

# Houston Amendments to the 2006 Uniform Mechanical Code



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## **CHAPTER 1 ADMINISTRATION**

### **101.0 Title**

These regulations shall be known as the “Uniform City of Houston Mechanical Code,” may be cited as such, and will be referred to herein as “this code.”

The City of Houston Construction Code collectively includes this volume and certain other codes, pamphlets, specifications and documents that are adopted in or by reference through the adopting ordinance, which appears in the preamble of the City of Houston Building Code.

### **103.0 Scope**

**103.1 General.** The provisions of this code shall apply to the addition to or erection, installation, alteration, repair, relocation, replacement, use, or maintenance of any heating, ventilating, cooling, refrigeration systems; incinerators; or other miscellaneous heat-producing appliances within this jurisdiction.

Additions, alterations, repairs to, and replacement of equipment or systems shall comply with the provisions for new equipment and systems, except as otherwise provided in Section 104.0 of this code.

Where, in any specific case, different sections of this code or another volume of the Construction Code specify different materials, methods of construction, or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement in this code or another volume of the Construction Code, the specific requirement shall be applicable.

The design and testing of equipment regulated by this code shall be subject to the approval of the Authority Having Jurisdiction.

The standards contained in Appendix A shall be considered as part of this code. Appendices B and C contain recommended practices that shall not apply unless specifically adopted. Appendix D contains conversion tables and a table for determining the approximate minimum thickness for carbon sheet steel.

**103.2 International Residential Code.** Mechanical systems for detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories high with separate means of egress and their accessory structures shall comply with the City of Houston Residential Code, based on the International Residential Code for One- and Two-Family Dwellings as adopted by the State of Texas in Subchapter G of Chapter 214 of the Texas Local Government Code, with amendments by this jurisdiction. Mechanical systems for residential occupancies to which the City of Houston Residential Code does not apply shall be governed by this code.

**103.3 Energy.** The Commercial Energy Conservation Code, the Residential Energy Conservation Code and Chapter 11 of the Houston Residential Code and any

amendments adopted as authorized by state law shall be enforced by this jurisdiction in accordance with state law.

**104.6 Retroactive provisions.** Notwithstanding any other provision of this section, those provisions of this code that are designated as being “retroactive” shall apply to existing installations and alteration thereof.

**108.3 Right of Entry.** When it is necessary to make an inspection to enforce the provisions of this code, or when the Authority Having Jurisdiction has reasonable cause to believe that there exists in a building or upon a premises a condition that is contrary to or in violation of this code that makes the building or premises unsafe, dangerous, or hazardous, the Authority Having Jurisdiction shall have the authority to enter the building or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such building or premises be occupied that credentials be presented to the occupant and entry requested. If such building or premises be unoccupied, the Authority Having Jurisdiction shall first make a reasonable effort to locate the owner or other person having charge or control of the building or premises and request entry. If entry is refused, the Authority Having Jurisdiction shall have recourse to the remedies provided by law to secure entry.

When, due to an emergency, immediate entry is necessary to make an inspection to protect life or property or when the Authority Having Jurisdiction has obtained a proper inspection warrant or other remedy provided by law to secure entry, no owner or occupant or person having charge, care, or control of any building or premises shall fail or neglect, after the proper request is made as herein provided, to promptly permit entry therein by the Authority Having Jurisdiction for the purpose of inspection and examination pursuant to this code.

**108.4 Stop Orders.** When any work is being done contrary to the provisions of this code, the Authority Having Jurisdiction shall have the authority to order the work stopped by notice in writing served on any persons engaged in doing or causing such work to be done, and such persons shall forthwith stop work until authorized by the Authority Having Jurisdiction to proceed with the work.

At the time such stop order is issued, the person performing the work and the permit holder shall be given notice of a right to a hearing on the matter by delivering to the persons performing the work if present at the site or otherwise shall be conspicuously posted at the site. Upon request, such a hearing shall be held within three business days unless the permit holder or person who was doing the work requests an extension of time. Any stop order that has been issued shall remain in effect pending any hearing that has been requested unless the stop order is withdrawn by Authority Having Jurisdiction.

**108.5 Authority to Disconnect Utilities in Emergencies.** The Authority Having Jurisdiction or authorized representative shall have the authority to disconnect fuel gas utility service or energy supplies to a building, structure, premises, or equipment regulated by this code in case of emergency ~~where~~ when necessary to eliminate an

immediate hazard to life or property. The Authority Having Jurisdiction shall, whenever possible, notify the serving utility, the owner, and the occupant of the building, structure, or premises of the decision to disconnect prior to taking such action, and shall notify such serving utility, owner, and occupant of the building, structure, or premises in writing of such disconnection immediately thereafter.

The notice shall also inform the owner and the occupant of the building (or the user if the mechanical equipment is not within a building) of a right to a hearing on the matter pursuant to Section 108.10 of this code. On request, such a hearing shall be conducted within three business days unless the owner requests an extension of time.

**108.6 Authority to Condemn Equipment.** When the Authority Having Jurisdiction ascertains that any equipment, or portion thereof, regulated by this code has become hazardous to life, health, or property, it shall order in writing that the equipment either be removed or restored to a safe or sanitary condition, as appropriate. The written notice shall contain a fixed time limit for compliance of not less than three (3) days, with such order and shall inform the owner and the occupant of the right to a hearing on the matter pursuant to Section 108.10 of this code. Persons shall not use or maintain defective equipment after receiving a notice.

When equipment or an installation is to be disconnected, written notice of the disconnection and causes therefor shall be given within twenty-four (24) hours to the serving utility, owner, and occupant of the building, structure, or premises. When any equipment is maintained in violation of this code, and in violation of a notice issued pursuant to the provisions of this section, the Authority Having Jurisdiction shall institute an appropriate action to prevent, restrain, correct, or abate the violation.

~~**108.8 Liability.** The Authority Having Jurisdiction charged with the enforcement of this code acting in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance shall not thereby be rendered personally liable for damages that may accrue to persons or property as a result of an act or by reason of an act or omission in the discharge of such duties. A suit brought against the Authority Having Jurisdiction or employee because of such act or omission performed by the Authority Having Jurisdiction or employee in the enforcement of any provision of such codes or other pertinent laws or ordinances implemented through the enforcement of this code or enforced by the code enforcement agency shall be defended by this jurisdiction until final termination of such proceedings, and any judgment resulting therefrom shall be assumed by this jurisdiction. Except as otherwise provided by law, the Authority Having Jurisdiction shall not personally be liable in damages for any act or omission arising out of any official action taken to implement and enforce the provisions of this code. Additionally, except as otherwise provided by law, the Authority Having Jurisdiction shall not personally be liable in damages for any act or omission taken in the course and scope of employment. Where and to the extent consistent with the provisions of Article X of Chapter 2 of the City Code, the jurisdiction shall provide legal representation and indemnification for any suit brought against the Authority Having Jurisdiction because of acts or omissions performed in the enforcement of this code.~~

This code shall not be construed to relieve from or lessen the responsibility of any person owning, operating, or controlling any equipment regulated herein for damages to persons or property caused by defects, nor shall the code enforcement agency or its parent jurisdiction be held as assuming any such liability by reason of the inspections authorized by this code or any permits or certificates issued under this code.

### **108.10 Hearing Procedures.**

**108.10.1 Hearing Notices.** Unless otherwise specifically provided, whenever notice is to be given to any person concerning the right to a hearing, the notice may be given by personal delivery, by certified mail, return receipt requested.

If the notice is being given to an applicant for a jurisdiction license or to a licensee or to a state license registrant, the notice may be mailed to the address set out in the application for the registration or license unless the applicant or registrant has given the Authority Having Jurisdiction written notice of a change of address, under which circumstances any notice concerning a hearing shall be sent to the most recent address shown on the notice. If any notice mailed to an applicant for a license or to a licensee or registrant is returned without delivery, notice shall be effective if posted where the public may observe it in the Permit Office.

If notice is being given to a building owner or to a tenant therein and the Authority Having Jurisdiction is unable to determine the name or address of such person after checking the building and the applicable records of the jurisdiction's Public Works and Engineering Department, the County Appraisal District, the electrical utility company, the gas utility company and the water utility provider, notice shall be mailed to the billing addresses of the building as shown on the records of the electrical company and the gas company and shall be posted on or in view of each entrance to the building. Additionally, if any notice is mailed to a building owner or a building tenant and is returned without delivery, notice shall be effective if posted on or in view of each entrance to the building.

**108.10.2 Hearings.** Except where otherwise specifically provided, all hearings held pursuant to this code shall be conducted by the jurisdiction's Director of Public Works and Engineering or a representative, who shall hereinafter be referred to as the hearing official. The director shall not designate any person to be a hearing official under this code who has taken any part in the investigation of the matter that is the subject of the hearing or any person who directly supervised the investigation. The hearing official shall consider only the evidence presented at the hearing in rendering a decision. The decision of the hearing official shall be set forth in writing and shall be served on each party in the same manner as a notice of right to a hearing.

### **110.0 Board of Appeals Boards and Licenses**

**110.1 General.** In order to hear and decide appeals of orders, decisions, or determinations made by the Authority Having Jurisdiction relative to the application and interpretations of this code, there shall be and is hereby created a Board of Appeals

~~consisting of members who are qualified by experience and training to pass upon matters pertaining to mechanical design, construction, and maintenance and the public health aspects of mechanical systems and who are not employees of the jurisdiction. The Authority Having Jurisdiction shall be an ex officio member and shall act as secretary to said board but shall have no vote upon any matter before the board. The Board of Appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the Authority Having Jurisdiction. The Mechanical Code Review Board or the Boiler Code Review and Licensing Board shall hear and decide appeals of orders, decisions or determinations made by the Authority Having Jurisdiction relative to the application and interpretations of this code. (See Sections 121 and 122.)~~

**110.2 Limitations of Authority.** ~~The Board of Appeals~~ aforsaid boards shall have no authority relative to interpretation of the administrative provisions of this code, which shall be the purview of the General Appeals Board (see Section 112 of the Building Code), unless otherwise specified nor shall the board be empowered to waive requirements of this code.

### **111.0 Violations and Penalties.**

**111.1 General.** It shall be unlawful for a person, firm, or corporation to erect, construct, enlarge, alter, repair, move, improve, remove, convert or demolish, equip, use, or maintain mechanical systems or equipment or cause or permit the same to be done in violation of this code.

**111.2 Penalties.** Where no specific penalty is otherwise provided in this code, the violation of any provision of this code shall constitute a misdemeanor punishable upon conviction by a fine of not less than \$500.00 and not more than \$2,000.00. Each day that any violation continues shall constitute and be punishable as a separate offense. Where any conduct in violation of this code also constitutes a violation of state penal law, then the offense shall be punishable as provided in the applicable state law. In prosecutions under this code, the various provisions hereof that are designated as an "exception" or "exceptions" shall not be treated as exceptions within the meaning of Section 2.02 of the Texas Penal Code, and instead, they shall constitute defenses to prosecution within the meaning of Section 2.03 of the Texas Penal Code.

**111.3 Mechanical Integrity.** All persons, firms, corporations and air-conditioning contractors installing, altering, repairing or demolishing systems, appliances, components and equipment regulated by this code must maintain the mechanical integrity of such work in accordance with the provisions of this code. Failure to maintain mechanical integrity shall constitute a violation of this code subject to the penalties set forth in Section 111.2.

**113.2 Plans and Specifications.** Plans, engineering calculations, diagrams, and other data shall be submitted in ~~one or more~~ two sets with each application for a permit.

When such plans are not prepared by an architect or engineer, the Authority Having Jurisdiction shall have the authority to require any applicant submitting such plans or other data to demonstrate that state law does not require that the plans be prepared by an architect or engineer. The Authority Having Jurisdiction also has the authority to require plans, computations, and specifications to be prepared and designed by an engineer or architect licensed by the state to practice as such even if not required by state law.

**Exception:** The Authority Having Jurisdiction has the authority to waive the submission of plans, calculations, or other data if it is found that the nature of the work applied for is such that review of plans is not necessary to obtain compliance with this code.

**113.2.1 Amended construction documents.** Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

### **113.3 Information on Plans and Specifications**

Plans and specifications shall be drawn to scale ~~upon substantial paper or cloth~~ and shall be of sufficient clarity to indicate the location, nature, and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules, and regulations.

**113.3.1 Penetrations Detailed.** Plans for buildings more than two stories in height of other than Group R, Division 3 and Group U Occupancies shall indicate how required structural and fire-resistive integrity will be maintained where a penetration will be made for electrical, mechanical, plumbing, and communication conduits, pipes, and similar systems.

**113.3.2 Direct Fired Gas Makeup and Industrial Air Heaters.** The installer shall submit plans showing the proposed installation, indicating the location of the heater and such accessories as may be required to ensure the proper and safe performance of its function.

**114.3 Validity.** The issuance of a permit or approval of plans, specifications, and computations shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of other ordinances of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid.

The issuance of a permit based upon plans, specifications, computations, and other data shall not prevent the Authority Having Jurisdiction from thereafter requiring the correction of errors in said plans, specifications, and other data or from preventing building operations being carried on thereunder when in violation of this code or of other ordinances of this jurisdiction.

A permit shall be valid only for the work performed by the licensed contractor to which the permit was issued. A new permit shall be obtained if the licensed contractor to which the permit was issued ceases to perform the work. The cost of the new permit shall be

50 percent of the original permit fee. In the case of the death of the original licensed contractor, the permit will be transferred to the new licensed contractor at a fee of 50 percent of the original permit fees, up to a maximum fee of \$70.00 per permit.

~~**114.4 Expiration.** Every permit issued under the provisions of this code shall expire by limitation and become null and void if the work authorized by such permit is not commenced within 180 days from the date of such permit, or if the work authorized by such permit is suspended or abandoned at any time after the work is commenced for a period of 180 days. Before such work can be recommenced, a new permit shall be first obtained, and the fee therefore shall be one half the amount required for a new permit for such work, provided no changes have been made or will be made in the original plans and specifications for such work and provided further that such suspension or abandonment has not exceeded one year. No permit shall be extended more than once. To renew action on a permit after expiration, the permittee shall pay a new full permit fee.~~

~~A permittee holding an unexpired permit may apply for an extension of the time within which work may be commenced under that permit when the permittee is unable to commence work within the time required by this section for good and satisfactory reasons. The Authority Having Jurisdiction shall have the authority to extend the time for action by the permittee for a period not exceeding 180 days upon written request by the permittee showing that circumstances beyond the control of said permittee have prevented action from being taken.~~

For the purposes of this section, the determination whether work has commenced under a permit or whether work has been abandoned under a permit shall be based upon whether the permit holder requests an inspection of the work performed under the permit by the Authority Having Jurisdiction. If work is not commenced under a permit within 180 days of the date of issuance or is abandoned at any time for a period of 180 consecutive days, the permit shall lapse. An elapsed permit shall expire the 180<sup>th</sup> day following the date that the permit lapsed unless, before the 180<sup>th</sup> day following the date that the permit lapsed, the permit holder obtains reactivation of the permit by:

- (1) Requesting reactivation of the permit by the Authority Having Jurisdiction, and
- (2) Requesting an inspection of work performed under the permit by the Authority Having Jurisdiction.

A permit may be reactivated only one time, and it shall expire if the work is again abandoned for a period of 180 consecutive days. In order to recommence work under an expired permit, the permit holder shall submit plans that comply with this code, if applicable, and pay the full permit fee applicable to the previously uninspected portion of the work.

**Exception:** The Authority Having Jurisdiction may upon request perform a final inspection of work for which the permit has expired or reactivate a permit for the purpose of issuing a certificate of occupancy or a certificate of compliance.

**114.5 Suspension or Revocation.** The Authority Having Jurisdiction shall have the authority to suspend or revoke a permit issued under the provisions of this code

whenever the permit is issued in error or on the basis of incorrect information supplied or in violation of other ordinances or regulations of the jurisdiction. Prior to taking such action, the Authority Having Jurisdiction shall provide notice of a right to a hearing on the matter pursuant to Section 108.10.

**115.1 General.** Fees shall be assessed in accordance with the provisions of this section and ~~as set forth in the fee schedule Table 1-1. The fees are to be determined and adopted by this jurisdiction.~~

**115.2 Permit Fees.** The fee for each permit shall be as set forth in ~~Table 1-4~~ Section 117 of the Building Code.

**115.3 Plan Review Fees.** ~~When plans or other data are required to be submitted by Section 113.2, a plan review fee shall be paid at the time of submitting plans and specifications for review. The plan review fees for mechanical work shall be determined and adopted by this jurisdiction.~~

~~—The plan review fees specified in this subsection are separate fees from the permit fees specified in Section 115.2 and are in addition to the permit fees.~~

~~When plans are incomplete or changed so as to require additional plan review, an additional plan review fee shall be charged at the rate shown in Table 1-1.~~

When approved plans are lost or changed so as to require an additional plan review or when a plan review is required and there is no building permit required, a plan review fee shall be charged at the rate shown in Section 117 of the Building Code.

## **115.6 Fee Refunds**

The Authority Having Jurisdiction ~~shall have the authority to~~ may authorize the refunding of any fee paid hereunder that was ~~erroneously~~ paid or collected due to an error by one or more city employees. This provision shall not be applicable if the error occurred due to incorrect information provided by the applicant.

**115.6.1** The Authority Having Jurisdiction ~~shall have the authority to~~ may authorize a the refunding of not more than a percentage, 90 percent of the amount in excess of \$25.00 of the permit fee paid as determined by this jurisdiction, when no work has been done under a permit issued in accordance with this code. If work has been done under the permit, no refund may be authorized.

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 115.6.2.}

**115.7 Annual Fee Increase.** Notwithstanding any maximum fee established by this Code, the fees set out herein, as adjusted according to this section, shall be automatically increased on the first day of each subsequent fiscal year by a percentage equal to the percentage increase to the Producers Price Index, if any, over the previous year ("the PPI Adjustment"). If there is a decrease or if there is no increase in any given year, the fees for that year shall remain the same as in the previous year.

**116.2 Operation of Mechanical Equipment.** The requirements of this section shall not be considered to prohibit the operation of mechanical systems installed to replace existing equipment or fixtures serving an occupied portion of the building ~~in the event provided that~~ a request for inspection of such equipment or fixture has been filed with the Authority Having Jurisdiction not more than forty-eight (48) hours after such ~~replacement work is completed,~~ equipment is made operational and before any portion of such mechanical system is concealed by any permanent portion of the building. It shall be a violation of this code, subject to the penalties set forth in Section 111.2, for a permit holder to fail to make all necessary arrangements for inspection so that this jurisdiction may perform the required inspection no later than the next work day immediately after the aforementioned 48 hour period expires.

**116.3 Testing of Equipment.** Refrigeration equipment regulated by this code shall be tested and approved as required by Section 1123.0 of this code.

Steam and hot-water boilers and piping shall be tested and approved as required by Sections 1023, 1201.2.8, 1201.3.6, and 1207.0 of this code.

Where applicable (see Section 103.0), fuel gas piping shall be tested and approved as required by ~~Section 1304.0 of the Houston Plumbing Code.~~ this Code.

