire-resistive rating is not required for the roof structure, and in all building provided with an approved automatic fire sprinkler system, approved plastics may be used with or without sash as the light transmitting medium in monitors and sawtooth roofs.

EXCEPTION: Plastics used in monitors or sawtooth roofs of Type IV-N buildings shall be of Class I or II material as set forth in Table No. 42-A.

(b) Allowable Areas. The area of individual plastic glazing used in monitor and sawtooth glazing shall not exceed 200 square feet. The total aggregate area of plastics used in skylights, monitors and sawtooth glazing shall not exceed 30 percent of the floor area of the room or occupancy sheltered.

(c) Area Separations. The areas of the plastic panels shall be separated
from each other by a section of noncombustible material or by a section of the roofing material of the structure not less than 4 feet in length.

SECTION 6007. PLASTIC LIGHT DIFFUSERS IN CEILINGS.

(a) **Luminous Ceilings.** For the purpose of this Section, a luminous ceiling shall be defined as any light diffusing or light transmitting ceiling consisting of transparent, translucent, louvered, egg-crated, mesh, or similar materials suspended from a ceiling or structural framework by means of hangers, and which may include a supporting grid on which the material rests.

1. Where ceilings are required to be fire-resistive or of noncombustible construction and are dropped greater than the distance specified in Chapter 42, plastics conforming to the requirements of a Class I finish material shall be used, except where they are protected on both sides by an automatic fire sprinkler system.

   **EXCEPTION:** Ceiling light diffusers of approved plastics shall not be required to conform to the above requirement, provided the installation meets the following requirements:

   1. The ceiling light diffusers, as installed, will fall from their mountings at an ambient temperature of at least 200 degrees Fahrenheit below the ignition temperature of the plastic material as measured by ASTM D-1929.

   2. The plastic light diffusers are mounted in the ceiling in a manner so they will remain in place at an ambient room temperature of 175 degrees Fahrenheit for a period of at least 15 minutes.

   3. The maximum length of any single plastic light transmitting panel shall not exceed 10 feet.

2. Luminous ceilings installed below sprinkler heads shall be installed so they will not interfere with the effective operation of the sprinkler system in the area to be protected, and shall provide a ready means of access to all valves and sprinkler heads of the system.

(b) **Use of Approved Plastics With Electrical Lighting Fixtures.** Light transmitting and light diffusing panels made from plastic materials installed in approved electric lighting fixtures shall be exempt from the requirements of Chapter 42 and Section 6007 (a), and shall meet the following requirements:

   1. The light diffusers shall meet the requirements of Section 6007 (a), Exceptions 1 and 2.

   2. Unless the occupancy is protected by an approved automatic sprinkler system, the area of approved plastic materials when used in exitways, exit passages, or corridors, or in Groups A, B, Division 1, and D occupancies, shall not exceed 30 percent of the aggregate area of the ceiling in which they are installed.

   3. The maximum area of any single plastic light diffuser shall not exceed 30 square feet.

SECTION 6008. PARTITIONS. Where partitions are not required to be of fire-resistive or noncombustible construction, approved plastics conforming to the requirements of Chapters 42 and 17, may be used.
SECTION 6009. EXTERIOR VENEER.

(a) **General.** Exterior veneer shall be of approved plastic materials, and shall conform to the provisions of this Section.

(b) **Limitations.** Exterior plastic veneer which meets the requirements for noncombustibility as defined in Chapter 4, shall be unlimited as to height and length of veneered area, except as limited by Chapter 30. All other approved plastic materials shall conform to the following provisions:

1. **Height.** The plastic veneer shall not be attached to any exterior wall above 20 feet.

SECTION 6010. Awnings and Patio Covers. Approved plastic may be used in awnings and patio covers. All the awnings shall be constructed in accordance with provisions governing projections and appendages as specified in Chapter 45.

SECTION 6011. Greenhouses. Approved plastics may be used in lieu of plain glass in greenhouses in Fire Zone No. 3.

SECTION 6012. Canopies. Plastic panels shall not be installed in canopies erected over motor vehicle service station pumps.

SECTION 6013. Standards. Unless provided for in other portions of this Building Code, the following Standards shall apply:

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<thead>
<tr>
<th>ORGANIZATION</th>
<th>TITLE OF PUBLICATION</th>
</tr>
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<tbody>
<tr>
<td>ASTM</td>
<td>Ignition Properties of Plastics, D-1929-68. Title 297.1.</td>
</tr>
<tr>
<td></td>
<td>Chamber Method of Text for Measuring Density of Smoke From the Burning or Decomposition of Plastic Materials, D-2843-70.</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing Materials</td>
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<td></td>
<td>1916 Race Street</td>
</tr>
<tr>
<td></td>
<td>Philadelphia, Penn. 19103</td>
</tr>
<tr>
<td>MCA</td>
<td>Manufacturing Chemists Association, Inc.</td>
</tr>
<tr>
<td></td>
<td>1825 Connecticut Avenue</td>
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<tr>
<td></td>
<td>N. W. Washington, D. C.</td>
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</table>
CHAPTER 56
SIGNS AND SIGN STRUCTURES

SECTION 5601. GENERAL.
(a) Scope. In addition to the other requirements of this Building Code, this Chapter and the Revised Municipal Code shall govern the installation, repair, maintenance, unsafe conditions and approval of all signs.
(b) Maintenance. Every sign shall be maintained a good structural condition. Signs shall be kept painted, including all metal parts and supports thereof that are not galvanized or of rust resisting metals. The owner of the sign shall maintain the premises in a clean and sanitary condition, free and clear of all rubbish. The Department shall inspect and shall have the authority to order the painting, repair, alteration, or removal of a sign which constitutes a hazard to safety, health or public welfare by reason of inadequate maintenance or design.

SECTION 5602. PROHIBITED SIGNS. See Zoning Ordinances.

SECTION 5603. OVER PUBLIC PROPERTY. Prior to the issuance of a Building Permit for a sign which is located over public property or which may require work over public property, the erector shall furnish proof that a revocable permit has been obtained from the Department of Public Works. See Revised Municipal Code.

SECTION 5604. PERMITS, FEES AND INSPECTIONS. Permits, fees and inspections shall be as required in Chapter 3.

SECTION 5605. DESIGN AND CONSTRUCTION. Signs and structures shall be designed and constructed in conformance with Chapters 23, 25, 26, 27, 28 and 60.

SECTION 5606. GROUND AND WALL SIGNS.
(a) General. Ground and wall signs may be constructed of any material meeting the requirements of this Building Code.
(b) Design. Supports for ground signs shall not be placed upon the public right-of-way or public easements.

SECTION 5607. ELECTRIC SIGNS.
(a) Erection. Electrical signs shall be erected and maintained in compliance with Chapter 53.
(b) Prohibition. No combustible material other than approved plastics shall be used in the construction of electrical signs. See Chapter 60 for plastics.
CHAPTER 57
SWIMMING POOLS

This Chapter is in the process of development. See Chapters 23, 50, 53, and 58 and Section 111 of this Building Code.
CHAPTER 58
BOILERS, PRESSURE VESSELS, STEAM AND WATER HEATING SYSTEMS AND PROCESS PIPING.

SECTION 5801. GENERAL.

(a) Scope. This Chapter shall govern the construction, installation, alteration, repair, maintenance and inspection of all boilers, pressure vessels, steam heating, water heating and process systems.

(b) Annual Boiler Inspections. See Chapter 3.

(c) Boiler Room Required. For boilers located in Group A through H occupancies a boiler room shall be required and shall meet the construction requirements of Chapter 17, except as provided herein. The boiler room enclosure may be waived when in the opinion of the Department, the enclosure is not necessary or would tend to increase the hazard.

   EXCEPTION: Boiler rooms located in dry cleaning plants, white rooms, chemical rooms or similar, and Group D and E occupancies, shall provide a 2 hour fire separation. Access to this room shall be from the exterior of the building.

(d) Combustion and Ventilation Air. Combustion air shall be provided in accordance with Chapter 51, and shall be a permanent opening with no restrictions open directly to the outside atmosphere. See Chapter 52 for ventilation air.

(e) Venting. See Chapter 37.

(f) Connection to Water Supply. See Chapter 50.

(g) Gas Piping. See Chapter 51.

(h) Burners. See Chapter 51.

(i) Stationary Engineer. See Chapter 2.

(j) Roof Mounted Equipment. See Chapters 32 & 52.

(k) Type of Energy. Gas, oil, or solid fuel fired appliance conversions, see Chapters 37 & 51. Electric fired appliances see Chapter 53.

(l) Temporary Heating and Process Equipment. All heating and process equipment used for temporary conditions shall be wired and operated so that all controls function in a normal manner.

(m) Exits and Access. See Chapters 32, 33, and 52.

(n) Solar and Geothermal Energy. All solar and geothermal energy systems shall be submitted to the Department for approval prior to construction.

(o) Prohibitions.

   1. Gas, oil or solid fuel-fired steam generators, boilers, or water heaters shall not be installed or maintained on the floor of any garage, wash rack, auto wash, or any building where gasoline or L.P.G. can be operated.

      EXCEPTION: Steam generators, water heaters or other open-flame devices may be located in auto washes or commercial garages if installed at least 5 feet, 6 inches above the floor, on an noncombustible stand.