**116.6 Reinspections.** ~~The Authority Having Jurisdiction shall have the authority to assess a~~ A reinspection fee may be assessed for each inspection or reinspection when such portion of work for which inspection is requested is not complete or when required corrections have not been made.

~~This provision~~ section is not to be interpreted as requiring reinspection fees the first time a job is rejected for failure to comply with the requirements of this code, but as controlling the practice of calling for inspections before the job is ready for inspection or reinspection.

Reinspection fees may be assessed when the inspection record card is not posted or otherwise available on the work site, when the approved plans are not readily available to the inspector, for failure to provide access on the date for which inspection is requested, or for deviating from plans requiring the approval of the Authority Having Jurisdiction.

To obtain reinspection, the applicant shall ~~file an application therefor in writing upon a form furnished for that purpose~~ make a request and pay the reinspection fee in accordance with Section 117 of the City of Houston Building Code, Table 1-1 or as set forth in the fee schedule adopted by the jurisdiction.

In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

117.2.1 Temporary Operation Inspection. For inspection of a boiler or heating, ventilation, refrigeration or air-conditioning system to be used on a temporary basis, a fee of \$70.00 shall be paid to the jurisdiction by a licensed air-conditioning contractor requesting such inspection. If the system is not approved for temporary operation on

the first inspection, the usual reinspection fee will be charged for each subsequent inspection for such purpose.

No permit for temporary use shall be valid for a period longer than 30 calendar days. The building official is authorized to reissue such permit upon payment of the full fee of \$70.00 for periods not more than 30 days each."

### **118.0 Emergency Work**

**118.1 General.** It is an exception to any provision of this code or of the City of Houston Construction Code that requires the issuance of a permit under this code prior to commencing work or that imposes an additional fee for work commenced without a permit being first obtained that:

- (1) The work involved the emergency repair or replacement of an existing air-conditioning, heating, ventilation or refrigeration system;
- (2) The work was required to be commenced immediately in order to protect property or to preserve the health of persons;
- (3) Notice was given to the Authority Having Jurisdiction by mail, telephone, fax or other approved method when the work was commenced; and
- (4) A permit was obtained as provided in Subsection 118.

The Authority Having Jurisdiction shall promulgate regulations and forms as required to administer this section.

**118.2 Time limit for obtaining permit.** The licensed air-conditioning contractor, in order to avoid penalties for failure to obtain a permit prior to commencing such job, in addition to complying with Section 118.1, must also obtain a permit for the job within 48 hours after 8:00 a.m., of the first day that the city permit office is opened for business after the date on which the contractor commences such alteration or installation.

**118.3 Operation of system.** If the alteration or installation is completed prior to the time that the licensed air-conditioning contractor is required to obtain a permit under these provisions, at the contractor's sole risk and responsibility for all injuries and damages that might result therefrom to persons and property, the contractor may place the system or installation in operation, provided that the contractor remains at the job site and checks the operation for a period of at least 15 minutes before leaving the premises. The contractor shall instruct the occupant of the premises or the person in charge of the premises the manner in which the equipment or system may be immediately shut off in case of malfunction in its operation, and shall provide the aforesaid occupant or person with a telephone number, or numbers, where the aforesaid licensed contractor can be reached in case of an emergency resulting from operation of the system or installation prior to the inspection by the jurisdiction.

**118.4 Emergency appeal.** In the event of a dispute between the jurisdiction's inspector and the licensed air-conditioning and refrigeration contractor doing the job as to the existence of the emergency authorizing the commencing of the job without a permit, the dispute shall be first considered by the Authority Having Jurisdiction. The contractor may appeal the decision of the Authority Having Jurisdiction to the Mechanical Code Review Board or Boiler Code Licensing and Review Board, as applicable, for its

consideration and decision. In reviewing the decision of the Authority Having Jurisdiction, the Board shall base its decision on the evidence and testimony presented by both parties.

### **119.0 Temporary Operation Permit**

**119.1 General.** Any heating, ventilating, refrigerating or air-conditioning system being altered or installed by authority of a permit issued under the provisions of this code may be operated for limited periods of time only for testing purposes prior to passing final inspection, on the following conditions:

- (1) The licensed air-conditioning contractor in whose name said permit is issued shall request that the Authority Having Jurisdiction inspect the system.
- (2) If, upon inspection, the system is approved for operation for testing purposes, the Authority Having Jurisdiction shall indicate the length of time that the system may be operated for testing purposes, this time shall be determined based upon the size and type of system and the extent of the installation or alteration involved.
- (3) Upon expiration of the temporary operation permit for testing purposes, the system shall be given a final inspection. If the system is not approved, a reinspection fee will be charged on all subsequent inspections until the system is approved as complying with the requirements of the code.

**119.2 Extension of Time.** The time period permitted for operating the system for testing purposes only may be extended by the building official when necessary to complete the testing of the system in order to determine that it is operating safely. The extension of such time period shall be noted in writing on the permit, and the system shall still be subject to Section 119.1(3).

For the temporary operation permit fee, see Section 117 of the Building Code.

### **120.0 Approvals**

The installation of mechanical equipment, or the alteration of any existing installation shall be approved only when such work is installed or performed in accordance with the provisions of this code.

An approved permit allows only the work authorized by that permit.

## **Part IV-Boards and Licensing**

### **121.0 Mechanical Code Review Board**

**121.1 Creation of Board.** There is hereby created a Mechanical Code Review Board hereinafter called "the board," consisting of seven members. Each member of the board except the members in Positions No. 1 and 2 shall be appointed by the Mayor and confirmed by the City Council. The Mayor shall designate a member to be chairman. The contractor members filling Positions No. 5 and 6 shall have been actively engaged

in the air conditioning business in the jurisdiction for at least five years prior to the date of their appointment.

The positions on said board shall be filled as follows:

**Position No. 1** shall be filled by the building official.

**Position No. 2** shall be filled by the fire marshal of the jurisdiction.

**Positions No. 3 and 4** shall each be filled by a registered professional engineer licensed by the State of Texas who is actively engaged in mechanical engineering.

**Position No. 5** shall be filled by a duly licensed Class A air conditioning and refrigeration contractor licensed under the Texas Air Conditioning and Refrigeration Contractor License Law.

**Position No. 6** shall be filled by a duly licensed Class B air conditioning and refrigeration contractor licensed under the Texas Air Conditioning and Refrigeration Contractor License Law.

**Position No. 7** shall be filled by a representative of the public generally.

The building official and the fire marshal each, from time to time, may designate in writing a person under their supervision to act in their place as their duly authorized representative. The representative shall enjoy all rights and privileges of the position. A copy of such a designation, specifying the dates any such person shall act as representative of the building official or of the fire marshal, shall be filed with the minutes of the board.

The terms of office for the appointees to Position Nos. 3, 5, and 7 on the board will expire on the second day of January of odd-numbered years. The terms of office for the appointees to Position Nos. 4 and 6 will expire on the second day of January on even-numbered years. However, each member shall continue in office until a successor has been appointed and qualified.

Those members of the board in Positions No. 1 and 2 shall serve ex officio.

The amendment of this code section shall not terminate the term of office of any person currently serving on the board. Any person who is currently serving on the board shall continue to serve in the position for which he was appointed and confirmed until a successor is appointed and qualified.

In addition to other qualifications hereinabove required, each member of the board shall be a citizen of the United States. All appointed members of the board shall be selected on the basis of their technical and professional qualifications, except that the appointee to Position 7 is not required to have the technical and professional qualifications required for other members of the board. Each member of the board shall be subject to removal by the Mayor. Four members of the board at any meeting shall constitute a quorum for transaction of all business of the board. A majority vote of the members present at any meeting at which a quorum is present shall prevail.

Whenever any position on the board becomes vacant by reason of death, resignation or removal, said vacancy shall be filled for the unexpired term of the member being replaced. Should a vacancy occur on the board, the Mayor shall appoint,

with the approval of the City Council, another qualified person to serve the unexpired term of the vacancy.

The board shall hold regular annual meetings in Houston, Texas, the exact time and place to be designated by the chairman of the board, who is also authorized to call special meetings when deemed necessary. The building official, or a duly authorized representative, shall act as secretary of the board. Each member of the board shall receive \$50.00 for each meeting the member attends (not to exceed three meetings in a calendar month) at which a quorum is present, provided, however each member of the board who is an employee of the jurisdiction will be paid only for those meetings they attend that are neither held during nor continue beyond his or her regular working hours.

The secretary of the board shall keep the minutes of the board meetings and other business of the board, including correspondence received and sent by the board. The minutes of the board shall be public records available for inspection by the public at all reasonable times.

**121.2 Duties.** The board shall serve as the Board of Appeals for matters relating to the provisions of this code and shall serve in an advisory capacity to the Authority Having Jurisdiction in technical matters pertaining to provisions of this code. In addition, the board is hereby authorized to perform such other duties as specified in this division and to make recommendations to City Council regarding the provisions of this code pertaining to or affecting air conditioning, ventilation, or refrigeration.

**Exception:** As provided by Section 122 of this code, matters within the jurisdiction of the Boiler Code Review and Licensing Board shall be heard by that board.

**121.3 Approval of New Materials.** A person, firm, or corporation (hereinafter called "person") desiring approval of any material, device, fixture, method of assemblage, installation, appurtenance, or appliance that is a part of or pertains to heating, air conditioning, ventilation, refrigeration or heat-producing appliances or systems (hereinafter individually and collectively referred to as "item") may submit the item to the Authority Having Jurisdiction for approval along with a written application containing such information as the Authority Having Jurisdiction may require for determination of approval under Section 105.

If the Authority Having Jurisdiction denies a request for an approval, the person who made the request may appeal that decision by delivering a written notice of appeal to the secretary of the board within 10 days of the date that the notice of the decision of the Authority Having Jurisdiction was either hand delivered or mailed to such person. Upon receipt of the notice of appeal, the board shall set the matter for hearing. The board may request any additional tests be conducted that it finds are necessary to determine whether the decision of the Authority Having Jurisdiction should be upheld or overturned. All such tests shall be at the expense of the person requesting the approval. The burden shall be on that person to show that the decision of the Administrative Authority Having Jurisdiction should be overturned.

The decision of the board upholding or overturning the decision of the Authority Having Jurisdiction shall be set out in the minutes of the board. If the board overturns

the decision of the Authority Having Jurisdiction, it shall set forth in its minutes any conditions or limitations to which the approval is made subject.

**121.4 Appeals.** Any owner, user, license applicant, license holder, or interested person who is affected and aggrieved by a decision of the board may appeal the board's decision to the City Council, pursuant to rule 12 of section 2-2 of the City Code of Ordinances.

Upon appeal to the City Council from the board's decision, the board's secretary shall file with the City Secretary a copy of the minutes of the board setting forth the board's decision and a copy of any minutes of the board reflecting any discussion or motions concerning the matter. Upon receipt of all materials required by the City Secretary's Office, the City Secretary shall set the matter for consideration. All appeals to the City Council are subject to rule 12 of Section 2-2 of the City Code of Ordinances.

All orders or decisions of the Authority Having Jurisdiction shall be in writing and shall be and remain in full force and effect until reversed by the board, the City Council, or suspended, cancelled or annulled.

The decision of the City Council shall be final.

**121.5 License Required.** Except as otherwise provided therein, a person who does not hold a current, valid and applicable license as required by the Texas Air Conditioning and Refrigeration Contractor License Law shall not install, alter or repair any heating, ventilating, air conditioning or refrigeration systems, or any part thereof, or obtain any permit to do so.

**Note:** The Texas Air Conditioning and Refrigeration Contractor Licensing Law, which is codified as Chapter 1302 of the Texas Occupations Code, includes certain exemptions from the requirement of obtaining a state license, which will be honored by this jurisdiction. These exemptions include: work performed by homeowners on their own homes, certain maintenance work by employees of the property owner or management company, certain work performed by employees of regulated electric and gas utility companies, and certain work performed by licensed professional engineers in connection with their business operations.

**121.6 State License Notification Requirement.** Each person licensed under the Texas Air Conditioning and Refrigeration Contractor License Law shall notify and register his or her notification with the Authority Having Jurisdiction in a form and manner prescribed by the Authority Having Jurisdiction prior to performing any work pertaining to that license within the jurisdiction. The notification shall be duly registered and maintained on file within the jurisdiction offices of the Mechanical Inspections Section, Code Enforcement Branch, Department of Public Works and Engineering. The fee for initial notification registration shall be \$70.00. A notification registration maintenance fee of \$70.00 shall be paid annually thereafter as long as the notification registration is renewed. Each notification registration shall expire on December 31 of each year. Additionally, a notification registration shall expire upon the registrant's failure to provide proof of current insurance coverage or proof of license renewal.

**121.7 Liability Insurance.** Each person who is required to register shall, upon registration and continuously thereafter for as long as the registration is renewed,

maintain proof of current liability insurance coverage in the amount and form specified in applicable state laws and regulations. The proof shall be in the form of a copy of the certificate furnished to the state and evidence that the carrier of the insurance will provide 10 days' notice to the Authority Having Jurisdiction in the event that the policy is reduced or terminated prior to the expiration date specified on the certificate.

**121.8 Violations.** It shall be unlawful for any person, partnership, firm or corporation, who is not licensed under the Texas Air Conditioning and Refrigeration Contractor License Law to display a sign or advertise in any other manner that such person, partnership, firm or corporation is authorized to engage in business as an air conditioning and refrigeration contractor.

It shall be unlawful for a licensed air conditioning and refrigeration contractor to:

- (1) Permit a license to be used in any manner contrary to any of the provisions of this code;
- (2) Obtain a permit required under this code in another person's name or allow the use of his or her name by another person for the purpose of obtaining a permit when the licensed air conditioning and refrigeration contractor does not intend to or does not, in fact, do or supervise the work authorized by the permit; or
- (3) Take out permits for air conditioning work to be done by a person, firm, partnership or corporation other than the person, firm, partnership, or corporation by whom the permittee is employed.

Licensed air conditioning and refrigeration contractors shall not be simultaneously employed by, or work for, more than one business entity for the purpose of obtaining permits under this code or for the purpose of doing or supervising work that can be done only by authority of a permit obtained under the provisions of this code.

**121.9 Identification of Vehicles and Sites.** Each vehicle used in conjunction with air conditioning and refrigeration contracting shall be marked as required by Title 16 Texas Administration Code Section 75.70(i), which provides that "each licensee and air conditioning and refrigeration contracting company shall display the license number and company name in letters not less than two inches high on both sides of all vehicles used in conjunction with air conditioning and refrigeration contracting. When an unlicensed subcontractor is at a job site not identified by a marked vehicle, the site shall be identified either by a temporary sign on the subcontractor's vehicle or on a sign visible and readable from the nearest public street containing the contractor's license number and company name."

**121.10 Contractor Records.** Each time that a licensed air conditioning and refrigeration contractor or any employee thereof does any installation, replacement, or repair of any type on any air conditioning, refrigeration, ventilation or heating system, or combination of such systems, the contractor shall make a record of the work. The records shall be readily made available upon request for inspection and copying by the Authority Having Jurisdiction and must be held on file for at least two years. Before leaving the premises where the work is performed, the contractor shall deliver one copy of the record to the owner or the owner's representative. These records shall contain the following information:

- (1) Name and address of licensed contractor.
- (2) License number of licensed contractor.
- (3) Name of owner.
- (4) Date.
- (5) General nature of work performed.
- (6) Any other information required by applicable provisions of the Texas Air Conditioning and Refrigeration Contractor License Law and regulations issued thereunder.

## **122.0 Boiler Code Review and Licensing Board**

**122.1 Creation and Composition.** There is hereby created a Boiler Code Review and Licensing Board consisting of five members, which is herein referred to as the "board." The members in Positions No. 1 through 4 of the board shall be appointed by the Mayor and confirmed by the City Council. The Mayor shall designate a member to be chairman. Each of the five positions shall be filled as follows:

**Position No. 1** shall be filled by a registered professional engineer licensed by the State of Texas who is actively engaged in the design of mechanical systems using boilers as a source of heat energy.

**Position No. 2** shall be filled by an owner, partner, officer, or manager of a firm that is actively engaged in the manufacture, sale, repair or installation (or combination thereof) of boilers.

**Position No. 3** shall be filled by a licensed stationary engineer who has held a first grade license issued by the jurisdiction for not less than 10 years.

**Position No. 4** shall be filled by a person who is an owner, partner, officer, or manager of a firm that is the user of a boiler or boilers.

**Position No. 5** shall be filled by the building official.

The building official, from time to time, may designate in writing a member of the jurisdiction's Boiler Inspection Section to act in his or her place as a duly authorized representative. The representative shall enjoy all rights and privileges of the position. A copy of the designation, specifying the dates such a person shall act as representative of the Building Official, shall be filed with the minutes of the board.

**122.2 Appointments, Removals, etc.** The terms of office for the appointees to position Nos. 1 and 3 shall expire on the second day of January of odd-numbered years, and the terms of the appointees to Position Nos. 2 and 4 shall expire on the second day of January of even-numbered years. However, each member shall continue in office until a successor is appointed and qualified. The amendment of this code section shall not terminate the term of office of any person currently serving in any position of the board. Any appointed member who is currently serving on the board shall continue to serve in the position for which he or she was appointed and confirmed until a successor is appointed and confirmed by City Council under this code. Each appointed member of

the board shall be subject to removal at any time by the Mayor. Each member of the board shall receive \$50.00 for services for each meeting of the board the member attends at which a quorum is present, provided, however, each member of the board who is an employee of the jurisdiction shall be paid only for those meetings that are neither held during nor continue beyond his or her regular working hours.

Three members of the board present at any meeting shall constitute a quorum for the transaction of all business of the board. A majority vote of board members present at any meeting at which a quorum is present shall prevail.

The board shall meet regularly twice each month. The chairman shall have the power to call a special session of the board when deemed necessary, but no more than three meetings may be held in any month. In the absence of the chairman at any meeting, the board members present may select a temporary chairman for that meeting.

**122.3 Restriction on Participation in Certain Matters.** No board member shall vote on any matter or participate as a board member in the discussion of any matter in which the member has a personal or financial interest other than as a member of a class or group, of which each member will be affected substantially to the same extent by the board's action or decision in the matter as will the other members of the class or group. (For restrictions on jurisdiction officials, see Chapter 171 of the Local Government Code.)

**122.4 Records.** The board shall keep or cause to be kept a written record of its meetings. The records shall be open to inspection by the public at all reasonable times.

**122.5 Authority Having Jurisdiction.** The Authority Having Jurisdiction is hereby charged with determining compliance with the provisions of this Code. The Authority Having Jurisdiction shall prepare and maintain a record of all persons qualified to install and operate boilers under the provisions of this code. The Authority Having Jurisdiction or duly appointed representative shall act as secretary to the board at all meetings.

**122.6 Examinations.** The board shall develop and administer examinations for stationary engineer's licenses. The examinations shall determine the applicants' capacity and ability to understand and safely operate boilers, steam equipment and the various auxiliary machinery, appliances and appurtenances in conjunction with the operation of such boilers and steam equipment. The board shall perform such other duties as may be required of it by the governing body and Mayor of the jurisdiction. The board shall adopt rules and regulations which, insofar as they relate to boilers, shall conform to the ASME Code and shall not be inconsistent with the terms and provisions of this code.