   2. Access to rooms containing gas, liquid, or solid fuel fired steam generators, boiler, or water heaters shall not be through any garage,
wash rack, auto wash, or any area where the presence of flammable vapor may be present.

3. Boilers or water heaters shall not be installed in dry cleaning plants except as permitted in Chapters 10 and 17.

4. The storage of materials of any kind shall not be permitted in boiler rooms.

5. The installation or use of gaseous chlorinators or chlorine piping in boiler rooms is prohibited.

6. The installation of any device, including compressors, that will create a pressure less than atmospheric in the boiler room containing gas, oil, or solid fuel-fired equipment is prohibited.

7. The installation of piping shall not be permitted in the shafts, pits, or penthouses of elevators.

   EXCEPTION: Piping necessary for the installation of heating equipment for penthouses shall be permitted in the penthouses.

8. The use of internal type low water cut-off controls is prohibited.

SECTION 5802. EQUIPMENT AND MATERIALS.

(a) Specifications. Design, materials and fabrication of equipment governed by this Chapter shall be in accordance with the Standards. See Section 5808.

(b) Piping for Steam and Water Heating Systems. For all steam systems with a pressure of 15 psig and less, and all water heating systems with a pressure no greater than 125 psig or 250 degrees F., the following shall apply:

1. Steam piping. Standard weight steel pipe or Type L copper.

2. Condensate Piping. Standard weight steel pipe or Type K copper.


   EXCEPTIONS, if copper used:
   A. Type L copper shall be used for heating water lines above 30 psig working pressure.
   B. Type L copper shall be used for hot water lines embedded in concrete or buried and shall provide brazed copper fittings.

4. Fittings. Fittings for copper tube shall be wrought copper, wrought bronze, or cast brass. Fittings for steel pipe shall be screwed cast iron, malleable iron, or forged steel welding fittings.

5. System Pressure. The system operating pressure shall not exceed the materials rated working pressure. For pressures above those listed herein, see Standards.

(c) Approved Materials.

1. Required gaskets shall be constructed of material approved for the pressure and temperature to which they are to be subjected.

2. All piping fittings, flanges and valves shall have pressure ratings for the pressures and temperatures of the installation.

(d) Safety or Relief Valves.

1. General. Safety relief valves shall be installed on all boilers, pressure vessels, hot water storage tanks in excess of 100 gallons storage capacity, closed piping systems, and other systems shall meet the requirements of the Standards, modified as follows:
A. The requirements for temperature relief valves shall be the same as required for pressure relief valves, except that temperature relief valves shall be an approved type, and bear the seal of the ASME.

(e) Low Water Cut-Offs. A low-water cut-off control shall be required on all steam boilers, and hot water boilers of 400,000 BTU input or over, and installed in accordance with the Standards.

SECTION 5803. INSTALLATION AND ERECTION.

(a) Installation and Erection. The installation or erection of new or used equipment shall be performed under a license issued by the Department. See Chapter 2. The installation of systems governed by this Chapter shall conform to the manufacturer’s instructions in addition to the requirements of this Chapter.

(b) Clearances.

1. Irrespective of other provisions of this Building Code, clearances shall be maintained around all equipment to permit inspection, servicing, repair or replacement, and normal visibility of all gauges and controls. Every boiler or combination boiler and cooling unit shall be installed in a space which allows a minimum clearance of 24 inches on all service sides.

2. All steam and water heating appliances shall provide a clearance to combustible material as specified in this Chapter and in NFPA Pamphlet 89M, and Table 58-A.

EXCEPTIONS:

A. Boilers specifically for installation with clearance less than specified in NFPA 89M may be installed in accordance with the conditions of the approval.

B. Boilers shall not be installed in confined spaces, alcoves, or closets unless the equipment has been approved specifically for the installation, and is installed in accordance with the conditions of the approval. See Chapter 51 for other prohibited locations.

3. Steam and hot water pipes shall be installed with a clearance required by NFPA 89M. Steam pipes and hot water pipes passing through shelving shall be covered with approved insulation at least 1 inch in thickness.

(c) Existing Buildings. The Permit holder shall be responsible for arranging for a professional determination of the adequacy of an existing building structure; or the structural modifications necessary to accommodate equipment to be installed. Proof of the adequacy shall be furnished the Department on request.

(d) Piping. Piping for low pressure steam and water heating systems shall comply with the following:

1. All pipe or tubing shall be reamed, after cutting, to at least full internal dimensions.

2. Steel piping shall be joined by welding or by the use of screwed or flanged fittings. Copper tubing shall be joined by the use of manufactured fittings or brazed or soldered. Manufactured mechanical joint fittings may be used for joining pipe or tubing when approved by the Department.
3. Pipe and piping shall be properly hung and supported from the structure to carry weight of the pipe and contents and to permit expansion and contraction.
   A. The hangers or supports shall be so spaced that there shall be no undue stress or strain on the pipe, joints, fittings, valves, or equipment and so that sagging will not occur in the pipe between points of suspension under normal operating conditions. Vertical piping shall be secured not less than every other story height.

4. Piping passing through walls, ceilings, floors, beams or any portion of the building structure, shall be installed in a manner to maintain the specified fire resistive requirement of the structure.

5. **Buried Piping:** All piping buried below ground shall be installed as follows:
   A. Steel piping shall be joined by welding.
   B. Copper tubing shall be joined with manufacturers fittings and solder having a minimum melting point of 1100 degrees F.
   C. All piping shall be installed with approved wrapping or by a manufactured system to protect against corrosion.
   D. All piping outside of buildings shall be buried with a minimum of 15” cover. When subject to vehicular traffic, depth is to be determined by calculation to carry the wheel loads and calculations shall be submitted to the Department upon request.

6. **Approved Materials:**
   A. All threads shall conform to Standards in this Chapter.
   B. Threaded joints shall be made with thread compound or lubricant suitable for the service intended.

7. **Pitch of Piping:**
   A. All piping shall be pitched or graded for proper venting. Wherever practical, water pipe shall be so pitched that the air or gases flowing to a high point or vent point will flow in the same direction as the water.
   B. All steam mains shall be pitched down in the direction of the flow of steam from the boiler. The grade or pitch shall be at least one inch per each 20 feet of horizontal pipe run. Risers and the ends of the steam mains shall be dripped and connected into the return piping of the system so that the condensate will be carried back to the boiler directly or to a boiler return pump or return trap.
   C. **Branches.**
      1. All branches to radiators or to supply risers on steam heating systems shall pitch up from the point of connection to main or return piping at least one inch per each 4 feet of horizontal run. If the horizontal run from the main to the radiator or riser on the steam system is over 8 feet in length, the run shall be increased one pipe size or pitched down and trapped at riser.
      2. If the building or structural conditions are such that the branches cannot be pitched up from the connection point and must be pitched down to the point where they rise to
connect into the radiator or riser, the branch shall be dripped to a steam trap at the low point and trap connected to the return piping.

D. Grading.

1. Where necessary, due to structural conditions, to regrade or elevate the steam main or mains; and where the change in grade or level causes the formation of pockets in which condensate can collect, a drip pocket and steam trap shall be installed at the low point and connected to the return piping. The size of the drip leg and trap connection shall be adequate to drain the amount of condensate anticipated, but in no case shall the drip connection be less than 1/2 inch iron pipe size.

2. Where the steam main cannot be pitched so that the steam and condensate will flow in the same direction, the main shall be sized in accordance with the Standards.

8. Embedded Piping. Where pipes or tubing are embedded in the structure of the building, all steel pipe shall be joined together by welding and all copper tubing shall be joined together with manufactured fittings and solder or copper brazing rods having a melting point of 1100 degrees F. or higher. The use of screwed fittings, compression fittings, flared fittings, or other means of joining the pipes or tubing together shall not be permitted.

(e) Cleaning.

1. Boilers. Steam boilers or steam generators shall be “boiled-out” prior to being put into service in accordance with the recommendations of Section VI or VII of the ASME Boiler Pressure Vessel Code.

2. Systems. Before final connections are made in the piping systems, all piping shall be cleansed for the removal of all foreign materials.

(f) Boilers. Unless approved for other mounting or setting, boilers shall be mounted on an approved non-combustible base. The construction shall extend not less than 12 inches beyond the boiler on all sides. Where solid fuel is used it shall extend not less than 48 inches at the front or sides where ashes are removed.

(g) Separation of Equipment. Direct fired heating equipment in Group A through H Occupancies shall be separated from air handling equipment by a fire separation of at least one-hour fire-resistive construction.

(h) Insulation. Piping and equipment insulation installed in all Types of buildings, shall conform to the test requirements of ASTM E-84 and the insulation shall provide a flame-spread not to exceed 25 and smoke-developed not to exceed 300.

EXCEPTION: Fitting covers if not located in air plenums.

SECTION 5804. USED EQUIPMENT.

(a) General. This Section shall not be construed to prevent the use, or reinstallation of a boiler or pressure vessel provided it has been made to conform to the requirements of this Chapter governing new or existing installations.

(b) Working Pressure. The maximum allowable working pressure of a
boiler or pressure vessel carrying the ASME Code symbol shall be determined by the applicable Sections of the ASME Code under which it was constructed and stamped.

(c) **Non-Standard Working Pressure.** The maximum allowable working pressure of a boiler or pressure vessel which does not carry the ASME Code symbol shall be computed in accordance with the Inspection Code of the National Board of Boiler and Pressure Vessel Inspectors.