**122.7 Review and Action of the Boiler Board.** Disputes arising between inspectors and any person or persons concerning the application of the provisions of this code to the installation of boiler facilities serving the property of such person or persons may be submitted to the Authority Having Jurisdiction. An interested party (other than an inspector) who is dissatisfied with the decision of the Authority Having Jurisdiction in the matter may appeal that decision to the board. Upon such an appeal, each party to the dispute shall be entitled to present his or her side of the matter to the board, and the

board shall render its decision on the matter based on the information presented by both sides and the board's interpretation of applicable provisions of this code.

The board shall have the power by a majority vote to revoke or cancel a stationary engineer's license, operator's license, or operator's permit for dishonesty, incompetency, or misconduct by the license or permit holder while discharging his or her duties or for neglect of his or her duties.

No license or permit shall be permanently revoked or canceled without first giving the license or permit holder an opportunity to be heard by the board. The building official shall provide notice of a right to a hearing on the matter pursuant to Section 108.10.

The Authority Having Jurisdiction of the jurisdiction shall have the authority to suspend for just cause a stationary engineer's license, operator's license, or operator's permit. The holder of a suspended license or permit shall not engage in activities authorized by the license or permit while such license or permit is suspended, but shall be given an opportunity to be heard by the board within five working days after delivering to the Authority Having Jurisdiction a written request for a hearing.

**122.8 Review of New Materials, Methods and Revisions to the Code.** Any person, firm, or corporation whose boiler products are not specifically approved by this code may file a petition in writing for approval thereof. The petition shall be delivered to the Authority Having Jurisdiction, who shall determine whether the material or method should be approved pursuant to Section 105 of this code. If the Authority Having Jurisdiction denies approval of the material or method, the person who made the request may appeal that decision by delivering a written notice of appeal to the secretary of the board within 10 days of the date that the notice of the decision of the Authority Having Jurisdiction was either hand delivered or mailed to such person. Upon receipt of the notice of appeal, the board shall set the matter for hearing. The board may request any additional tests be conducted that it finds are necessary to determine whether the decision of the Authority Having Jurisdiction should be upheld or overturned. All such tests shall be at the expense of the person requesting the approval. The burden shall be on that person to show that the decision of the Administrative Authority Having Jurisdiction should be overturned.

The decision of the board upholding or overturning the decision of the Authority Having Jurisdiction shall be set out in the minutes of the board. If the board overturns the decision of the Authority Having Jurisdiction, it shall set forth in its minutes any conditions or limitations to which the approval is made subject.

The board shall receive requests for revisions to those provisions of this Code that affect matters relating to boilers, and it shall be the duty of the board to recommend to the City Council any changes herein that the board deems necessary. The board shall make a report to the City Council annually stating its recommended changes.

**122.9 Appeals.** Any owner, user, license applicant, license holder, or interested person who is affected and aggrieved by a decision of the board may appeal the board's decision to the City Council, pursuant to rule 12 of section 2-2 of the City Code of Ordinances.

Upon appeal to the City Council from the board's decision, the board's secretary shall file with the City Secretary a copy of the minutes of the board setting forth the board's decision and a copy of any minutes of the board reflecting any discussion or motions concerning the matter. Upon receipt of all materials required by the City Secretary's Office, the City Secretary shall set the matter for consideration. All appeals to the City Council are subject to rule 12 of Section 2-2 of the City Code of Ordinances.

All orders or decisions of the Authority Having Jurisdiction shall be in writing and shall be and remain in full force and effect until reversed by the board, the City Council, or suspended, cancelled or annulled.

The decision of the City Council shall be final.

### **123.0 Stationary Engineer's License**

**123.1 License.** Persons who desire to secure a stationary engineer's license shall apply to the board and pay to the Authority Having Jurisdiction the applicable fee.

Licenses shall be granted in three grades:

- (1) A first-grade stationary engineer's license authorizes the licensee to have direct charge of, operate or supervise any power boiler or boilers of any size.
- (2) A second-grade stationary engineer's license authorizes the licensee to have direct charge of, operate, and supervise any power boiler or boilers having an aggregate amount of heat output not to exceed 8,380,000 Btu per hour and to act as assistant or watch engineer under the charge and supervision of the holder of a first-grade stationary engineer's license of any power boiler or boilers.
- (3) A third-grade stationary engineer's license authorizes the licensee to have direct charge of, operate, or supervise any power boiler or boilers having an aggregate amount of heat output not to exceed 3,352,000 Btu per hour and to act as assistant or watch engineer under the charge and supervision of the holder of a first or second-grade stationary engineer's license of any power boiler or boilers having an aggregate amount of heat output not to exceed 8,380,000 Btu per hour.

**123.2 Stationary Engineer Examination Application.** An applicant for a first-grade stationary engineer's license shall present to the board service letters showing that he or she has either the following specified experience or combination of experience and education: (i) at least five years of hands-on boiler operating experience on boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; (ii) a graduation certificate from an accredited engineering school and at least two years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; or (iii) a United States Department of Labor diploma showing the applicant finished a full three-year course as an apprentice stationary engineer and two years of hands on boiler operating experience with boilers used to heat water or liquid

for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat.

An applicant for a second-grade stationary engineer's license shall present to the board service letters showing that he or she has: (i) at least three years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; or (ii) a graduation certificate from an accredited engineering school and at least one year of hands on boiler operating experience on boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat.

An applicant for a third-grade stationary engineer's license shall present to the board service letters showing that he or she has: (i) at least two years of hands on boiler operating experience with boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat; or (ii) a graduation certificate from an accredited engineering school and at least six months of hands on boiler operating experience on boilers used to heat water or liquid for environmental heating or commercial processing purposes or for generating steam or vapor by direct application of heat.

No person may take an examination for a stationary engineer's license unless he or she has submitted the service letters, certificates, and/or diplomas to the board as required by this section and the submitted documents have been accepted by the board.

Applicants will be required to correctly answer at least 70 percent of the questions comprising the examination in order to qualify for a stationary engineer's license of any grade. All questions and answers will be written in the English language.

An applicant for a stationary engineer's license who fails to satisfactorily pass an examination shall not be entitled to a refund of the examination fee paid to the jurisdiction and shall not be reexamined for the grade in which the applicant failed, or examined for a higher grade, within a period of less than 90 days.

Each applicant shall pay a \$100 examination fee for each examination the applicant applies for. The fee is to be paid to the Authority Having Jurisdiction at the time the application is filed. Service letters shall be filed with the application. An applicant shall be eligible for examination on the date of the next regularly scheduled examination that is held at least seven days after the date of application.

Applicants who *have* successfully passed the examination shall pay a \$70.00 license fee to the jurisdiction prior to the issuance of the license. The license shall expire on December 31 of the year of issuance, unless suspended or *revoked*. Thereafter, the license may be renewed annually pursuant to the provisions set forth below. The receipt for payment of a license renewal fee shall be displayed with the license. Failure to do so shall constitute grounds for the suspension or *revocation* of the license.

**123.3 License Renewals.** License renewals shall be granted without reexamination upon payment of a \$70.00 fee, provided such fee is paid within 30 days after the expiration date of the license and not thereafter. When a renewal application is filed more than 30 days after the expiration of the license, the fee for renewal shall be \$75.00

for the first year after the expiration date, plus \$70.00 for each additional year or part of a year thereafter. When the annual license renewal fee has not been paid for a period of five consecutive years, the license shall not be renewed until the applicant has successfully passed a reexamination.

Each certificate or license issued under the terms and provisions of this section shall be signed by the person to whom it was issued as required by the board.

**123.4 Validity, Replacement of License.** When the holder of a license is examined by the board and granted a license in a higher grade, the higher grade license shall not be issued until the license of the lower grade is surrendered and all required fees are paid to the Authority Having Jurisdiction.

When a license becomes lost or destroyed, the board shall grant a new license in the same grade, provided proof of such loss or destruction is presented to the satisfaction of the board. The fee for replacement license shall be \$70.00. If the proof of such loss or destruction is not satisfactory to the board, reexamination in the same grade shall be required, and the fee for the reexamination shall be as provided in Section 123.2

**123.5 Reciprocity.** A person who holds a current and valid marine engineer's license issued by the United States Coast Guard shall be qualified for examination by the board for a stationary engineer's license of equal or lower grade, provided the license fee set forth in Section 123.2 has been paid.

A person who holds a current and valid stationary engineer's or a steam engineer's license issued by a state, municipality, or government agency shall be qualified for examination by the board in the grade of the equivalent license in this jurisdiction, as determined by the board, provided the holder of the license presents proof to the satisfaction of the board that said license was granted as a result of boiler operating experience and a passing grade on a written examination on the operation, maintenance and repair of boilers and boiler accessories and safety rules for the boilers.

No license issued by a foreign government, graduation certificate from a foreign school, college, or university, or any service letter from an employer in a foreign country shall qualify the holder thereof to be examined by the board for a stationary engineer's license of any grade unless the submitted document and the information contained therein are determined valid by the board and equivalent to the standards prescribed above. Upon examination of the information presented, the board shall designate the grade in which the applicant may be examined, if such evidence is found by the board to be valid.

**123.6 Expiration of License.** Each license issued for stationary engineers that was in effect immediately preceding the adoption of this code by City Council shall expire on the 31<sup>st</sup> day of December of the year in which this code is adopted. Any such license may be renewed as though it had been originally issued pursuant to this code.

**123.7 Limitations of Operator.** Except as provided in Section 124, no person shall:

(1) Have direct charge, control, or supervision of any power boiler; or

(2) Act as or perform the duties of a stationary engineer or assistant watch engineer on any power boiler.

Nor shall any owner, user or person operate or use, or cause or permit any boiler to be operated or used unless the persons responsible for the operation of the boiler have current and valid licenses for the applicable classes as required in Section 123.1.

**123.8 Duties of the Certificate Holder.** Each holder of a certificate of stationary engineer's license shall file with the board the name of the employer, the plant location, and the aggregated amount of Btu-per-hour heat output of the boiler or boilers that the holder is operating. Each holder of a stationary engineer's license shall enclose his or her license certificate under glass in a dustproof frame and shall display it in a conspicuous place in the plant where the holder is employed.

The operator's permit issued under Section 124 designating the person in charge of the boiler shall be enclosed under glass in a dustproof frame and prominently displayed as near as possible to the boiler or boilers to which the operator's permit applies.

**123.9 Responsibility of the Boiler Owner or User.** Every owner or user of a power boiler that has an aggregate heat output that exceeds 1,676,000 Btu per hour shall establish a method of operation utilizing one or more full time employed licensed stationary engineers of the herein required license grade(s). The operating method shall include direct physical examination of the boiler by the licensed stationary engineer(s) at reasonable time intervals to ensure its safe operation. The owner or user shall establish the operating method based on accepted boiler industry practices commensurate with load characteristics, use, and configuration of the boiler.

#### **124.0 Boiler Operator's Permit**

An owner or user of any hot-water-heating boiler, low-pressure hotwater- heating boiler, or steam heating boiler at pressure of 15 pounds per square inch or less used to heat water or liquid for environmental heating or commercial processing purposes or a power boiler having an aggregate heat output that does not exceed 1,676,000 Btu per hour, may apply to the board for a permit to allow the boiler to be operated by the owner or user or by a person knowledgeable in the operation of the boiler, instead of by a licensed stationary engineer. The person who is to operate the boiler or boilers shall be the owner of the boiler or his or her bona fide employee and shall demonstrate competency to do so in a manner determined by the board. The board shall establish the method of testing and the minimum knowledge, ability, and qualifications such person must demonstrate to show competency to operate the distinctive types of boilers. If a person demonstrates competency in the operation of the type of boiler for which the permit is sought, the permit shall be granted upon the payment of a permit fee of \$70.00. The permit shall expire on December 31 st of each year, unless suspended or revoked before the expiration date.

Renewal of such permits shall be granted upon the payment of \$70.00 if the renewal is applied for within 30 days after the expiration of such permit. If the renewal is not applied for within 30 days, the applicant may renew the permit upon payment of a fee of \$75.00.

A permit shall be valid only for the specific location and for the boiler(s) at the location named on the permit. Separate permits may be issued for a person to operate boilers at two or more locations owned by the employer of the boiler operator listed on the permit. When a permit is issued for boiler operation at two or more locations, the applicant must file for a separate boiler operator permit for each location and pay the fee for each boiler operator permit received.

When an operator's permit becomes lost or destroyed, the board may grant a replacement permit in the same manner as set forth for a stationary engineer's license in Section 123.4 of this Code.

All permits issued for the operation of boilers that were in effect immediately preceding the adoption of this code by City Council shall expire on the 31st day of December of the year in which this code is adopted. Any such permit may be renewed as though it had been originally issued pursuant to this code.

### **125.0 Boiler Related Inspections and Liabilities**

The Authority Having Jurisdiction shall periodically inspect each location where a boiler is installed to determine if the boiler is being operated by an authorized person in accordance with all applicable laws. Such inspections shall be made annually or at such other intervals as the Authority Having Jurisdiction determines is necessary to ensure compliance with applicable laws.

**Exception:** Boilers used solely for the production of domestic water.

If there is a conflict between this code and the State of Texas Boiler Law in Chapter 755 of the Texas Health and Safety Code and any amendments thereto, then state law will apply.

The provisions of this code shall not be construed to relieve from responsibility or lessen the responsibility of any person, firm, corporation, master plumber, appliance dealer, or installer owning, operating, or installing any boiler or other equipment described in this section for damages to persons or property caused by any defect therein, nor shall the jurisdiction be held responsible for any such liability as a result of an inspection authorized or an approval issued by this code.

{EDITOR'S NOTE: DELETE TABLE 1-1 IN ITS ENTIRETY.}

## CHAPTER 2 DEFINITIONS

**APPLIANCE** – a device that utilizes fuel or other forms of energy to produce light, heat, power, refrigeration, ventilation or air-conditioning. This definition also shall include a vented decorative appliance.

**AUTHORITY HAVING JURISDICTION** – ~~The jurisdiction's Director of the Public Works and Engineering Department, who is appointed to administer and enforce the provisions of this code. organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, installations, or procedures. The Authority Having Jurisdiction shall be a federal, state, local, or other regional department or an individual such as a plumbing official, mechanical official, labor department official, health department official, building official, or others having statutory authority. In the absence of a statutory authority, the Authority Having Jurisdiction may be some other responsible party.~~ This definition shall include the Authority Having Jurisdiction's duly authorized representatives.

**{EDITOR'S NOTE: DELETE DEFINITION OF BREATHING ZONE IN ITS ENTIRETY.}**

**{EDITOR'S NOTE: DELETE DEFINITION OF BREATHING ZONE OUTDOOR AIRFLOW (VBz) IN ITS ENTIRETY.}**

**BRINE** – ~~As determined in accordance with NFPA 30. is a~~ Any liquid used for the transmission of heat without a change in its state, having no flash point or a flash point above 150°F (66°C), as determined by the requirements of the Fire Code. (See U.F.C. Standard 2-2 in Appendix A.)

**BUILDING CODE** – The City of Houston Building Code, as adopted by this jurisdiction.

**BUILDING THERMAL ENVELOPE** – The basement walls, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.

**CITY CODE** – The Code of Ordinances, Houston, Texas.

**CLOTHES DRYER** – An appliance used to dry wet laundry by means of heat derived from the combustion of fuel gases or electric heating elements.

**DESIGN FLOOD ELEVATION** ~~– See Chapter 19 of the City Code for provisions regarding the flood plain. The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard map.~~

**ELECTRICAL CODE** – The *National Electrical Code* promulgated by the National Fire Protection Association, as adopted by this jurisdiction, and the *City of Houston Electrical Code*.

**FIRE CODE** – The *City of Houston Fire eCode*, as adopted by this jurisdiction.

**FLOOD HAZARD AREA** – {EDITOR’S NOTE: DELETE EXISTING DEFINITION AND REPLACE WITH THE FOLLOWING.} See Chapter 19 of the City Code for provisions regarding the flood plain.

**FLOOD HAZARD AREA SUBJECT TO HIGH VELOCITY WAVE ACTION** – {EDITOR’S NOTE: DELETE EXISTING DEFINITION AND REPLACE WITH THE FOLLOWING.} See Chapter 19 of the City Code for provisions regarding the flood plain.

**FULL TIME EMPLOYEE** – An employee who is present on the job/property either 40 hours a week or at least 80% of the time a boiler is in operation.

**INTERNATIONAL RESIDENTIAL CODE** – The *City of Houston Residential Code* based on the *International Residential Code for One- and Two-Family Dwellings*, as adopted by the State of Texas in Subchapter G of Chapter 214 of the Texas Local Government Code, with amendments adopted by this jurisdiction.

**MECHANICAL INTEGRITY** – The physical installation of products, systems, or equipment in accordance with their intended purpose and according to the manufacturer’s specifications and manufacturer’s installation instructions.

**OCCUPANCY CLASSIFICATION** – {EDITOR’S NOTE: DELETE EXISTING DEFINITION AND REPLACE WITH THE FOLLOWING.} Classifications shall be as defined in Chapter 3 of the *Building Code*.

**OCCUPIED SPACE** – {EDITOR’S NOTE: DELETE EXISTING DEFINITION AND REPLACE WITH THE FOLLOWING.} A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational, or similar purposes or in which

occupants are engaged at labor, and which is equipped with means of egress and light and ventilation facilities meeting the requirements of the Building Code.

**PLUMBING CODE** – ~~The Uniform City of Houston Plumbing Code promulgated by the International Association of Plumbing and Mechanical Officials, as adopted by this jurisdiction.~~

**RECOGNIZED ENGINEERING PRINCIPLES** – Principles that are consistent with accepted and sound practices followed by licensed professional engineers within the jurisdiction and approved by the Authority Having Jurisdiction.

**REFRIGERATION CAPACITY RATING** – A unit expressed as one horsepower, one ton or 12,000 Btu/h (3.52 kW), each of which shall mean the same quantity.

**REFRIGERATION SYSTEM, UNIT** – A refrigerating unit not exceeding 3 horsepower rating that has been factory assembled and tested prior to its installation. The unit shall not be connected to any ductwork and shall be a complete one-unit package without remote parts.

**SHAFT** – An interior space enclosed by walls or construction extending through one or more stories or basements that connects openings in successive floors, or floors and roof, to accommodate elevators, dumbwaiters, mechanical equipment, ventilation air ducts, or similar devices to transmit light ~~or ventilation air~~.

**SOLDERED JOINT** - A joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at a temperature below 800°F (427°C) and above 400°F (204°C).