(d) **Used Equipment.** Before a used boiler or pressure vessel can be installed an inspection shall be made by an approved recognized authority. Used boilers shall be hydrostatically tested.

(e) **Re-Installation.** Where a stationary boiler or pressure vessel is moved and reinstalled, the fittings and appurtenances shall comply with the requirements for new installations.

**SECTION 5805. REPAIRS AND ALTERATIONS.**

(a) **General.** Repairs or alterations to existing installations shall be in accordance with the following:

1. Equipment items originally furnished under the ASME Code shall be repaired or altered in accordance with the requirements of Chapter VI, Repairs and Alterations to Boilers and Pressure Vessels, of the National Board Inspection Code published by the National Board of Boiler and Pressure Vessel Inspectors, and be approved by the Department.

2. Any item which does not have an ASME Code stamp may be repaired or altered in accordance with procedures approved by the Department.

**SECTION 5806. CENTRAL UTILITY STEAM.**

(a) **General.** Steam piping from any central utility heating system entering into an individual building shall be provided with a steam shut off valve of the same size as the supply pipe to the building and shall be installed near the entrance of the pipe and the building. Connections to the steam supply of building piping shall be made on the building or load side of the valve.

(b) **Reducing Valve Required.**

1. Where the steam pressure supplied from such systems is of greater pressure than the design pressure of the heating equipment or other equipment used in the building, an approved reducing valve shall be installed to regulate the steam pressure to this equipment.

2. If a bypass line is installed around the pressure reducing valve, this bypass shall be at least 1/2 the size of the reducing valve and shall be controlled by a globe type stop valve.

3. On the downstream side or low pressure side of the reducing valve, a steam gauge and low pressure relief or safety valve shall be installed, set at maximum pressure at which the low pressure heating system is designed to be operated. The relief or safety valve shall be installed in compliance with Section 5802 (d) and the Standards herein.

(c) **Return Condensate.** The return condensate from a building heated by.
a central steam supply may be discharged either into a return condensate system or wasted into a sewer drain connection or approved leaching well. This condensate when discharging into a sanitary sewer system shall be sufficiently cooled so that the temperature of the discharge water reaching the sewer shall not be in excess of 180 degrees F. and the discharge cannot be directly connected to any sanitary sewer system; the discharge shall be to an open floor drain or a special drain connection or approved receptor. If the floor drain or drain connection to the sewer is above the level of the return piping so that it cannot flow by gravity, an automatic sump pump shall be installed into which the condensate can be discharged and pumped from the sump to the sewer drain.

SECTION 5807. CONTROL VALVES. Approved main burner safety shutoff valves shall be required on all boilers in excess of 400,000 Btu.

SECTION 5808. INSPECTION AND TESTING BY THE DEPARTMENT. The testing of boilers and pressure vessels shall be performed by the Permit holder and the inspection of boilers and pressure vessels shall be performed by the Department. See Chapter 3.

SECTION 5809. STANDARDS. Unless provided for in other portions of this Building Code, the following Standards shall apply:

<table>
<thead>
<tr>
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<th>TITLE OF PUBLICATION</th>
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| ANSI         | Pipe Threads (Except Dryseal), B2.1-1968.  
                 Fuel Gas Piping, B31.2-1968.  
                 Refrigeration Piping, B31.5-1966 and including Addendum, B31.5a-1968. |
                 Heating Boilers, Section IV, 1974.  
                 Recommended Rules for Care and Operation of Heating Boilers, Section VI, 1974.  
                 Recommended Rules for Care of Power Boilers, Section VII, 1974.  
                 Pressure Vessels, Section VIII, 1974.  
| ASTM         | Surface Burning Characteristics of Building Materials, E84-70. |
ASHRAE

1975 Equipment Volume.
1972 Handbook of Fundamentals.
1974 Application Volume.

LEGEND

ORGANIZATION

ASME
The American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

ASTM
American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

NBBI
The National Board of Boiler and Pressure Vessel Inspectors
1155 North High Street
Columbus, Ohio 43201

NFPA
National Fire Protection Association
470 Atlantic Avenue
Boston, Mass. 02210

ANSI
American National Standards Institute
1430 Broadway
New York, N.Y. 10018

API
American Petroleum Institute
Publications and Distribution Section
1801 K. Street, N.W.
Washington, D.C. 20006

SECTION 5810. TABLES.
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## CLEARANCES (Inches)

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<th>RESIDENTIAL TYPE APPLIANCES FOR INSTALLATION IN ROOMS WHICH ARE LARGE</th>
<th>APPLIANCE</th>
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<tr>
<td></td>
<td>Above Top of Casing or Appliance</td>
</tr>
<tr>
<td><strong>BOILERS AND WATER HEATERS</strong></td>
<td></td>
</tr>
<tr>
<td>Steam Boilers - 15p.s.i.</td>
<td>Automatic Oil or Comb. Gas-Oil</td>
</tr>
<tr>
<td>Water Boilers - 250°F</td>
<td>Automatic Gas</td>
</tr>
<tr>
<td>Water Heaters - 200°F</td>
<td>Solid</td>
</tr>
<tr>
<td>All Water Walled or Jacketed</td>
<td></td>
</tr>
<tr>
<td><strong>HEAT EXCHANGER</strong></td>
<td></td>
</tr>
<tr>
<td>Steam - 15 p.s.i. Max</td>
<td></td>
</tr>
<tr>
<td>Hot Water - 250°F Max</td>
<td></td>
</tr>
<tr>
<td><strong>RADIATORS</strong></td>
<td></td>
</tr>
<tr>
<td>Steam or Hot Water&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Gas</td>
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<tr>
<td><strong>COMMERCIAL INDUSTRIAL TYPE LOW-HEAT APPLIANCES ANY AND ALL PHYSICAL SIZES EXCEPT AS NOTED</strong></td>
<td></td>
</tr>
<tr>
<td><strong>BOILERS AND WATER HEATERS</strong></td>
<td></td>
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<tr>
<td>100 cu. ft. or less</td>
<td>All Fuels</td>
</tr>
<tr>
<td>Any p.s.i. Steam</td>
<td></td>
</tr>
<tr>
<td>50 p.s.i. or less</td>
<td>All Fuels</td>
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<tr>
<td>Any Size</td>
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<tr>
<td><strong>UNIT HEATERS</strong></td>
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<tr>
<td>Floor Mounted or Suspended - Any Size</td>
<td>Steam or Hot Water</td>
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**CLEARANCES (Inches)**

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<tr>
<th>Boilers and Water Heaters</th>
<th>Above Top of Casing or Appliance</th>
<th>From Top and Sides of Warm Air Bonnet or Plenum</th>
<th>From Front</th>
<th>From Back</th>
<th>From Sides</th>
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<tr>
<td>Over 50 p.s.i.</td>
<td>All Fuels</td>
<td>48&lt;sup&gt;d&lt;/sup&gt;</td>
<td>96</td>
<td>36&lt;sup&gt;d&lt;/sup&gt;</td>
<td>36&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Over 100 cu. ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Rooms which are large in comparison to the size of the appliance are those having a volume equal to at least 12 times the total volume of a furnace and at least 16 times the total volume of a boiler. If the actual ceiling height of a room is greater than 8 feet, the volume of a room shall be figured in the basis of a ceiling height of 8 feet.

<sup>b</sup> The minimum dimension should be that necessary for servicing the appliance including access for cleaning and normal care, tube removal, etc.

<sup>c</sup> If the appliance is encased in brick, the 18-inch clearance above and at sides and rear may be reduced to not less than 12 inches.

<sup>d</sup> If the appliance is encased in brick, the clearance above may be not less than 36 inches and at sides and rear may be not less than 18 inches.

<sup>e</sup> Steam pipes and hot-water heating pipes shall be installed with a clearance of at least 1 inch to all combustible construction or material, except that at the points where pipes carrying steam or hot water at not over 16 pounds gage pressure emerge from a floor, wall, or ceiling, the clearance at the opening through the finish floorboards or wall ceiling boards may be reduced to not less than 1/2 inch. Each such opening shall be covered with a plate of noncombustible material.

Such pipes passing through stock shelving shall be covered with not less than 1 inch of approved insulation.

Wood boxes or casings enclosing uninsulated steam- or hot-water heating pipes, or wooden covers to recesses in walls in which such uninsulated pipes are placed, shall be lined with metal or asbestos millboard.

Where the temperature of the boiler piping does not exceed 160° F., the provisions of this Table shall not apply.

Coverings or insulation used on steam- or hot-water pipes shall be of materials suitable for the operation temperature of the system. The insulation or jackets shall be of noncombustible materials, or the insulation of jackets and lap-seal adhesives shall be tested as a composite product. Such composite product shall have a flame spread of not more than 25 and smoke developed not to exceed 300 when tested in accordance with ASTM E-84.

**NOTES:**

1. When appliances are installed in large rooms these standard clearances may be reduced by affording protection to combustible material in accordance with Footnote C.

2. An appliance may be mounted on a combustible floor if the appliance is listed for installation on a combustible floor, or if the floor is protected in an approved manner.
CHAPTER 61
LAWN SPRINKLER SYSTEMS

SECTION 6101. GENERAL.
(a) **Scope.** In addition to the other requirements of this Building Code, this Chapter shall govern the design, construction, and installation of lawn sprinkler systems connectd to the potable water supply. For pressure lines, See Chapter 50.
(b) **Lawn Sprinkler System.** Shall include apparatus and equipment affixed permanently to the property in the lawn, ground, flower beds, or fence, connected to the potable water supply, and normally used for the purpose of irrigation. Connection to the water supply shall also mean connections to the hose bibs, as well as permanent connections to the water supply line.