{**EDITOR'S NOTE:** ~~DELETE DEFINITION OF SYSTEM OUTDOOR AIRFLOW (*V<sub>ot</sub>*) IN ITS ENTIRETY.~~}

~~**SYSTEM OUTDOOR AIRFLOW (*V<sub>ot</sub>*)** – The rate of outdoor airflow required at the ventilation system outdoor air intake.~~

{**EDITOR'S NOTE:** ALL OTHER PORTIONS OF **CHAPTER 2** REMAIN AS SET FORTH IN THE *2006 UNIFORM MECHANICAL CODE.*}

## CHAPTER 3 GENERAL REQUIREMENTS

### 301.0 Scope

This chapter ~~covers~~ contains general requirements for heating, ventilating, air-conditioning, refrigeration, miscellaneous heat-producing, and energy-utilizing equipment. ~~Such equipment~~ Systems and equipment shall conform to the requirements of this code.

Equipment shall not be installed or altered in violation of this code, nor shall the fuel input rate to equipment be increased in excess of the approved Btu/h (kW) rating at the altitude where it is being used.

Defective material or parts shall be replaced in such a manner ~~as not to invalidate any approval~~ to preserve an approval or a listing.

**303.1** Gas utilization equipment shall be connected to the building piping in compliance with Section 1312.4 by one of the following:

- (1) Rigid metallic pipe and fittings.
- (2) Semi-rigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used ~~in exterior locations~~.
- (3) Listed connectors used in accordance with the terms of their listing that are completely in the same room as the equipment.
- (4) Listed gas hose connectors in accordance with Section 303.2.
- (5) Gas-fired food service (commercial cooking) equipment listed for use with casters or otherwise subject to movement for cleaning, and other large and heavy gas utilization equipment than can be moved, shall be connected in accordance with the connector manufacturer's installation instructions using a listed appliance connector complying with ANSI Z21.69, Standard for Connectors for Movable Gas Appliances.
- (6) In Sections 303.1(2), (3), and (5), the connector or tubing shall be installed so as to be protected against physical and thermal damage. Aluminum alloy tubing and connectors shall not be used. ~~be coated to protect against external corrosion where they are in contact with masonry, plaster, or insulation or are subject to repeated wettings by such liquids as water (except rainwater), detergents, or sewage.~~

**303.2 Use of Gas Hose Connectors.** Listed gas hose connectors shall be used in accordance with the terms of their listing and as follows:

- (A) **Indoor.** Indoor gas hose connectors shall be permitted to be used with laboratory, shop, or ironing equipment that requires mobility during operation. An equipment shutoff valve shall be installed where the connector is attached

to the building piping. The connector shall be of minimum length and shall not exceed 3 6 feet. (0.9 4.8-m). The connector shall not be concealed and shall not extend from one room to another or pass through wall partitions, ceilings, or floors.

**Exception:** Listed metal appliance connectors shall have an overall length not to exceed three (3) feet (914 mm), except range and domestic clothes dryer connectors, which may not exceed six (6) feet (1829 mm).

- (B) **Outdoor.** Outdoor gas hose not to exceed 15 feet (4.6 m) with connectors shall be permitted to be used to connect portable outdoor gas-fired equipment. An equipment shutoff valve, a listed quick-disconnect device, or a listed gas convenience outlet shall be installed where the connector is attached to the supply piping and in such a manner so as to prevent the accumulation of water or foreign matter. This connection shall only be made in the outdoor area where the equipment is to be used.

### **303.3 Connection of Portable and Mobile Industrial Gas Equipment.**

- (A) Portable industrial gas utilization equipment or equipment requiring mobility or subject to vibration shall be permitted to be connected to the building gas piping system by the use of flexible hose not to exceed 15 feet (4.6 m), suitable and safe for the conditions under which it can be used.
- (B) Industrial gas utilization equipment requiring mobility shall be permitted to be connected to the rigid piping by the use of swivel joints or couplings that are suitable for the service required. Where swivel joint or couplings are used, only the minimum number required shall be installed.
- (C) Industrial gas utilization equipment subject to vibration shall be permitted to be connected to the building piping system by the use of all metal flexible connectors suitable for the service required.
- (D) Where flexible connections are used, they shall be of the minimum practical length and shall not extend from one room to another or pass through any walls, partitions, ceilings, or floors. Flexible connections shall not be used in a concealed location. They shall be protected against physical or thermal damage and shall be provided with gas shutoff valves in readily accessible locations in rigid piping upstream from the flexible connections. [NFPA 54:8.5.1, 8.5.2, 8.5.3]

**304.4 Anchorage of Appliances.** Appliances designed to be fixed in position shall be securely fastened in place. Supports for appliances shall be designed and constructed to sustain vertical and horizontal loads within the stress limitations specified in the Building Code for the minimum basic wind speed.

**Exception:** Replacement of appliances in kind need only match the fastening requirements of the equipment being replaced.

**304.6 LPG Appliances.** Liquefied petroleum gas-burning appliances shall not be installed in a pit, basement or similar location where heavier-than-air gas might collect. Appliances so fueled shall not be installed in an above-grade under-floor space or basement unless such location is provided with an approved means for removal of unburned gas.

**304.67 Liquefied Petroleum Gas Facilities.** Containers, container valves regulating equipment, and appurtenances for the storage and supply of liquefied petroleum gas shall be installed in accordance with the Fire Code.

### **305.2 Access to Appliances and Equipment on Roofs.**

**305.2.1 Appliances and equipment located on roofs or other elevated locations shall be accessible.**

**305.2.2 In buildings where the point of access is more than fourteen (14) feet (4,267.2 mm) above grade, an inside means of access to the roof shall be provided. [NFPA 54-09:9.4.3.2]**

**305.2.3 The inside means of access shall be a permanent or foldaway inside stairway or ladder, terminating in an enclosure, scuttle, or trapdoor. Such scuttles or trapdoors shall be at least twenty-two (22) inches × twenty-four (24) inches (560 mm × 610 mm) in size, shall open easily and safely under all conditions, especially snow, and shall be constructed so as to permit access from the roof side unless deliberately locked on the inside. At least six (6) feet (1,829 mm) of clearance shall be available between the access opening and the edge of the roof or similar hazard, or rigidly fixed rails or guards a minimum of forty-two (42) inches (1,067 mm) in height shall be provided on the exposed side. Where parapets or other building structures are utilized in lieu of guards or rails, they shall be a minimum of forty-two (42) inches (1,067 mm) in height. [NFPA 54-09:9.4.3.3]**

An attic or furred space in which a warm-air furnace is installed shall be provided with a pull down stairway with a clear opening not less than 22 inches in width and a load capacity of not less than 350 pounds and an unobstructed passageway as large as the largest piece of the furnace and in no case less than thirty (30) inches by thirty (30) inches (762 mm × 762 mm) continuous from the opening to the furnace and its controls.

#### **305.2.4 Permanent ladders providing roof access shall:**

- 1. Have side railings that extend at least thirty (30) inches (762 mm) above the roof edge or parapet wall.**
- 2. Have landings less than eighteen (18) feet (5486 mm) apart measured from the finished grade.**
- 3. Be at least fourteen (14) inches (356 mm) in width.**
- 4. Have rungs not more than fourteen (14) inches (356 mm) on center.**
- 5. Have a minimum of six (6) inches (152 mm) toe space.**

**305.2.5 Platform.** A furnace located on a roof shall be installed on a substantial, level platform. When the roof has a slope greater than one (1) in twelve (12), a level working platform at least thirty (30) inches (762 mm) in depth and width shall be provided along the firebox and control sides of the furnace. Sides of a working platform facing the roof edge below shall be protected by a substantial railing forty-two (42) inches (1067 mm) in height with vertical rails not more than twenty-one (21) inches (533 mm) apart, except that parapets at least twenty-four (24) inches (610 mm) in height may be utilized in lieu of rails or guards.

**307.3.6 Instructions and Clearances.** Appliances shall be accompanied by clear and complete installation instructions, including required clearances from combustibles other than mounting or adjacent surfaces, and temperature rating of field-installed wiring connections if over 140°F (60°C).

**308.2 Protection Against Flood Damage.** For buildings located in flood hazard areas, heating, ventilating, air conditioning, refrigeration, miscellaneous heat producing, and energy-utilizing equipment and appliances shall be elevated at or above the design flood elevation. For provisions regarding flood provisions see Chapter 19 of the City Code.

~~**Exception:** Equipment and appliances are permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood resistant construction requirements of the Building Code.~~

~~**308.2.1 Walls Below Buildings in Flood Hazard Areas Subject to High Velocity Wave Action.** In flood hazard areas subject to high velocity wave action, equipment and appliances, including piping, shall not be mounted on or penetrate walls intended to break away under flood loads.~~

~~**308.2.2 Air Exhaust and Intake Openings.** Outside air exhaust openings and air intake openings shall be located at or above the design flood elevation.~~

### **309.0 Electrical Connections.**

Equipment regulated by this code requiring electrical connections of more than fifty (50) volts shall have a positive means of disconnect in accordance with the Electrical Code. ~~adjacent to and in sight from the equipment served. A 120 volt receptacle shall be located within twenty-five (25) feet (7,620 mm) of the equipment for service and maintenance purposes. The receptacle need not be located on the same level as the equipment.~~ Low-voltage wiring of fifty (50) volts or less within a structure shall be installed in a manner to prevent physical damage.

**310.2 Condensate Control.** When a cooling coil or cooling unit is located in an attic or furred space, or in any area where damage may result from condensate overflow, an additional watertight pan of corrosion-resistant metal shall be installed beneath the cooling coil or unit top to catch the overflow condensate due to a clogged primary condensate drain, or one pan with a standing overflow and a separate secondary drain may be provided in lieu of the secondary drain pan. The additional pan or the standing overflow shall be provided with a drain pipe, minimum 3/4 inch (19.1 mm) nominal pipe size, discharging at a point that can be readily observed.

**Exception:** The additional watertight pan may be of corrosion resistant material other than metal, when approved by the Authority Having Jurisdiction.

This requirement is in addition to the requirements in Sections 310.3 and 310.4.

**310.2.1 Water-Level Sensing Devices.** On units and other coils on a roof or above a ceiling that do not have a secondary drain or means to install a secondary drain pan, a water level sensing device shall be installed inside the primary drain pan. This device shall shut off the appliance in the event that the primary drain becomes restricted. Inline overflow devices installed in the primary drain line shall not be permitted.

**310.3 Condensate Waste Sizing.** Condensate waste pipes from air-cooling coils shall be sized in accordance with equipment capacity as follows:

Equipment Capacity in		Minimum Condensate Pipe Diameter	
Tons of Refrigeration	(kW)	Inches	(mm)
Up to <u>10-20</u>	(Up to <u>35.17-70.34</u> )	3/4	(20)
<u>Over 10-21-40</u>	( <u>Over 35.17-73.85 -140.67</u> )	1	(25)
<u>Over 40-41-90</u>	( <u>Over 140.67-144.19 -316.6</u> )	1-1/4	(32)
<u>Over 90-91-125</u>	( <u>Over 316.6-320.03 -439.6</u> )	1-1/2	(40)
<u>Over 125-126-250</u>	( <u>Over 439.6-443.12 -879.2</u> )	2	(50)

The size of condensate waste pipes may be for one unit or a combination of units, or as recommended by the manufacturer. ~~The capacity of waste pipes assumes a 1/8 inch per foot (10.5 mm/m) or 1 percent slope, with the pipe running three-quarters full at the following conditions:~~

<del>Outside Air – 20%</del>		<del>Room Air – 80%</del>	
<del>—DB</del>	<del>WB</del>	<del>DB</del>	<del>WB</del>
<del>—90°F</del>	<del>—73°F</del>	<del>75°F</del>	<del>62.5°F</del>
<del>—(32°C)</del>	<del>—(23°C)</del>	<del>(24°C)</del>	<del>(17°C)</del>

Condensate drain sizing for other slopes or other conditions shall be approved by the Authority Having Jurisdiction.

**310.5 Plastic Fittings.** Female PVC screwed fittings shall not be used ~~with plastic male fittings and plastic male threads only.~~

**312.2 Filters for Direct Gas-fired Makeup-air Heaters.** Air passing through or over the burners of direct gas fired makeup air heaters shall be outside air and screened or filtered to prevent leaves, papers, or other objects from being picked up from the outside, ignited, and discharged into the heated space.

**312.3 Filters for Direct Gas-fired Industrial Air Heaters.** Industrial gas-fired air heaters employing recirculation shall have filters installed in both the outside air inlet and the recirculating system.

**312.4 Filters for Ventilation Systems.** Air filters shall be listed units. Liquid adhesive coatings used on filters shall have a flash point of 350°F (177°C) or higher, as determined by ASTM D-93.

## **CHAPTER 4**

### **VENTILATION AIR SUPPLY**

#### **401.0 General.**

This chapter contains requirements for ~~ventilation air supply and exhaust~~, evaporative cooling systems and makeup air requirements for direct-gas-fired heaters, industrial air heaters and miscellaneous heaters. Ventilation air supply requirements for specific occupancies are found in Part III of this chapter.

#### **Part I – Ventilation Air**

**{EDITOR’S NOTE: DELETE SECTION 402 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}**

#### **402.0 Makeup Air**

Makeup air requirements for direct gas-fired heaters, industrial air heaters, and miscellaneous heaters are found in Chapters 5 and 9.

#### **Part II – Evaporative Cooling Systems**

**{EDITOR’S NOTE: DELETE SECTION 403 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}**

**403.0 General.** Evaporative cooling systems shall comply with this chapter.

Except for Section 906.0, evaporative cooling systems shall be provided with outside air as specified for cooling systems in this code.

Air ducts and fire dampers which are a portion of an evaporative cooling system shall comply with this code.

**{EDITOR’S NOTE: DELETE SECTION 404 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}**

**404.0 Location.** Evaporative cooling systems shall be installed so as to minimize the probability of damage from an external source.

**{EDITOR’S NOTE: DELETE SECTION 405 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}**

#### **405.0 Access, Inspection and Repair.**

Evaporative coolers shall be accessible for inspection, service and replacement without removing permanent construction.

#### **406.0 Installation.**

An evaporative cooler supported by the building structure shall be installed on a substantial level base and shall be secured directly or indirectly to the building structure by suitable means to prevent displacement of the cooler. Modifications made to the supporting framework of buildings as a result of the installation shall be in accordance with the requirements of the Building Code. Openings in exterior walls shall be flashed in an approved manner in accordance with the requirements of the Building Code. An evaporative cooler supported directly by the ground shall be isolated from the ground by a level concrete slab extending not less than three (3) inches (76 mm) above the adjoining ground level. An evaporative cooler supported on an above-ground platform shall be elevated at least six (6) inches (152 mm) above adjoining ground level.

### **PART III Ventilation Requirements**

#### **407.0 Scope**

Buildings and structures enclosing spaces intended for human occupancy shall be provided with ventilation in accordance with this chapter.

#### **408.0 Ventilation**

**408.1 General.** Enclosed portions of buildings and structures in occupancies other than the locations specified in Sections 408.3 through 408.7 shall be provided with natural ventilation through openable exterior openings with an area of not less than 1/20 of the total floor area of such portions or shall be provided with a mechanically operated ventilating system. The mechanically operated ventilating system shall be capable of supplying ventilation air in accordance with Table 4-1 during such time as the building or space is occupied.

**408.2 Applicability.** Outside air quantities listed in Table 4-1 are minimum requirements and are not necessarily adequate for all occupancy conditions.

**408.3 Toilet Rooms.** Toilet rooms shall be provided with a fully openable exterior window at least 3 square feet (0.27m<sup>2</sup>) in area; a vertical duct not less than 100 square inches (0.064 516 m<sup>2</sup>) in area for the first toilet facility, with 50 additional square inches (0.032 m<sup>2</sup>) for each additional facility; or a mechanically operated exhaust system capable of exhausting 50 cubic feet of air per minute (23.6 L/s) for each water closet or urinal installed in the toilet room. Such systems shall be connected directly to the outside. The point of discharge shall be at least 3 feet (914 mm) from any openable window.

**408.4 Ventilation in Hazardous Locations.** Rooms, areas, or spaces in which explosive, corrosive, combustible, flammable, or highly toxic dusts, mists, fumes, vapors, or gases are or may be emitted due to the processing, use, handling, or storage of materials shall be mechanically ventilated as required by the Fire Code and other parts of this code.

Emissions generated at work stations shall be confined to the area in which they are generated as specified in the Fire Code and other parts of this code.

Supply and exhaust openings shall be in accordance with this code. Exhaust air contaminated by highly toxic material shall be treated in accordance with the Fire Code.

**408.5 Group B Occupancies.** In Group B Occupancies, or portions thereof, where Class I, II or IIIA liquids are used, mechanical exhaust shall be provided sufficient to produce six air changes per hour. Such mechanical exhaust shall be taken from a point at or near the floor level.

**408.6 Group S Parking Garages.** In parking garages, other than open parking garages as defined in the Building Code, used for storing or handling of automobiles operating under their own power and on loading platforms in bus terminals, ventilation shall be provided capable of exhausting a minimum of 0.75 cubic feet per minute (cfm) per square foot (0.354 L/s/m<sup>2</sup>) of gross floor area. The building official may approve an alternate ventilation system designed to exhaust a minimum of 14,000 cfm (6608 L/s) for each operating vehicle. Such system shall be based on the anticipated instantaneous movement rate of vehicles, but not less than 2.5 percent (or one vehicle) of the garage capacity. Automatic carbon monoxide-sensing devices may be employed to modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during any eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour.

**Exception:** In repair garages and motor vehicle fuel-dispensing stations without lubrication pits, in storage garages, and in aircraft hangars, the ventilating system may be omitted when, in the building official's opinion, the building is supplied with unobstructed openings to the outer air that are sufficient to provide the necessary ventilation.

Connecting offices, waiting rooms, ticket booths and similar uses shall be supplied with conditioned air under positive pressure.

**408.7 Group S Repair Garages.** In buildings used for the repair or handling of motor vehicles operating under their own power, mechanical ventilation shall be provided capable of exhausting a minimum of 1.0 cfm per square foot (5.1 L/s/m<sup>2</sup>) of floor area. Each engine repair stall shall be equipped with an exhaust pipe extension duct that extends to the outside of the building, and if over 10 feet (3048 mm) in length, shall mechanically exhaust 300 cfm (141.6 L/s). Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

**Exception:** In repair garages and aircraft hangars, the building official may authorize the omission of such ventilating equipment when, in his or her opinion, the building is supplied with unobstructed openings to the outer air that are well distributed and sufficient in size to provide the necessary ventilation. Doors providing adequate cross ventilation may serve to satisfy this requirement.