SECTION 6102. DEFINITIONS. Also see Chapter 50.
(a) **Approved.** See Chapter 4.
(b) **Back Flow.** The reverse flow of water into the pipes of a potable supply of water. Back siphonage is one type of back flow.
(c) **Back Flow Preventor.** A device or means to check or stop water from flowing into a potable supply of water from the sprinkler system. See Table 50-B.
(d) **Sprinkler Distribution Pipe.** A water line not under continuous pressure conveying water form the control valves to the sprinkler heads.
(e) **Control Valves.** The valves controlling distribution of water from the sprinkler supply line to sprinkler distribution pipes. The valves may be installed singly or in a manifold.
(f) **Pressure Lines.** A water line designed or intended to contain water under continuous working pressure.
(g) **Service Line.** A pipe or pipes conveying water from the water main into the building.

SECTION 6103. CONSTRUCTION AND INSTALLATION.
(a) **Design and Installation.** Design and installation of sprinkler systems shall, under calm wind conditions, prevent spray of water onto sidewalks, streets, or other public ways.
(b) **Drainage of Sprinkler Distribution Pipe.** Pipes shall be sloped to drain. Drain valves shall drain into a sump or gravel pocket.
(c) **Cross Connections.** Cross connections shall not be made between the potable water supply and any other source of water.
(d) **Connection to Water Supply.** Connection to the potable water supply may be made either to the service line or to the water distribution line. In either case, the connection shall be made at least 5 feet downstream from water meter. Provisions shall be made to protect the sprinkler supply line from freezing.
(e) **Installation of Back-Flow Preventor.** An approved back-flow preventor shall be installed in all lawn sprinkler systems. The back back-flow preventor, unless of the reduced pressure type, shall be installed at least 6 inches above the highest sprinkler head.
(f) **Material for Pressure Lines.** In addition to meeting the requirements specified in Chapter 50, tubing under pressure from the back-flow preventor to remote control valves shall be capable of withstanding a minimum of 125 p.s.i.

(g) **Materials for Sprinkler Distribution Pipe** All sprinkler distribution pipe and fittings shall be capable of withstanding a continuous working pressure of 80 pounds per square inch.

(h) **Identification Marking.** Each pipe fitting, sprinkler head, valve or device used in a lawn sprinkler system shall have the manufacturer's name and type or classification cast, stamped, or indelibly marked on it. Each length of pipe shall be marked continuously on its length showing the manufacturer's mark and type or classification of piping.

**SECTION 6104. STANDARDS.** Unless provided for in other portions of this Building Code, the following Standards shall apply. For additional Standards, see Chapter 50.

**ORGANIZATION**

**ASTM**

**TITLE OF PUBLICATION**


**LEGEND**

**ASTM**

**ORGANIZATION**

American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103
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(This Index compiled, edited and tabulated by Emil Gadeken, P.E., Building Department)
DENVER COUNTY COURT

General Sessions And General Violations Bureau Fine

Schedule

Persuant to the authority vested in the Presiding Judge of the County Court of the City and County of Denver under Article 155 of the Revised Municipal Code of the City and County of Denver, as amended, the Presiding Judge does hereby establish, within the County Court, a General Sessions and General Violations Bureau, and does hereby designate the following offenses under the Revised Municipal Code and the Building Code and sets forth the applicable fines relating thereto.

Payment of said fines so designated on the fine schedule may be accepted by the General Sessions and Violations Bureau of the Denver County Court.

A person charged with an offense for which payment of a fine may be made to the General Sessions and Violations Bureau shall have the option of paying said fine within the time specified on the Notice or on the Summons and Complaint, at the General Sessions and Violations Bureau, upon entering a Plea of Guilty and waiving appearance in court; or, upon a Plea of Not Guilty, shall be entitled to a trial as authorized by law.

If a Defendant is charged, on the same complaint, with an offense listed on the schedule of fines and also with an offense not listed on the schedule of fines, the Defendant must appear in court on all charges.

Whenever a person fails to appear in the Bureau within the time specified in the Summons and Complaint, this schedule shall not apply and the Defendant is required to appear in court.

A previous offense is applicable only when it is an identical offense occurring within twelve months of the current offense.
108 (f) 1 to 8  PLUMBING. Plumbing systems of devices which have any of the following defects:

1. When the supply water does not meet the standards of potability as required by the Colo. State Dept. of Public Health and the City Dept. of Health and Hospitals.