**{EDITOR'S NOTE: DELETE TABLE 4-1 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING. }**

**TABLE 4-1**  
**Outdoor Air Requirements for Ventilation<sup>(8) (9) (10)</sup>**

<u>APPLICATIONS<sup>(1)</sup></u>	<u>OUTDOOR VENTILATION</u> <u>AIR</u> (cfm per square foot of area unless noted) <sup>(2)</sup>
	<u>0.472 for L/s per m<sup>2</sup></u>
<u>Aircraft Hangers</u> – for Repair – for Storage	<u>0.02</u> <u>No Requirement</u>
<u>Animal Housing Areas</u>	<u>1.00</u>
<u>Art Classrooms / Studios</u>	<u>0.25</u>
<u>Assembly Rooms</u> – Auditoriums – Multi-purpose	<u>0.50<sup>(6)</sup></u> <u>0.50<sup>(6)</sup></u>
<u>Autopsy Rooms</u>	<u>0.50<sup>(4)</sup></u>
<u>Ballrooms and Discos</u> – Where smoking is permitted – Where smoking is prohibited	<u>1.67</u> <u>0.50</u>
<u>Bank Vaults</u> – Greater than 200 square feet – Equal to or Less than 200 square feet	<u>0.08</u> <u>No Requirement</u>
<u>Barber Shops</u>	<u>0.22</u>
<u>Barracks Sleeping Areas</u>	<u>15 cfm / bed<sup>(5)</sup></u>
<u>Bars, Cocktail Lounge</u>	<u>1.00</u>
<u>Bathrooms</u> – Intermittent Exhaust – Continuous Exhaust	<u>50 cfm / room<sup>(4, 5)</sup></u> <u>20 cfm / room<sup>(4, 5)</sup></u>
<u>Beauty Shop / Salon</u>	<u>0.22</u>
<u>Bedrooms</u>	<u>30 cfm / room<sup>(5)</sup></u>
<u>Bowling Alleys (seating areas)</u>	<u>1.67</u>
<u>Cafeteria Fast Food</u>	<u>0.25</u>
<u>Classrooms</u>	<u>0.22</u>
<u>Clothiers</u>	<u>0.12</u>
<u>Computer Equipment Rooms/Data Centers</u>	<u>0.02</u>

<u>Conference Rooms</u>	<u>0.20</u>
<u>Correctional Facilities – Cells</u>	<u>10 cfm / person</u>
<u>Corridors and Utilities</u>	<u>0.05</u>
<u>Courtrooms</u>	<u>0.5</u> <sup>(6)</sup>
<u>Daycare</u>	<u>0.18</u>
<u>Day Rooms – Correctional Facilities</u> <u>– Other</u>	<u>10 cfm / person</u> <u>0.25</u>
<u>Department Stores, Sales Floors and Showroom Floors</u>	<u>0.10</u>
<u>Dining Rooms or Dining Halls</u>	<u>0.25</u>
<u>Dormitory Sleeping Rooms</u>	<u>15 cfm / bed</u> <sup>(5)</sup>
<u>Dressing Rooms</u>	<u>0.10</u>
<u>Dry Cleaners</u> <u>– Coin-operated</u> <u>– Commercial dry cleaners and storage</u> <u>– Pick-up areas</u>	<u>0.30</u> <u>0.90</u> <u>0.12</u>
<u>Duplicating, Printing Areas</u>	<u>0.20</u>
<u>Enclosed Parking Garages</u>	<u>0.75</u>
<u>Fabric Stores</u>	<u>0.12</u>
<u>Florists</u>	<u>0.10</u>
<u>Food Stores</u>	<u>0.08</u>
<u>Game Rooms</u>	<u>0.83</u>
<u>Guard Stations</u>	<u>0.20</u>
<u>Gymnasium or Enclosed Stadium (playing area)</u>	<u>0.30</u>
<u>Gymnasium – (spectator/seating area)</u>	<u>0.50</u> <sup>(6)</sup>
<u>Health Clubs – (reducing salons &amp; exercise areas)</u> <u>– (racket ball court rooms)</u>	<u>0.50</u> <u>0.10</u>
<u>Holding Cells</u>	<u>0.25</u>
<u>Ice Arenas – (playing areas)</u>	<u>0.30</u>
<u>Kitchens</u> <u>– (residential w/continuous exhaust)</u> <u>– (residential w/intermittent exhaust)</u>	<u>25 cfm / room</u> <sup>(4, 5)</sup> <u>100 cfm / room</u> <sup>(4, 5)</sup>
<u>Kitchens</u> <u>– (commercial cooking)</u> <u>– (warming)</u>	<u>0.30</u> <sup>(3)</sup> <u>0.20</u>
<u>Kitchens</u> <u>– (intermittent exhaust)</u>	<u>100 cfm / room</u> <sup>(4, 5)</sup>

<u>Laboratories – (educational or art labs)</u>	<u>0.25</u> <sup>(3)</sup>
<u>Laboratories – (testing and research)</u>	<u>0.25</u> <sup>(3)</sup>
<u>Laundries – (coin-operated and commercial)</u>	<u>0.25</u>
<u>Lecture Hall</u>	<u>0.50</u> <sup>(6)</sup>
<u>Libraries</u>	<u>0.15</u>
<u>Living Areas</u>	<u>See footnote 7</u>
<u>Lobbies – (in assembly occupancies)</u>	<u>0.18</u>
<u>Lobbies – (other than assemblies)</u>	<u>0.05</u>
<u>Locker and Dressing Rooms</u>	<u>0.20</u>
<u>Locker Rooms (with showers)</u>	<u>0.25 (for exhaust)</u>
<u>Malls and Arcades</u>	<u>0.10</u>
<u>Manicure, Pedicure Stations &amp; Foot Spas</u>	<u>225 cfm / station of outdoor air ± 200 cfm / station exhaust</u>
<u>Medical Procedure Rooms</u>	<u>0.30</u> <sup>(8)</sup>
<u>Motor Vehicle – (repair garages)</u>	<u>See Section 408.7</u>
<u>Motor Vehicle – (showrooms)</u>	<u>0.12</u>
<u>Museums / Galleries</u>	<u>0.12</u>
<u>Music Rooms</u>	<u>0.30</u>
<u>Office Spaces</u>	<u>0.08</u>
<u>Operating Rooms</u>	<u>0.60</u> <sup>(8)</sup>
<u>Patient Rooms</u>	<u>0.25</u> <sup>(8)</sup>
<u>Pharmacies</u>	<u>0.10</u>
<u>Photo Studios</u>	<u>0.10</u>
<u>Physical Therapy Rooms</u>	<u>0.30</u> <sup>(8)</sup>
<u>Radio and Television Stations</u>	<u>0.08</u>
<u>Reception Areas</u>	<u>0.20</u>
<u>Recovery and ICU Rooms</u>	<u>0.30</u> <sup>(8)</sup>
<u>Restaurant – (fast food)</u>	<u>0.25</u>
<u>Restrooms</u> – Private (intermittent exhaust) – Public (per water closet or urinal)	<u>35 cfm / room</u> <sup>(5)</sup> <u>50 cfm / water closet or urinal</u> <sup>(4)</sup>
<u>Shipping and Receiving Areas</u>	<u>0.10</u>
<u>Smoking Lounges</u>	<u>1.00</u>
<u>Spectator Areas</u>	<u>0.50</u> <sup>(6)</sup>
<u>Sports Arena – (play area)</u>	<u>0.30</u>

<u>Stages, Studios</u>	<u>0.50</u>
<u>Storage Rooms</u>	<u>0.05</u>
<u>Swimming Pools – (pool and deck area)</u>	<u>0.50</u>
<u>Telecommunication Call Centers/Data Entry Spaces</u>	<u>0.25</u>
<u>Theater – (lobbies)</u>	<u>0.18</u>
<u>Ticket Booths</u>	<u>0.25</u>
<u>Training Shops – (wood, metal, and auto training)</u>	<u>0.25</u>
<u>Transportation Platforms</u>	<u>1.00</u>
<u>Transportation Waiting Rooms</u>	<u>0.20</u>
<u>Warehouses</u>	<u>0.05</u>
<u>Wood and Metal Shops</u>	<u>0.25</u>

**FOOTNOTES FOR TABLE 4-1**

- 1** Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be made by the Authority Having Jurisdiction.
- 2** Based on net occupiable space. The minimum amount of outdoor air supplied during occupancy shall be permitted to be based on the rate per square foot (m<sup>2</sup>) of floor area indicated in Table 4-1 or cfm (L/s) per person in accordance with nationally recognized standards. Controls shall be permitted to adjust outdoor air ventilation rates to provide equivalent rates per person under different conditions of occupancy.
- 3** The exhaust air minus the sum of the outdoor air and transfer air from adjacent spaces shall be sufficient to provide a negative pressure with respect to adjoining spaces.
- 4** Normally supplied by transfer air with local mechanical exhaust with no recirculation.
- 5** Independent of room size.
- 6** Where there is fixed seating, use 6 cfm/seat.
- 7** Not less than 15 cfm (7.08 L/s) per person. Occupancy shall be based on the number of bedrooms: first bedroom = two persons, each additional bedroom = one person. Air quantities from natural ventilation are considered adequate if operable window option is provided.
- 8** Conformance to applicable state and federal licensing standards will be acceptable in complying with this code.
- 9** Natural ventilation provided as per Chapter 12 of the Houston Building Code is an acceptable alternative.
- 10** The rates in this table are allowed to be intermittent operation.

**{EDITOR’S NOTE: DELETE TABLES 4-2, 4-3, AND 4-4 IN THEIR ENTIRETY.}**

## CHAPTER 5 EXHAUST SYSTEMS

### 502.0 Definitions.

**COMPENSATING HOOD.** A hood that has an outside-air supply with air delivered ~~below or within~~ the hood. When makeup air is diffused directly into the exhaust within the hood cavity, it becomes a short-circuit hood.

{EDITOR'S NOTE: REMAINDER OF SECTION 502.0 REMAINS UNCHANGED.}

**503.1 General.** Motors and fans shall be sized to provide the required air movement. Motors in areas that contain flammable vapors or dusts shall be of a type approved for such environments. A manually operated remote control installed at an approved location shall be provided to shut off fans or blowers in flammable vapor or dust systems. Electrical equipment used in operations that generate explosive or flammable vapors, fumes, or dusts shall be interlocked with the ventilation system so that the equipment cannot be operated unless the ventilation fans are in operation. Motors for fans used to convey flammable vapors or dusts shall be located outside the duct or shall be protected with approved shields and dustproofing. Motors and fans shall be accessible for servicing and maintenance. Motors and fans located on roofs shall be accessible as specified in Section 904.10.3. A toilet exhaust fan shall automatically shut down when the associated air-handling units serving that space shut down.

**504.1 Makeup and Exhaust-Air Ducts.** Environmental air ducts not regulated by other provisions of this code shall comply with this section. Ducts shall be substantially airtight and comply with the provisions of Chapter 6. ~~Exhaust ducts shall not extend into or through ducts or plenums.~~ Exhaust ducts shall terminate outside the building and shall be equipped with back-draft dampers. Environmental air ducts that have an alternate function as a part of an approved smoke-control system do not require design as Class 1 product-conveying ducts.

**504.2 Domestic Range Vents.** Ducts used for domestic kitchen range ventilation shall be of metal and shall have smooth interior surfaces. Ducts for domestic range hoods shall only serve cooking appliances. Up draft vents do not require backdraft dampers. Vents shall terminate a minimum of 9 inches above grade.

**Exception:** Ducts for domestic kitchen downdraft grill-range ventilation installed under a concrete slab floor may be of approved Schedule 40 PVC provided:

- (1) The under-floor trench in which the duct is installed shall be completely backfilled with sand or gravel.
- (2) Not more than ~~one (1) six (6) inches (25.4 mm) (152.4 mm)~~ of a six (6) inch diameter (152 mm) PVC coupling may protrude above the concrete floor surface.

- (3) PVC pipe joints shall be solvent cemented to provided an air- and grease-tight duct.
- (4) The duct shall terminate a minimum of 12 inches above grade outside the building and shall be equipped with a backdraft damper.

**504.3.1 Moisture Exhaust Ducts.** Moisture exhaust ducts shall terminate on the outside of the building a minimum of 9 inches above grade and shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination. Ducts for exhausting clothes dryers shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the flow. Clothes dryer moisture exhaust ducts shall not be connected to a gas vent connector, gas vent, or chimney, and shall only serve clothes dryers. Clothes dryer moisture exhaust ducts shall not extend into or through ducts or plenums.

**504.3.2.2 Length Limitation.** Unless otherwise permitted or required by the dryer manufacturer's installation instructions and approved by the Authority Having Jurisdiction, domestic dryer moisture exhaust ducts shall not exceed a total combined horizontal and vertical length of fourteen (14) feet (4,263 mm), including two (2) 90 degree (1.57 rad) elbows, of 25 feet for 4 inch diameter duct, and 40 feet for 5-inch diameter duct. Two (2) feet (610 mm) shall be deducted for each 90-degree (1.57 rad) elbow in excess of two. For duct lengths in excess of 40 feet, a system designed by a registered professional engineer licensed to practice as such in the State of Texas is required.

**504.6 Gypsum Wallboard Ducts.** Bathroom and laundry room exhaust ducts and other environmental air ducts shall not may be constructed of gypsum wallboard—subject to the limitations of Section 602.1.

**504.7 Nail Salon Exhaust.** Nail Salons shall be exhausted to the exterior of the building at a rate of 200 cfm and provided with .22 cfm of outside makeup air per salon station. Each room provided with an exhaust system shall have air supplied to the room equal to 80% of the amount of air to be exhausted. When a stand-alone makeup air system is provided, it shall be interlocked to the exhaust fans.

**504.8 Exhaust Duct Termination.** Exhaust ducts shall terminate outside the building unless otherwise approved by the Authority Having Jurisdiction.

**505.1 General.** A mechanical ventilation or exhaust system shall be installed to control, capture, and remove emissions generated from product use or handling when required by the ~~Building Construction Code~~ or Fire Code and when such emissions result in a hazard to life or property. The design of the system shall be such that the emissions are confined to the area in which they are generated by air currents, hoods, or enclosures and shall be exhausted by a duct system to a safe location or treated by removing contaminants. Ducts conveying explosives or flammable vapors, fumes, or dusts shall

extend directly to the exterior of the building without entering other spaces ~~and shall not extend into or through ducts and plenums.~~

**Exception:** Ducts conveying vapor or fumes having flammable constituents less than 25 percent of their lower flammability limit (LFL) may pass through other spaces.

**505.3 Makeup Air.** Makeup air shall be provided to replenish air exhausted by the ventilation system. Makeup-air intakes shall be located so as to avoid recirculation of contaminated air ~~within enclosures.~~

**505.4 Hoods and Enclosures.** Hoods and enclosures shall be used when contaminants originate in a concentrated area. The design of the hood or enclosure shall be such that air currents created by the exhaust systems will capture the contaminants and transport them directly to the exhaust duct. The volume of air shall be sufficient to dilute explosive or flammable vapors, fumes, or dusts as set forth in Section 505.2. Hoods of steel shall have a base metal thickness not less than 0.027 inch (0.69 mm) (No. 22 gauge) for Class 1 and Class 5 metal duct systems; 0.033 inch (0.84 mm) (No. 20 gauge) for hoods serving a Class 2 duct system; 0.044 inch (1.12 mm) (No. 18 gauge) for hoods serving a Class 3 duct system; and 0.068 inch (1.73 mm) (No. 14 gauge) for hoods serving a Class 4 duct system.

Approved nonmetallic hoods and duct systems may be used for Class 5 corrosive systems when the corrosive mixture is nonflammable. ~~Metal hoods used with Class 5 duct systems shall be protected with suitable corrosion-resistant material.~~ Edges of hoods shall be rounded. The minimum clearance between hoods and combustible construction shall be the clearance required by the duct system.

**505.5 Exhaust Duct Termination.** Exhaust ducts shall terminate outside the building unless otherwise approved by the Authority Having Jurisdiction.

**506.1 Materials.** Materials used in product-conveying duct systems shall be suitable for the intended use and shall be of metal.

**Exceptions:**

- (1) Asbestos-cement, concrete, clay, or ceramic materials may be used when it is shown that these materials will be equivalent to metal ducts installed in accordance with this chapter.
- (2) Ducts serving a Class 5 system may be constructed of approved nonmetallic material when the corrosive characteristics of the material being conveyed make a metal system unsuitable and when the mixture being conveyed is nonflammable.

Approved nonmetallic material shall be either a listed product having a flame-spread index of twenty-five (25) or less and a smoke-developed rating of fifty (50) or less on both inside and outside surfaces without evidence of continued progressive combustion, or shall have a flame-spread index of twenty-five (25) or

less and shall be installed with an automatic fire-sprinkler protection system inside the duct.

- (3) Ducts used in central vacuum cleaning systems within a dwelling unit ~~shall~~ may be constructed of PVC pipe or other materials in compliance with the applicable standards referenced in Chapter 17. Penetrations of fire walls or floor-ceiling or roof-ceiling assemblies shall comply with the Building Code.

Copper or ferrous pipes or conduits extending from within the separation between a garage and dwelling unit to the central vacuuming unit may be used.

Aluminum ducts shall not be used in systems conveying flammable vapors, fumes, or explosive dusts, nor in Class 2, 3, or 4 systems. Galvanized steel and aluminum ducts shall not be used when the temperature of the material being conveyed exceeds 400°F (205°C).

~~Metal ducts used in Class 5 systems that are not resistant to the corrosiveness of the product shall be protected with appropriate corrosion resistant material.~~

~~If a room or building contains a dust explosion hazard that is external to protected equipment, as defined in 2.2.3.1 of NFPA 654, such areas shall be provided with deflagration venting to a safe outside location.~~

**506.2 Construction.** Ducts used for conveying products shall be of substantial airtight construction and shall not have openings other than those required for operation and maintenance of the system. Ducts constructed of steel shall comply with Table 5-5 or 5-6.

**Exceptions:**

- (1) Class 1 product-conveying ducts that operate at less than four (4) inches water column (995.6 Pa) negative pressure and convey noncorrosive, nonflammable, and nonexplosive materials at temperatures not exceeding 250°F (121°C) may be constructed in accordance with Tables 6-1, 6-2, 6-3, 6-4, 6-5, 6-7, 6-8, or, with prior approval, UMC Standard No. 6-2.
- (2) Ducts used in central vacuuming systems within a dwelling unit ~~shall~~ may be constructed of PVC or other materials in compliance with the applicable standards referenced in Chapter 17. Penetrations of fire-resistive walls, or floor-ceiling or roof-ceiling assemblies shall comply with the Building Code. Copper or ferrous pipes or conduit extending from within the separation between a garage and dwelling unit to the central vacuum unit may be used.

The use of rectangular ducts conveying particulates shall be subject to approval of the building official. The design of rectangular ducts shall consider the adhesiveness and buildup of products being conveyed within the duct.

Aluminum construction may be used in Class 1 duct systems only. The thickness of aluminum ducts shall be at least two Brown and Sharpe gauges thicker than the gauges required for steel ducts set forth in Tables 5-5 and 5-6.

**506.4 Explosion Venting.** Ducts conveying explosive dusts shall have explosion vents, openings protected by ant flashback swing valves, or rupture diaphragms. Openings to relieve explosive forces shall be located outside the building. When relief devices cannot provide sufficient pressure relief, ductwork shall be designed to withstand an internal pressure of not less than 100 pounds per square inch (689 kPa).

~~—If a room or building contains a dust explosion hazard that is external to protected equipment, as defined in 2.2.3.1 of NFPA 654, such areas shall be provided with deflagration venting to a safe outside location.~~

**506.5.1** Duct supports shall be designed to carry the weight of the duct half filled with material. Where sprinkler protection is provided in the duct, the hanger's design shall include the weight of the duct half filled with water or with the material being conveyed, whichever has the higher density. Loads shall not be placed on connecting equipment.

~~**Exception:** Where adequate drainage is provided, the weight of the water shall not require consideration.~~

~~{EDITOR'S NOTE: DELETE REMAINDER OF SECTION 506.5.}~~

~~{EDITOR'S NOTE: DELETE AND RESERVE SECTION 506.6.}~~

**507.1** Cooking equipment used in processes producing smoke or grease-laden vapors shall be equipped with an exhaust system that complies with all the equipment and performance requirements of this ~~Code standard, and all such equipment and performance shall be maintained per this standard during all periods of operation of the cooking equipment.~~ Specifically, the following equipment shall be kept in good working condition:

- ~~(A) Cooking equipment~~
- ~~(B) Hoods~~
- ~~(C) Ducts (if applicable)~~
- ~~(D) Fans~~
- ~~(E) Fire suppression systems~~
- ~~(F) Special effluent or energy control equipment~~

~~—All airflows shall be maintained. Maintenance and repairs shall be performed on all components at interval necessary to maintain these conditions.~~

~~**507.1.2** Multiple tenancy applications shall require the concerted cooperation of design, installation, operation, and maintenance responsibilities by tenants and by the building owner.~~

**507.1.3~~2~~** All interior surfaces of the exhaust system shall be reasonably accessible for cleaning and inspection purposes.

~~**507.1.4** Cooking equipment used in fixed, mobile, or temporary concessions, such as trucks, buses, trailers, pavilions, tents, or any form of roofed enclosure, shall comply with this standard unless all or part of the installation is exempted by the Authority Having Jurisdiction~~

**507.1.5~~3~~** Cooking equipment that has been listed in accordance with UL 197 or an equivalent standard for reduced emissions shall not be required to be provided with an exhaust system. [NFPA 96: 4.1.1.1]

~~**507.1.6** The listing evaluation of cooking equipment covered by section 507.1.5 shall demonstrate that the grease discharge at the exhaust duct of a test hood placed over the appliance shall not exceed 5 mg/m<sup>3</sup> when operated with a total airflow of 0.236 cubic meters per second (500 dm). [NFPA 96 4.1.1.2]~~

**507.2.1** Except where enclosures are required, hoods, grease removal devices, exhaust fans, and ducts shall have a clearance of at least eighteen (18) inches (457.2 mm) to combustible material, three (3) inches (76.2 mm) to limited combustible material, and 0 inches (0 mm) to noncombustible material.

~~**Exception No. 1:** Where the hood, duct, or grease removal device is listed for lesser clearances When using listed materials, clearances shall be as provided in the manufacturer's installation instructions.~~

**Exception No. 2:** Reduced clearance to combustible material if the combustible material is protected as follows:

- (a) 0.013 inch (0.33 mm) (no. 28 gauge) sheet metal spaced out one (1) inch (25.4 mm) on noncombustible spacers shall have nine (9) inch (228.6 mm) clearance to combustible material.
- (b) 0.027 inch (0.69 mm) (No. 22 gauge) sheet metal on one (1) inch (25.4 mm) mineral wool batts or ceramic fiber blanket reinforced with wire mesh or equivalent spaced out one (1) inch (25.4 mm) on noncombustible spacers shall have three (3) inch (76.2 mm) clearance to combustible material.

**Exception No. 3:** Reduced clearance to limited-combustible materials to zero clearance where protected by metal lath and plaster, ceramic tile, quarry tile, other noncombustible materials or assembly of noncombustible materials, or materials and products that are listed for the purpose of reducing clearance and are acceptable to the Authority Having Jurisdiction. The listed materials shall be installed in accordance with the conditions of the listing and the manufacturer's instructions and shall be acceptable to the Authority Having Jurisdiction.

**507.2.3 Field-Applied and Factory Built Grease Duct Enclosures.** ~~Field-applied grease duct enclosures and factory built grease duct enclosures shall listed in accordance with UL 2221, Standard for Tests of Fire Resistive Grease Duct~~

~~Enclosure Assemblies, or equivalent standard and installed in accordance with the manufacturer's instructions and the listing requirements. [NFPA 96: 4.3.1] Factory-built grease duct enclosures shall be protected with a through-penetration firestop system classified in accordance with ASTM E814 having an "F" and "T" rating equal to the fire resistance rating of the assembly being penetrated from the point at which the duct penetrates a ceiling, wall, or floor to the outlet terminal. The factory-built grease duct protection system shall be listed in accordance with UL 2221, *Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies* and installed in accordance with the manufacturer's instructions and the listing requirements. [NFPA 96: 4.3.3, 4.3.3.1, 4.3.3.2]~~

~~Field-applied grease duct enclosures shall be protected with a through penetration firestop system classified in accordance with ASTM E814 having an "F" and "T" rating equal to the fire resistance rating of the assembly being penetrated. The surface of the field fabricated grease duct shall be continuously covered on all sides from the point at which the duct enclosure penetrates a ceiling, wall, or floor to the outlet terminal, listed in accordance with ASTM E 2336 *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems*, and installed in accordance with the manufacturer's instructions and the listing requirements. [NFPA 96: 4.3.1, 4.3.1.1, 4.3.1.2]~~

~~**507.4** If required by the Authority Having Jurisdiction, notification in writing shall be given of A permit shall be required for any alteration, replacement, or relocation of any exhaust or extinguishing system or part thereof or cooking equipment. Satisfaction shall be provided to the Authority Having Jurisdiction that the complete exhaust system as addressed in this standard is installed and operable in accordance with the approved design and the manufacturer's instructions.~~

~~**508.1 Where Required.** Type 1 hHoods shall be installed at or above all commercial-type deep fat fryers, broilers, fry grills, steam-jacketed kettles, hot-top ranges, ovens, barbecues, solid-fuel burning appliances, rotisseries, dishwashing machines, and similar equipment that produces comparable amounts of steam, smoke, grease, or heat in a food-processing establishment to collect and remove the grease and smoke. For the purpose of this section, a food processing establishment shall include any building or portion thereof used for the processing of food, but shall not include a dwelling unit.~~

~~Type 2 hoods shall be installed at or above other commercial-type ovens, rotisseries, and dishwashing machines.~~

~~**Exceptions:**~~

- ~~(1) Direct vent dishwashers connected to an approved exhaust system.~~
- ~~(2) Under counter, and enclosed single-batch low temperature chemical dishwashers (maximum 135E F).~~

**Exceptions for both type 1 and 2 hoods:**

(3) This requirement shall not apply to domestic type cooking equipment located in daycare facilities, churches, employee lunchrooms, or similar uses that are no more hazardous than kitchen facilities in an individual dwelling unit.

(4) Listed convection ovens.

**508.1.1 Construction.** The hood or that portion of a primary collection means designed for collecting cooking vapors and residues shall be constructed of and be supported by steel not less than 0.043 inch (1.09 mm) (No. 18 MSG) in thickness, stainless steel not less than 0.037 inch (0.94 mm) (No. 20 MSG) in thickness, or other approved material of equivalent strength and fire and corrosion resistance.

**Exceptions:**

(1) Listed exhaust hoods with or without exhaust dampers.

(2) Type II hoods shall be constructed of at least 0.024 inch (0.61 mm) (No. 24 gauge) steel. Hoods constructed of copper shall be of copper sheets weighing at least twenty-four (24) ounces per square foot (7.32 kg/m<sup>2</sup>). Joints and seams shall be substantially tight. Solder shall not be used except for sealing a joint or seam on copper hoods.

All hoods shall be secured in place by noncombustible supports.

**508.4.1.1 Capacity of Hoods.** Canopy-type commercial cooking hoods shall exhaust through the hood a minimum quantity of air determined by application of the following formulas:

*WHERE:*

*A* = the horizontal surface area of the hood, in square feet (m<sup>2</sup>).

*P* = that part of the perimeter of the hood that is open, in feet (mm).

*D* = distance in feet (mm) between the lower lip of the hood and the cooking surface.

*Q* = quantity of air, in cubic feet per minute (L/s).

When cooking equipment is installed back to back and is covered by a common island-type hood, the airflow required may be calculated using the formula for three sides exposed. Type II hood airflow requirements shall be in accordance with the requirements for low-temperature appliance hoods. When all appliances are electric, the airflow required may be reduced to 80 percent of the formula value.

**510.1.1** Ducts shall not pass through fire walls or fire partitions.

**Exception:** Steel supply and exhaust ducts may be protected with a duct wrap material approved for such use, that provides an equivalent fire-rating when installed in accordance with the manufacturer's specifications and an in approved fire-rated design, including through-penetration fire-stop and sealants.

A letter sealed by the design professional or a special inspector certifying compliance with the fire-rated design and manufacturer's installation requirements for the finished installation must be provided to the authority having jurisdiction.

**510.1.4** All ducts shall be installed without forming dips or traps that might collect residues. In manifold (common duct) systems, the lowest end of the main duct shall be connected flush on the bottom with the branch duct. Duct systems serving a Type I hood shall be so constructed and installed that grease cannot become pocketed in any portion thereof, and the system shall slope not less than 1/4 inch per lineal foot (21 mm/m) toward the hood or toward an approved grease reservoir. ~~Where horizontal ducts exceed seventy-five (75) feet (22,860 mm) in length, the slope shall be not less than one (1) inch per lineal foot (83 mm/m).~~

**510.1.6** A sign shall be placed on all duct access panels stating the following:

**ACCESS PANEL—DO NOT OBSTRUCT**

**510.1.8 Ducts, Non-Grease.** Ducts and plenums serving Type II hoods shall be constructed of rigid metallic materials as set forth in Chapter 6. Duct bracing and supports shall comply with Chapter 6. ~~Ducts subject to positive pressure shall be adequately sealed.~~ Ducts serving dishwasher exhaust shall be liquid tight and shall be constructed of aluminum or not less than 304 stainless steel.

**510.3.4.1 Horizontal Ducts.** On horizontal ducts, at least one 20 inch by 20 inch (508 mm by 508 mm) opening shall be provided at twelve-foot intervals. ~~for personnel entry. Additionally, an access door shall be provided within two feet of any change in direction.~~ [NFPA 96: 7.4.1.1]

**510.3.4.1.1** ~~Horizontal ducting shall be secured sufficiently to allow for the weight of personnel entry into the duct. Where an opening of this size is not possible, openings large enough to permit thorough cleaning shall be provided at twelve (12) foot (3.7 m) intervals.~~ [NFPA 96: 7.4.1.3]

**510.3.4.1.2** ~~Support systems for horizontal grease duct systems 609 mm (24 in.) and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 363 kg (800 lb) at any point in the duct systems.~~ [NFPA 96: 7.4.1.3]

**510.3.4.3 Vertical Ducts.** Adequate access for cleaning shall be provided on each floor at no more than 15-foot intervals. ~~On vertical ductwork where personnel entry is possible, access shall be provided at the top of the vertical riser to accommodate descent.~~ [NFPA 96: 7.4.2.1]

~~510.3.4.3.1 Where personnel entry is not possible, adequate access for cleaning shall be provided on each floor. [NFPA 96: 7.4.2.2]~~

**510.5.2.2 Butt-weld, welded flange or overlapping duct connections** of either the telescoping or the bell type shall be used for welded field joints, ~~not butt-weld connections~~. The inside duct section shall always be uphill of the outside duct section. The difference between inside dimensions of overlapping sections shall not exceed 1/4 inch (6.4 mm). The overlap shall not exceed two (2) inches (50.8 mm). (See Figure 5-3.)

**{EDITOR'S NOTE: DELETE AND RESERVE SECTIONS 510.7.3.1 AND 510.7.3.2.}**

**510.7.5** If openings in the enclosure walls are provided, they shall be protected by approved self-closing fire doors of proper rating. Fire doors shall be installed in accordance with NFPA 80, Standard for Fire Doors and Fire Windows. Openings on other listed materials or products shall be clearly identified and labeled according to the terms of the listing and the manufacturer's instructions and shall be acceptable to the Authority Having Jurisdiction. The panels shall be ~~readily~~ accessible.

### **510.8.2 Rooftop Terminations.**

**510.8.2.1** Rooftop terminations shall be arranged with or provided with the following:

**(A)** A minimum of ten (10) feet (3.05 m) of clearance from the outlet to adjacent buildings, property lines, and air intakes. Where space limitations absolutely prevent a ten (10) foot (3.05 m) horizontal separation from an air intake, a vertical separation shall be permitted, with the exhaust outlet being a minimum of three (3) feet (0.92 m) above any air intake located within ten (10) feet (3.05 m) horizontally.

#### **Exceptions:**

**(1)** Exhaust outlets for grease ducts serving commercial food heat-processing equipment may terminate not less than five (5) feet (1524 mm) from an adjacent building, adjacent property line or air intake opening into a building if the air from the exhaust outlet is discharged away from such locations.

**(2)** Upon approval of the Authority having jurisdiction, the exhaust from any hood serving commercial food heat-processing equipment may terminate in a properly engineered air recovery system for recirculation to the room in which the hood is located.

**(B)** The exhaust flow directed up and away from the surface of the roof and a minimum of forty (40) inches (1.02 m) above the roof surface.

- (C) The ability to drain grease out of any traps or low points formed in the fan or duct near the termination of the system into a collection container that is noncombustible, closed, rainproof, structurally sound for the service to which it is applied, and will not sustain combustion. A grease collection device that is applied to exhaust systems shall not inhibit the performance of any fan.

**Exception:** Grease containers that are evaluated for equivalency with the preceding requirements and listed as such.

- (D) A listed grease duct complying with Section 510.4, or with ductwork complying with Section 510.5.
- (E) A hinged upblast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit proper inspection and cleaning that is listed for commercial cooking equipment, provided the ductwork extends a minimum of eighteen (18) inches (457.2 mm) above the roof surface and the fan discharges a minimum of forty (40) inches (1.02m) above the roof surface. (See Section 511.1.1.)
- (F) Other approved fan, provided (1) it meets the requirements of Sections 510.8.2(C) and 511.1.3, and (2) its discharge or its extended duct discharge meets the requirements of Section 510.8.2(B).

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 510.8.2.2.}

### 511.1 Exhaust Fans for Commercial Cooking Equipment.

Where solid-fuel cooking equipment is to be vented, the duct system shall comply with Section 517.0. All fans used for grease exhaust shall be listed for their intended use.

**511.1.2.1** Listed in-line fans shall be of the type with the motor located outside the airstream and with belts and pulleys protected from the airstream by a grease tight housing. They shall be connected to the exhaust duct by flanges securely bolted as shown in Figure 5-6(a), or by a system specifically listed for such use. Flexible connectors shall not be used.

{EDITOR'S NOTE: DELETE AND RESERVE SECTIONS 511.1.4.}

**511.2.2** Exhaust-air volumes for hoods shall be of sufficient level to provide for capture and removal of grease-laden cooking vapors. ~~Test data, performance acceptable to the Authority Having Jurisdiction, or both, shall be provided, displayed, or both, upon request.~~

{EDITOR'S NOTE: DELETE SECTION 511.3 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**511.3 Makeup Air.** Each room provided with an exhaust system shall have air supplied to the room that is a minimum of 95% of the amount of air to be exhausted. Supplied air may be transferred from adjacent conditioned spaces. Makeup diffusers shall be located to prevent a short-circuiting of air to the exhaust system. Exterior windows and doors shall not be used for the purpose of providing makeup air. The exhaust and makeup air systems shall be connected by an electrical interlocking switch. Compensating hoods shall meet the airflow requirements specified in Sections 508.4.1.3 through 508.4.1.5. Compensating hoods shall extract at least twenty percent (20%) of their required exhaust airflow from the kitchen area.

**Exceptions:**

- ~~(1) When its fire-extinguishing system discharges, makeup air supplied internally to a hood shall be shut off.~~
- ~~(2) Compensating hoods shall meet the airflow requirements specified in Sections 508.4.1.3 through 508.4.1.5. Compensating hoods shall extract at least 20 percent of their required exhaust airflow from the kitchen area.~~

**511.4.1** Master kitchen exhaust ducts that serve multiple tenants shall include provision to bleed air from outdoors or from adjacent spaces into the master exhaust duct where required to maintain the necessary minimum air ~~velocity~~ quantity in the master exhaust duct.

**513.5 Manual Activation.**

{EDITOR'S NOTE: DELETE REMAINDER OF SECTION 513.5 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**513.5.1** A readily accessible means for manual activation shall be located between forty-two (42) inches and forty-eight (48) inches (1,067 mm and 1,219 mm) above the floor, located in a path of exit or egress, and shall clearly identify the hazard protected. A manual actuation device shall be located a minimum of ten (10) feet (3 m) when possible and a maximum of twenty (20) feet (6 m) from the protected kitchen appliance(s) within the path of egress. Manual actuation using a cable-operated pull station shall not require more than forty (40) pounds (178 N) of force, with a pull movement not to exceed fourteen (14) inches (356 mm) to actuate the fire suppression system. The automatic and manual means of system activation external to the control head or releasing device shall be separate and independent of each other so that failure of one will not impair the operation of the other.

**513.5.2** The manual means of system activation shall be permitted to be common with the automatic means if the manual activation device is located between the control head or releasing device and the first fusible link.

513.5.3 An automatic sprinkler system shall not require a manual means of system activation.

513.5.4 The means for manual actuator(s) shall be mechanical or rely on electrical power for actuation.

513.5.5 Electrical power shall be permitted to be used for manual activation if a standby power supply is provided or if supervision is provided in accordance with Section 513.7.

#### **514.0 Procedures for the Use and Maintenance of Equipment.**

For the purpose of enforcement the building owner is responsible for compliance with all operating and maintenance procedures specified in this Code and by the manufacturer. Compliance with and enforcement of operating and maintenance procedures listed in the following sections is the responsibility of the building owner.

#### **514.5 Cooking Equipment Maintenance. [NFPA 96:11.5]**

514.5.1 An inspection and servicing of the cooking equipment shall be made at least annually by properly trained and qualified persons. [NFPA 96:11.5.1]

514.5.2 Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles or charbroilers, shall be inspected and, if found with grease accumulation, cleaned by a properly trained, qualified, and certified person acceptable to the Authority Having Jurisdiction. [NFPA 96:11.5.2]

#### **514.6 Recirculating Systems Use and Maintenance.**

514.6.1 Automatic or manual covers on cooking appliances, especially fryers, shall not interfere with the application of the fire suppression system.

514.6.2 All filters shall be cleaned or replaced in accordance with the manufacturer's instructions.

514.6.3 All electrostatic precipitators (ESP)s shall be cleaned a minimum of once per week following manufacturer's cleaning instructions.

514.6.4 The entire hood plenum and the blower section shall be cleaned a minimum of once every three (3) months.

514.6.5 Inspection and testing of the total operation and all safety interlocks in accordance with the manufacturer's instructions shall be performed by qualified service personnel a minimum of once every six (6) months, or more frequently if required.