2. Those water systems subjected to the hazards of back-flow or back-siphonage which might create a pollution to the potable water supply.

3. Where inadequate piping does not supply sufficient water to the various appliances.

4. Clogged sewers or drains.

5. Where a trap seal is not provided or is inadequate.

6. Inadequate venting.

7. Leaking water, sewage, or swere gas within a building or structure.

8. Trenches or ditches not properly shored or cribbed.
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<td>$100</td>
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<td>Court</td>
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<td>Unlawful entry into an unsafe building or structure, unlawful removal of a sign from an unsafe building or structure</td>
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<td>50</td>
<td>100</td>
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<td>112 (a) 2.</td>
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<td>150</td>
<td>300</td>
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<td>112 (a) 5.</td>
<td>Work performed without a permit</td>
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<td>307 (a)</td>
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<td>25</td>
<td>50</td>
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<tr>
<td>307 (c)</td>
<td>Failure to pay inspection fees on boilers or elevators</td>
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<tr>
<td>4402 (b)</td>
<td>Unlawful for any person, firm, or corp. to perform any work on bldg. or structure in such manner as to endanger persons and property on the street or public property</td>
<td>$100</td>
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<td>50</td>
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<td>4601 (e)</td>
<td>Failure to settle dust resulting from demolition</td>
<td>50</td>
<td>100</td>
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<tr>
<td>4601 (f)</td>
<td>Trucks and other equipment used by the contractor blocking vehicular or pedestrian traffic</td>
<td>50</td>
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<tr>
<td>4601 (g)</td>
<td>Failure to keep adjacent streets, alleys, and other public ways and places free from all rubbish from a removal or wrecking operation</td>
<td>150</td>
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<tr>
<td>4601 (k)</td>
<td>Failure to obtain liability insurance before wrecking or moving a building, structure or utility</td>
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<tr>
<td>4601 (n)</td>
<td>Failure to protect utilities in the process of wrecking or moving a building, structure or utility</td>
<td>$100</td>
<td>$150</td>
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<tr>
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<td>100</td>
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<tr>
<td>4602 (h)</td>
<td>Failure to follow proper procedures in the method of demolition</td>
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<td>4610 (f)</td>
<td>Storage of moved buildings - not to exceed 72 hours unless approved by the Bldg. Dept.</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>4611</td>
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<td>150</td>
<td>200</td>
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RELATING TO SIGNS VIOLATION

<table>
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<td>5600 (c)</td>
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<td>5600 (d)</td>
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<td>100</td>
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<td>5602 (a)</td>
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<td>5602 (b)</td>
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<td>50</td>
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<td>5602 (c)</td>
<td>Obstruction of traffic control devices by the erection or maintenance of a sign</td>
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<td>5603 (a)</td>
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<tr>
<td>5617 (c)</td>
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<td>50</td>
<td>100</td>
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<td>Obstruction on public property</td>
<td>25</td>
<td>50</td>
</tr>
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</table>

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| 861.1          | License required to excavate on or near the public way                                    | 75          | Court       |

Approved & signed this 1st day of June, 1977

Geo. A. Manerbino.
CITY AND COUNTY OF DENVER
RULES AND REGULATIONS
OF
THE BUILDING INSPECTION DIVISION
DEPARTMENT OF PUBLIC WORKS

APPROVED FOR LEGALITY:
John L. Stoffel, Jr.
Attorney for the City and
County of Denver

APPROVED AND ADOPTED:
William J. Miller
Director of Building Inspection
Division
Department of Public Works
City and County of Denver

Adopted and Published pursuant to Article
123 of the Revised Municipal Code and Section
104(f) of the Building Code of the City and
County of Denver
RULE NO. I
POSTING OF OCCUPANT LOAD

(a) The maximum occupant load certificate issued by the Department indicating the permissible occupant load shall be posted in a conspicuous place within the area being used for assembly purposes.

(b) In addition to the posting of the maximum occupant load certificate each area being used for assembly purposes shall be posted in a conspicuous place near the entrance thereto with an approved sign made of durable materials with lettering at least 1/2 inch in height and numbers at least 1 inch in height. The lettering and background shall be of contrasting colors approved by the Department and shall read as follows:

THE MAXIMUM NUMBER
OF PERSONS PERMITTED
IN THIS AREA IS *

* Number to be a numerical number

By order of the Building Inspection Division of the Department of Public Works Section 3301 (e) of the Denver Building Code
RULE NO. 2

SECTION 3801 (f).
Sprinkler systems shall be zoned and annunciated per Section 3811 (f) 5. Where a manual or automatic fire alarm system is required or provided in a building and a separate water flow alarm and annunciation is provided on main fire sprinkler system supply per Section 3804, each zone which contains sprinkler and alarm may be connected together.