**Exception:** Fire-extinguishing equipment shall be inspected in accordance with Section 514.2.

**514.6.6** A signed and dated log of maintenance as performed in accordance with Sections 516.6.4 and 516.6.5 shall be available on the premises for use by the Authority Having Jurisdiction.

{**EDITOR'S NOTE: DELETE SECTION 515.3** IN ITS ENTIRETY.}

{**EDITOR'S NOTE: DELETE SECTION 516.6** IN ITS ENTIRETY.}

**517.6.1** A replacement or makeup-air system shall be provided to ensure a positive supply of replacement air at all times during cooking operations, as specified by Section 511.3.

**517.8.1** Metal-fabricated solid-fuel cooking appliances shall be listed for the application where produced in practical quantities or shall be approved by the Authority Having Jurisdiction. When listed, they shall be installed in accordance with the terms of their listings and with the applicable requirements of this code standard.

## CHAPTER 6 DUCT SYSTEMS

{EDITOR'S NOTE: DELETE SECTION 601.2 IN ITS ENTIRETY.}

**602.1 General.** Supply air, return air, and outside air for heating, cooling, or evaporative cooling systems shall be conducted through duct systems constructed of metal as set forth in Tables 6-1, 6-2, 6-3, 6-4, 6-7, 6-8, 6-9, and 6-10, or metal ducts complying with UMC Standard No. 6-2 or the referenced HVAC duct construction standard in Chapter 17. Rectangular ducts in excess of two (2) inches w.g. shall comply with UMC Standard No. 6-2 or the referenced HVAC duct construction standard in Chapter 17. Ducts, plenums, and fittings may be constructed of concrete, clay, or ceramics when installed in the ground or in a concrete slab, provided the joints are tightly sealed.

Corridors shall not be used to convey air to or from rooms ~~if the corridor is required to be of fire resistive construction~~ except when allowed by per the Building Code.

Concealed building spaces or independent construction within buildings may be used as ~~ducts or return air~~ plenums.

When gypsum products are exposed in ducts or plenums, the air temperature shall be restricted to a range from 50°F (10°C) to 125°F (52°C), and moisture content shall be controlled so that the material is not adversely affected. For the purpose of this section, gypsum products shall not be ~~exposed in~~ used as ducts serving as supply from evaporative coolers, and in other air handling systems regulated by this chapter when the temperature of the gypsum product will be below the dew point temperature.

See Chapter 8 for limitations on combustion products venting systems extending into or through ducts or plenums.

See Chapter 5 for limitations on environmental air systems exhaust ducts extending into or through ducts ~~or plenums.~~

Exhaust ducts under positive pressure and venting systems shall not extend into or pass through ducts ~~or plenums.~~ For appliance vents and chimneys, see Chapter 8.

**602.2 Combustibles Within Ducts or Plenums.** Materials exposed within ducts or plenums shall be noncombustible or shall have a flame spread index not greater than twenty-five (25) and a smoke developed index not greater than fifty (50), when tested as a composite product in general accordance with one of the following test methods: NFPA 255, Method of Test of Surface Burning Characteristics of Building Materials, ASTM E84, Surface Burning Characteristics of Building Materials, or UL 723, Test for Surface Burning Characteristics of Building Materials, or CAN/ULC S102.2-M88, Standard Method of Test For Surface Burning Characteristics of Floor Coverings, and Miscellaneous Materials and Assemblies, except as indicated below.

**Exceptions:**

- (1) Return-air and outside-air ducts, plenums, or concealed spaces that serve a dwelling unit shall be permitted to be of combustible construction. Floor joists or trusses shall not be located within a return air plenum.
- (2) Air filters meeting the requirements of Sections 312.0 and 503.3.
- (3) Water evaporation media in an evaporative cooler.
- (4) Charcoal filters when protected with an approved fire suppression system.
- (5) Electrical wiring in plenums shall comply with NFPA 70, National Electrical Code. Electrical wires and cables and optical fiber cables shall be listed and labeled as suitable for use in plenums and shall have a flame spread distance not greater than five (5) feet (1,524 mm), an average optical density not greater than 0.15, and a peak optical density not greater than 0.5, when tested in accordance with NFPA 262, Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

**Exception:** Except in computer/data processing rooms.

- (6) Nonmetallic ~~fire-sprinkler~~ piping in plenums shall be listed and labeled as suitable for use in plenums and shall have a flame spread distance not greater than five (5) feet (1,524 mm), an average optical density not greater than 0.15, and a peak optical density not greater than 0.5, when tested in accordance with UL 1887, Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.
- (7) Nonmetallic pneumatic tubing in plenums shall be listed and labeled as suitable for use in plenums and shall have a flame spread distance not greater than five (5) feet (1,524mm), an average optical density not greater than 0.15, and a peak optical density not greater than 0.5, when tested in accordance with UL 1820, Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics.
- (8) Loudspeakers and recessed lighting fixtures, including their assemblies and accessories, in plenums shall be listed and labeled as suitable for use in plenums and shall have a peak rate of heat release not greater than 100 kilowatts, an average optical density not greater than 0.15, and a peak optical density not greater than 0.5, when tested in accordance with UL 2043, Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.
- (9) Smoke detectors.
- (10) Duct insulation, coverings, and linings and other supplementary materials complying with Section 605.0.
- (11) Materials in a Group H-5, ~~Division 6~~, HPM fabrication area including the areas above and below the fabrication area sharing a common air recirculation path with the fabrication area.

- (12) Miscellaneous systems components of predominantly CPVC construction, including valve handles, that accumulatively do not exceed one pound of plastic material in any one hundred cubic feet volume of a return air plenum.

**602.4 Joints and Seams of Ducts.** Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing, or other means. Sealant materials and methods of assemblage shall be in accordance with the manufacturer's instructions and conform to SMACNA Method A.

Crimp joints for round ducts shall have a contact lap of at least 1-1/2 inch (38mm) and shall be mechanically fastened by means of at least three (3) sheet-metal screws equally spaced around the joint, or an equivalent fastening method.

Joints and seams for 0.016 inch (0.41 mm) (No. 28 gauge) and 0.013 inch (0.33 mm) (No. 30 gauge) residential rectangular ducts shall be as specified in Table 6-1 for 0.019 inch (0.48 mm) (No. 26 gauge) material.

Joints and seams for rectangular duct systems shall be as specified in Table 6-1.

Joints and seams for flat oval ducts and round ducts in other than single-dwelling units shall be as specified in Table 6-8.

Joints and seams and all reinforcements for factory-made air ducts and plenums shall meet with the conditions of prior approval in accordance with the installation instructions that shall accompany the product. Closure systems for rigid air ducts and plenums shall be listed in accordance with UL 181A, Standard for Closure Systems for Use with Rigid Air Ducts and Air Connectors. Closure systems for flexible air ducts shall be listed in accordance with UL 181B, Standard for Closure Systems for Use with Flexible Air Ducts and Air Connectors.

**602.5 Metal.** Every duct, plenum, or fitting of metal shall comply with Table 6-1 or 6-8.

**Exceptions:**

- (1) Ducts, plenums, and fittings for systems serving single-dwelling units may comply with Table 6-9.
- (2) Duct systems complying with UMC Standard 6-2 or the referenced HVAC duct construction standard in Chapter 17, with prior approval, or duct systems complying with UL 181, Standard for Factory-Made Air Ducts and Air Connectors.
- (3) Duct systems complying with the UMC Standard 6-2 or the referenced HVAC duct construction standard in Chapter 17, ~~with prior approval.~~

**604.5 Support of Ducts.** Installers shall provide the manufacturer's field fabrication and installation instructions to the Authority Having Jurisdiction.

In the absence of specific supporting materials and spacing, approved factory-made air ducts may be installed as set forth in Table 6-10.

{EDITOR'S NOTE: DELETE SECTION 604.6 IN ITS ENTIRETY.}

### 605.0 Insulation of Ducts.

Supply- and return-air ducts and plenums of a heating or cooling system shall be insulated to achieve the minimum thermal (R) value as set forth in Tables 6-6-A and B.

#### Exceptions:

- (A) Factory-installed plenums, casings, or ductwork furnished as a part of HVAC equipment tested and rated in accordance with approved energy efficiency standards.
- (B) Ducts or plenums located in conditioned spaces.
- (C) For runouts less than ten (10) feet (3 m) in length to air terminals or air outlets, the rated R-value of insulation need not exceed R-3.5 (R-0.6).
- (D) Backs of air outlets and outlet plenums exposed to unconditioned or indirectly conditioned spaces with face areas exceeding five (5) square feet (0.5 m<sup>2</sup>) need not exceed R-2 (R-0.4); those five (5) square feet (0.5 m<sup>2</sup>) or smaller need not be insulated.
- (E) Ducts and plenums used exclusively for evaporative cooling systems.

Approved materials shall be installed within ducts and plenums for insulating, sound deadening, or other purposes. Materials shall have a mold, humidity, and erosion-resistant surface that meets the requirements of the referenced standard for air ducts in Chapter 17. Duct liners in systems ~~operating with air velocities exceeding 18 inches in height and width 2000 feet per minute (10.16 m/s)~~ shall be fastened with both adhesive and mechanical fasteners, and exposed edges shall have adequate treatment to withstand the operating velocity.

Insulation applied to the surface of ducts, including duct coverings, linings, tapes, and adhesives, located in buildings shall have a flame-spread of index not greater than twenty-five (25) and a smoke developed index not greater than fifty (50), when tested in accordance with NFPA 255, Method of Test of Burning Characteristics of Building Materials, or in accordance with ASTM E 84, Surface Burning Characteristics of Building Materials, or in accordance with the provisions of UL 723, Test for Surface Burning Characteristics of Building Materials. The specimen preparation and mounting procedures of ASTM E 2231, Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics, shall be used. Air duct coverings and linings shall not flame, glow, smolder, or smoke when tested in accordance with ASTM C 411, Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 250°F (121°C).

Factory-made air ducts and faced insulations intended for installation on the exterior of ducts shall be legibly printed with the name of the manufacturer, the thermal resistance (R) value at installed thickness, and the flame-spread index and smoke developed index ratings of the composite material.

Insulation on ducts in unconditioned spaces shall be vapor sealed.

**606.2 Fire Dampers.** Fire dampers shall comply with the standard for fire dampers referenced in Chapter 17, and shall be installed in accordance with the approved manufacturer's installation instructions when required by the Building Code. Fire dampers shall have been tested for closure under airflow conditions and shall be labeled for both maximum airflow permitted and direction of flow. When more than one damper is installed at a point in a single air path, the entire airflow shall be assumed to be passing through the smallest damper area. Fire dampers shall be labeled by an approved agency. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation, and air conditioning systems that are intended to operate with fans "on" during a fire.

Ductwork shall be connected to damper sleeves or assemblies in accordance with the fire damper manufacturer's installation instructions.

**606.5 Access and Identification.** Dampers shall be provided with an approved means of access large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not impair fire-resistive construction. Access shall not require the use of tools, keys, or special knowledge. Access points shall be permanently identified visibly on the exterior of the duct and at the ceiling level by a label with letters not less than 1 ½-inch (25.4 12.7-mm) in height reading: **SMOKE DAMPER** or **FIRE DAMPER**. Access doors in ducts shall be tight fitting and suitable for the required duct construction, and access doors shall be not more than 2 inches less than the size of the duct up to 24 inches, and 24 inch by 24 inch in ducts of 28-inch dimension or larger.

### **609.0 Automatic Shutoffs.**

Air-moving systems supplying air in excess of 2,200 2,000 cubic feet per minute (944 1038.2834 L/s) to enclosed spaces within buildings shall be equipped with an automatic shutoff. Automatic shutoff shall be accomplished by interrupting the power source of the air-moving equipment upon detection of smoke in the main supply-air duct or return-air duct served by such equipment. Smoke detectors shall be labeled by an approved agency for air duct installation and shall be installed in accordance with the manufacturer's approved instructions. Such devices shall be compatible with the operating velocities, pressures, temperatures, and humidities of the system. Where fire-detection or alarm systems are provided for the building, the smoke detectors required by this section shall be supervised by such systems.

#### **Exceptions:**

- (1) When the space supplied by the air-moving equipment is served by a total coverage smoke-detection system complying with the Fire Code, interconnection to such system may be used to accomplish required shutoff.
- (2) Automatic shutoff is not required when all occupied rooms served by the air-handling equipment have direct exit to the exterior and the travel distance does

not exceed 100 feet (30,480 mm). For the purpose of this exception, occupied rooms shall not include rooms that have less than 300 square feet and are ancillary to the function of the space served by the air-handling system, such as restrooms, storerooms, or cashier or manager offices.

- (3) Automatic shutoff is not required for Group R, Division 3 and Group U Occupancies.
- (4) Automatic shutoff is not required for approved smoke-control systems or where analysis demonstrates shutoff would create a greater hazard, such as may be encountered in air-moving equipment supplying specialized portions of Group H occupancies and clean rooms. Such equipment shall be required to have smoke detection with remote indication and manual shutoff capability at an approved location.
- (5) Smoke detectors that are factory installed in listed air-moving equipment may be used in lieu of smoke detectors installed in the main supply-air duct served by such equipment.

{EDITOR’S NOTE: DELETE TABLES 6-6 A & 6-6 B AND REPLACE WITH THE FOLLOWING.}

**TABLE 6-6**  
**Insulation of Ducts**

<u>Duct Location</u>	<u>Insulation Types</u> <u>Mechanically Cooled and Outside Air</u>	<u>Insulation Types</u> <u>Heating Only</u>
1. On roof or exterior of building	R-8, V, W	R-8,W
2. Inside the building thermal envelope)	R-5,V	R-5
3. Outside the building thermal envelope)	R-8,V	R-8

NOTES:

V. Vapor retarders: Material with a perm rating not exceeding 0.5 perm (29 ng/Pa·s· m<sup>2</sup>). Vapor retarders shall be installed on cooling supply ducts in spaces vented to the outside in geographic areas where the summer dew point temperature exceeds 60°F (16°C) at the 2 ½ percent summer design dry-bulb with mean coincident wet-bulb temperature. All joints to be sealed.

W. Approved weatherproof barrier.

## CHAPTER 7

### COMBUSTION AIR

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 701.1.4.}

#### 701.9 Louvers, Grilles and Screens.

**(A) Louvers and Grilles.** The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver, grille or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louver and grille design and free area are not known, it shall be assumed that wood louvers will have a 25 percent free area and metal louvers and grilles will have a 75-50 percent free area. Nonmotorized louvers and grilles shall be fixed in the open position. [~~NFPA 54:9.3.7.1~~]

**(B) Minimum Screen Mesh Size.** Screens shall not be smaller than 1/4-inch mesh. [NFPA 54:9.3.7.2]

**(C) Motorized Louvers.** Motorized louvers shall be interlocked with the equipment so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting should the louver fail to open during burner startup and to shut down the main burner if the louvers close during burner operation. [NFPA 54:9.3.7.3]

**TABLE 7-1**

**Size of Combustion-Air Openings for Ducts<sup>1</sup>**

<b>COLUMN 1</b> <b>Buildings of Ordinary Tightness</b>		<b>COLUMN 2</b> <b>Buildings of Unusually Tight Construction<sup>2</sup></b>	
<b>CONDITION</b>	<b>SIZE OF OPENINGS OR DUCTS</b>	<b>CONDITION</b>	<b>SIZE OF OPENINGS OR DUCTS</b>
<b><u>Appliance in unconfined space<sup>2</sup>:</u></b>	May rely on infiltration alone.	<b><u>Appliance in unconfined space<sup>2</sup>:</u></b> Obtain combustion air from outdoors or from space freely communicating with outdoors.	Provide two openings, each having 1 sq. inch (645 mm <sup>5</sup> ) per 5000 Btu/h (1.47 kW) input. Ducts admitting outdoor air may be connected to the cold-air return.
<b><u>Appliance in confined space<sup>4</sup>:</u></b> 1. All air from inside building.	Provide 2 openings into enclosure, each having 1 sq. inch (645 mm <sup>2</sup> ) per 1000 Btu/h (293 W) input freely communicating with other unconfined interior spaces. Minimum 100 sq. inch (0.06 m <sup>2</sup> ) each opening. <sup>3</sup>	<b><u>Appliance in confined space<sup>4</sup>:</u></b> Obtain combustion air from outdoors or from space freely communicating with outdoors.	1. Provide two <b>vertical ducts</b> or plenums; 1 sq. inch (645 mm <sup>2</sup> ) per 4000 Btu/h input each duct or plenum. 2. Provide 2 <b>horizontal ducts</b> or plenums; 1 sq. inch (645 mm <sup>2</sup> ) per 2,000 Btu/h input each duct or plenum. 3. Provide 2 <b>openings in an exterior wall</b> of the enclosure;
2. Part of air from inside building.	Provide 2 openings into the enclosure <sup>3</sup> from other freely		

	<p><u>communicating unconfined<sup>2</sup> interior spaces, each having an area of 100 sq. inch (0.06 m<sup>2</sup>), plus 1 duct or plenum opening to outdoors, having an area of 1 sq. inch Per (645 mm<sup>2</sup>) 5000 Btu/h (1.47 kW) input rating. The outdoor duct or plenum opening may be connected to the cold-air return.</u></p>		<p><u>each opening 1 sq. inch (645 mm<sup>2</sup>) per 4,000 Btu/h (1.17 kW) input.</u>  <u>4. Provide 1 ceiling opening to ventilated attic and 1 vertical duct to attic; each opening 1sq. inch (645 mm<sup>2</sup>) per 4000 Btu/h (1.17 kW) input.</u>  <u>5. Provide 1 opening in enclosure ceiling to ventilated attic and 1 opening enclosure floor to ventilated crawl space; each opening 1 sq. inch (645 mm<sup>2</sup>) per 4000 Btu/h (1.17 kW) input.</u>  <u>6. Provide 1 opening or 1 vertical duct or 1 horizontal duct in the enclosure; 1 sq. inch Per 3000 Btu/h input</u></p>
<p><u>3. All air from outdoors. Obtain from outdoors or from space freely communicating with outdoors.</u></p>	<p><u>Use any of the methods listed for confined space in unusually tight construction as indicated in Column II.</u></p>		
<p><b>Footnotes:</b></p>			
<u>1.</u>	<u>For location of openings, see Section 701.3.</u>		
<u>2.</u>	<u>As defined in Section 223.0.</u>		
<u>3.</u>	<u>When the total input rating of appliances in enclosure exceeds 100,000 Btu/h (29.3 kW), the area of each opening into the enclosure shall be increased 1 square inch (645 mm<sup>2</sup>) for each 1,000 Btu/h (293 W) over 100,000 (29.3 kW).</u>		
<u>4.</u>	<u>As defined in Section 205.0.</u>		

## CHAPTER 8 CHIMNEY AND VENTS

**802.2.2 Equipment Not Required to Be Separately Vented.** The following equipment shall not be required to be vented [~~NFPA 54:12.3.2~~]:

**802.2.2.8** Room heaters listed for unvented use (see Sections 924.43 and 924.24). [~~NFPA 54:12.3.2(8)~~]

**802.3.6 Circulating Air Ducts and Furnace Plenums.** No portion of a venting system shall extend into or pass through any circulating air duct or furnace plenum. A duct or furnace plenum shall not be construed as a return air plenum. [~~NFPA 54:12.4.5.1~~]

**802.5.4-3.1** ~~Where an incinerator is vented by a chimney, it shall not serve any serving other fossil fuel gas-utilization equipment, the gas input to the incinerator shall not be included in calculating chimney size, provided the chimney flue diameter is not less than one (1) inch (25 mm) larger in equivalent diameter than the diameter of the incinerator flue outlet.~~ [~~NFPA 54:12.6.3.2~~]

**802.8.2** A mechanical draft venting system of other than direct-vent type shall terminate at least four (4) feet (1.2 m) below, four (4) feet (1.2 m) horizontally from, or one (1) feet (300 mm) above any door, operable window, or gravity air inlet into any building. The bottom of the vent terminal shall be located at least twelve (12) inches (300 mm) above grade. Venting systems shall terminate at least three (3) feet above an outside air or makeup air inlet located within ten (10) feet and at least four (4) feet from a property line, except in a public way.

**802.8.3** The vent terminal of a direct-vent appliance with an input of 10,000 Btu/h (3 kW) or less shall be located at least six (6) inches (150 mm) from any air opening into a building, and such an appliance with an input over 10,000 Btu/h (3 kW) but not over 50,000 Btu/h (14.7 kW) shall be installed with a nine (9) inches (230 mm) vent termination clearance, and an appliance with an input over 50,000 Btu/h (14.7 kW) shall have at least a twelve (12) inches (300 mm) vent termination clearance. The bottom of the vent terminal and the air intake shall be located at least twelve (12) inches (300 mm) above grade. Venting systems shall terminate at least three (3) feet above an outside air – or makeup air inlet located within ten (10) feet and at least four (4) feet from a property line, except in a public way.

{**EDITOR'S NOTE: DELETE SECTION 802.9.2** IN ITS ENTIRETY.}

**802.10.3.1** A vent connector for gas utilization equipment with a single draft hood or for a Category I fan-assisted combustion system appliance shall be sized and installed in accordance with Section 803.0 ~~or other approved engineering methods.~~

**802.10.3.3** Where two or more gas appliances are connected to a common vent or chimney, each vent connector shall be sized in accordance with Section 803.0 ~~or other approved engineering methods. As an alternative method applicable only when all of the appliances are draft hood equipped, each vent connector shall have an effective area not less than the area of the draft hood outlet of the appliance to which it is connected.~~

**802.10.3.4** Where two or more gas appliances are vented through a common vent connector or vent manifold, the common vent connector or vent manifold shall be located at the highest level consistent with available headroom and clearance to combustible material and shall be sized in accordance with Section 803.0 ~~or other approved engineering methods.~~

As an alternate method applicable only where there are two draft hood-equipped appliances, the effective area of the common vent connector or vent manifold and all junction fittings shall be not less than the area of the larger vent connector plus 50 percent of the areas of smaller flue collar outlets.

**802.10.12 Inspection.** The entire length of a vent connector shall be readily accessible for inspection, cleaning, and replacement.

**803.2.10** Sea level input ratings shall be used when determining maximum capacity ~~for high altitude installation. Actual input (derated for altitude) shall be used for determining minimum capacity for high altitude installation.~~

## CHAPTER 9

### INSTALLATION OF SPECIFIC EQUIPMENT APPLIANCES

#### 902.0 General.

- (A) This chapter is applicable primarily to nonindustrial-type gas utilization ~~equipment~~ appliances and installations and, unless specifically indicated, does not apply to industrial-type ~~equipment~~ appliances and installations. Listed gas utilization ~~equipment~~ appliances shall be installed in accordance with their listing and the manufacturer's instructions, or as elsewhere specified in this chapter. Unlisted ~~equipment~~ appliances shall be installed as specified in this part as applicable to the equipment. For additional information concerning particular ~~gas~~ equipment appliances and accessories, including industrial types, reference can be made to the standards listed in Chapter 17.
- (B) ~~A~~ gas utilization ~~equipment~~ appliance shall not be installed so its combustion, ventilation, and dilution air are obtained only from a bedroom or bathroom unless the bedroom or bathroom has the required volume in accordance with Section 701.2.
- (C) Where the room size in comparison with the size of the ~~equipment~~ appliance is to be calculated, the total volume of the appliance is determined from exterior dimensions and is to include fan compartments and burner vestibules, where used. Where the actual ceiling height of a room is greater than eight (8) feet (2.4 m), the volume of the room is figured on the basis of a ceiling height of eight (8) ft. (2.4 m). ~~[NFPA 54:9.1]~~
- (D) Prohibited installation:** Air handling units shall not be located in the same room with gas utilization equipment.

**Exception:** Listed central heating furnaces.

**902.1 Added or Converted Appliances.** When additional or replacement appliances or equipment are installed or an appliance is converted to gas from another fuel, the location in which the appliances or equipment are to be operated shall be checked to verify the following:

- (A)** Air for combustion and ventilation is provided where required, in accordance with the provisions of Chapter 7. Where existing facilities are not adequate, they shall be upgraded to meet Chapter 7 specifications.
- (B)** The installation components and appliances meet the clearances to combustible material provisions of this code. It shall be determined that the installation and operation of the additional or replacement appliances do not render the remaining appliances unsafe for continued operation.
- (C)** The venting system is constructed and sized in accordance with the provisions of Chapter 8. Where the existing venting system is not adequate, it shall be upgraded to comply with Chapter 8.

**902.2 Type of Gas(es).** A determination shall be made as to whether the appliance has been designed for use with the gas to which it will be connected. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the installation instructions, the serving gas supplier, or the appliance manufacturer for complete instructions.

**903.0 Air-Conditioning ~~Equipment~~ Appliances (Gas-Fired Air Conditioners and Heat Pumps).**

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 903.1.}

**903.3 Clearances for Indoor Installation.** The installation of air-conditioning ~~equipment~~ appliances shall comply with the following requirements:

- (A) Listed air-conditioning ~~equipment~~ appliances installed in rooms that are large in comparison with the size of the ~~equipment~~ appliances shall be installed with clearances per the terms of their listing and the manufacturer's instructions. (See Table 9-1.)
- (B) Air-conditioning ~~equipment~~ appliances installed in rooms that are NOT large (such as alcoves and closets) in comparison with the size of the equipment shall be listed for such installations and installed in accordance with the manufacturer's instructions. Listed clearances shall not be reduced by the protection methods described in Table 5-3, regardless of whether the enclosure is of combustible or noncombustible material.
- (C) Unlisted air-conditioning ~~equipment~~ appliances shall be installed with clearances from combustible material of not less than eighteen (18) inches (~~460~~ 457 mm) above the ~~equipment~~ appliances and at the sides, front, and rear, and nine (9) inches (~~230~~ 229 mm) from the draft hood.
- (D) Air-conditioning ~~equipment~~ appliances (listed and unlisted) installed in rooms that are large in comparison with the size of the ~~equipment~~ appliances shall be permitted to be installed with reduced clearances to combustible material provided the combustible material or ~~equipment~~ appliances ~~is~~ are protected as described in Table 5-3 [see 5-3(2)].
- (E) Where the furnace plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is two (2) inches (50 mm) or less.
- (F) Listed air-conditioning ~~equipment~~ appliances shall have the clearance from supply ducts within three (3) feet (0.9m) of the furnace plenum be not less than that specified from the furnace plenum. No clearance is necessary beyond this distance. [~~NFPA 54:9.2.3~~]

**903.4 Assembly and Installation.** Air-conditioning ~~equipment~~ appliances shall be installed in accordance with the manufacturer's instructions. Unless the ~~equipment~~

appliances is-are listed for installation on a combustible surface, such as a floor or roof, or unless the surface is protected in an approved manner, it shall be installed on a surface of noncombustible construction with noncombustible material and surface finish and with no combustible material against the underside thereof. [NFPA 54:10.2.4]

**903.5 Furnace Plenums and Air Ducts.** A furnace plenum supplied as a part of ~~the an~~ air-conditioning ~~equipment—appliance~~ shall be installed in accordance with the manufacturer's instructions. Where a furnace plenum is not supplied with the ~~equipment appliance~~, any fabrication and installation instructions provided by the manufacturer shall be followed. The method of connecting supply and return ducts shall facilitate proper circulation of air. ~~[NFPA 54:10.2.5]~~

{EDITOR'S NOTE: DELETE SECTION 903.7 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

### **903.7 Return and Outside Air.**

**903.7.1 Source.** A warm-air furnace shall be provided with return air, outside air, or both. Heating systems regulated by this code and designed to replace required ventilation shall be arranged to discharge into the conditioned space not less than the amount of outside air specified in the Building Code.

**903.7.2 Separation.** Except as permitted by the exceptions to Section 903.7(F), there shall be a positive separation between combustion air and outside or return air for blower-type heating systems. The combustion-chamber opening shall be separated from a fan plenum by an airtight separation without openings, other than through an air lock at least 16 square feet (1.49 m<sup>2</sup>) in area, equipped with tight-fitting doors arranged to close automatically. A fan plenum access not exceeding twenty-four (24) inches by thirty (30) inches (610 mm × 762 mm) may be equipped with a tight-fitting panel or door.

**903.7.3 Area Requirements.** The minimum unobstructed total area of the outside or return-air ducts or openings to a gravity-type warm-air furnace shall be not less than seven (7) square inches ( 4516 mm<sup>2</sup>) per 1000 Btu/h (293 W) approved output rating or as indicated by the conditions of listing of the furnace.

The minimum unobstructed total area of the outside or return-air ducts or openings to a blower-type warm-air furnace shall be not less than two (2) square inches (1290 mm<sup>2</sup>) per 1000 Btu/h (293 W) approved output rating or bonnet capacity of the furnace. The total area of the outside or return-air ducts or openings need not be larger than the minimum indicated by the conditions of listing of the furnace.

The minimum unobstructed total area of the outside or return-air ducts or openings to a heat pump shall be not less than six (6) square inches (3871 mm<sup>2</sup>) per 1000 Btu/h (293 W) nominal output rating or as indicated by the conditions of listing of the heat pump.

**903.7.4 Dampers.** Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

**903.7.5 Ducts for Blower-Type Warm-Air Furnace.** Except as provided in Section 903.7(F), air for every fuel-burning blower-type warm-air furnace shall be conducted into the blower housing from outside the furnace space by continuous airtight ducts.

**903.7.6 Prohibited Sources.** Outside or return air for a heating system shall not be taken from the following locations:

**903.7.6.1** Closer than ten (10) feet (3048 mm) from an appliance vent outlet, a vent opening of a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is three (3) feet (914 mm) above the outside-air inlet.

**903.7.6.2** Where it will pick up objectionable odors, fumes, or flammable vapors; or where it is less than ten (10) feet (3048 mm) above the surface of any abutting public way or driveway; or where it is in a horizontal position in a sidewalk, street, alley, or driveway.

**903.7.6.3** A hazardous or insanitary location or a refrigeration machinery room as defined in this code.

**903.7.6.4** An area, the volume of which is less than 25 percent of the entire volume served by such system, unless there is a permanent opening to an area the volume of which is equal to 25 percent of the entire volume served. This permanent opening, when used to provide return air to a warm-air furnace, shall be of sufficient area to comply with Section 903.7.3.

**Exception:** Such opening when used for a warm-air furnace in a dwelling unit may be reduced to no less than 50 percent of the required area, provided the balance of the required return air is taken from a room or hall having at least three doors leading to other rooms served by the furnace.

**903.7.6.5** A room or space having any fuel-burning appliances therein.

**Exception:** This shall not apply to:

(1) Fireplaces, fireplace appliances, residential cooking appliances, direct vent appliances, enclosed furnaces and domestic-type clothes dryers installed within the room or space.

(2) A gravity-type or listed vented wall furnace.

(3) A blower-type system complying with the following requirements:

a. Where the return air is taken from a room or space having a volume exceeding one (1) cubic foot (0.028 m<sup>3</sup>) for each ten (10) Btu/h (2.93 W) fuel input rate of all fuel-burning appliances therein.

b. At least 75 percent of the supply air is discharged back into the same room or space.

c. Return-air inlet shall not be located within ten (10) feet (3048 mm) of any appliance firebox or draft diverter in the same enclosed room or confined space.

**903.7.6.6** A closet, bathroom, toilet room or kitchen.

### **903.8 Air Supply**

**903.8.1 Duct Size.** The minimum unobstructed total area of the supply-air ducts from a blower-type warm-air furnace shall be not less than two (2) square inches (1290 mm<sup>2</sup>) per 1000 Btu/h (293 W) approved output rating of the furnace, and the minimum unobstructed total area of the supply-air ducts from a gravity-type warm-air furnace shall be not less than seven (7) square inches (4516 mm<sup>2</sup>) per 1000 Btu/h (293 W) approved output rating or as specified by the conditions of listing of the furnace. The total area of the supply-air ducts need not exceed the area of the furnace outlet plenum collar.

For the purpose of this section, a volume damper, grille or register installed to control airflow shall not be considered an obstruction.

The minimum unobstructed total area of the supply-air ducts from a heat pump shall be not less than six (6) square inches (3871 mm<sup>2</sup>) per 1000 Btu/h (293 W) nominal output rating or as indicated by the conditions of the listing of the heat pump.

**903.8.2 Surgical Operating Room.** Warm-air furnace duct openings serving a surgical operating room shall be at least five (5) feet (1524 mm) above the floor.

**904.1.2 Gasketing.** Gasketing on gasket doors or frames shall be furnished only in accordance with the published listings of the door, frame, or gasketing material manufacturer.

~~**Exception:** Where acceptable to the Authority Having Jurisdiction, gasketing of noncombustible or limited-combustible material (see NFPA 220, Standard on Types of Building Construction) shall be permitted to be applied to the frame, provided closing and latching of the door are not inhibited. [NFPA 80: 2-4.8]~~

### **904.2 Clearance.**

- (A)** Listed central heating furnaces and low-pressure boilers installed in rooms that are large in comparison with the size of the equipment appliances shall be installed with clearances per the terms of their listings and the manufacturer's instructions. (See Sections 208.0 and 1004.0 for definition.)
- (B)** Central-heating furnaces and low-pressure boilers installed in rooms that are NOT large (such as alcoves and closets) in comparison with the size of the equipment appliances shall be listed for such installations. Listed clearances shall not be reduced by the protection methods described in Table 5-3 and illustrated in Figures 9-1(a) through 9-1(c), regardless of whether the enclosure is of combustible or noncombustible material.
- (C)** Unlisted central-heating furnaces and low-pressure boilers installed in rooms that are large in comparison with the size of the equipment appliances shall be installed with clearances not less than those specified in Table 9-1.
- (D)** Central-heating furnaces and low-pressure boilers (listed and unlisted) installed in rooms that are large in comparison with the size of the equipment appliances shall

be permitted to be installed with reduced clearances to combustible material provided the combustible material or ~~equipment~~ appliance is protected as described in Table 5-3.

- (E) Front clearance shall be sufficient for servicing the burner and the furnace or boiler.
- (F) Where the furnace plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is two (2) inches (50 mm) or less.
- (G) ~~The clearance to this equipment~~ these appliances shall not interfere with combustion air, draft hood clearance and relief, and accessibility for servicing. (See Sections 305.1, 701.1, and 802.12.7.)
- (H) Listed central heating furnaces shall have the clearance from supply ducts within three (3) feet (0.9m) of the furnace plenum be not less than that specified from the furnace plenum. No clearance is necessary beyond this distance.
- (I) Unlisted central heating furnaces with temperature limit controls that cannot be set higher than 250°F (121°C) shall have the clearance from supply duct within six (6) feet (1.8m) of the furnace plenum be not less than six (6) inches (150 mm). No clearance is necessary beyond this distance.
- (J) Central-heating furnaces other than those listed in Section 904.2(h) or (i) shall have clearances from the supply ducts of not less than eighteen (18) inches (~~0.46~~ 57 mm) from the furnace plenum for the first three (3) feet (914 mm), then six (6) inches (150 mm) for the next three (3) feet (9m) and one (1) inch (25 mm) beyond six (6) feet (1.8 m). [NFPA 54:9.3.2]

**904.3.1 Under-floor Installation.** Furnaces installed in an under-floor area of the building shall comply with the Section 904.3.1.1 through 904.3.1.3.

**904.3.1.1 Supported by Ground.** Where a furnace is supported by the ground, it shall be installed on a concrete slab not less than three (3) inches (76 mm) above the adjoining ground level.

**904.3.1.2 Supported from Above.** Where a furnace is supported from above, a minimum clearance of six (6) inches (152mm) shall be provided from finished grade.

**904.3.1.3 Excavation.** Where excavation is necessary to install a furnace, it shall extend to a depth of six (6) inches (152 mm) below and twelve (12) inches (300 mm) on all sides of the furnace, except on the service side, which shall have thirty (30) inches (762mm). If the depth of the excavation for either the furnace or passageway exceeds twelve (12) inches (300 mm), walls shall be lined with concrete or masonry four (4) inches (102 mm) above the adjoining ground level.

**904.4 Temperature- or Pressure-Limiting Devices.** See Chapter 10 of this code. ~~Steam and hot water boilers, respectively, shall be provided with approved automatic limiting devices for shutting down the burner(s) to prevent boiler steam pressure or~~

~~boiler water temperature from exceeding the maximum allowable working pressure or temperature. Safety limit controls shall not be used as operating controls. [NFPA 54:9.3.4]~~

**904.5 Low-Water Cutoff.** See Chapter 10 of this code. ~~Hot water boilers installed above the radiation level and all steam boilers shall be provided with an automatic means to shut off the fuel supply to the burner(s) if the boiler water level drops to the lowest safe water line. [NFPA 54:9.3.5]~~

**904.6 Steam Safety and Pressure-Relief Valves.** See Chapter 10 of this code. ~~Steam and hot water boilers shall be equipped, respectively, with listed or approved steam safety or pressure-relief valves of appropriate discharge capacity and conforming with ASME requirements. A shutoff valve shall not be placed between the relief valve and the boiler or on discharge pipes between such valves and the atmosphere.~~

~~(1) Relief valves shall be piped to discharge near the floor.~~

~~(2) The entire discharge piping shall be at least the same size as the relief valve discharge piping.~~

~~(3) Discharge piping shall not contain a threaded end connection at its termination point. [NFPA 54:9.3.6]~~

#### **904.7 Furnace Plenums and Air Ducts.**

~~**(A) Reserved.** Furnace plenums and air ducts shall be installed in accordance with NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, or NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.~~

{EDITOR'S NOTE: NO CHANGE TO REMAINDER OF SECTION 904.7.}

**904.8 Refrigeration Coils.** The installation of refrigeration coils shall comply with the following requirements:

**(A)** A refrigeration coil shall not be installed in conjunction with a forced-air furnace where circulation of cooled air is provided by the furnace blower, unless the blower has sufficient capacity to overcome the external static resistance imposed by the duct system and cooling coil and the air throughput necessary for heating or cooling, whichever is greater.

**(B)** Furnaces shall not be located upstream from cooling units, unless the cooling unit is designed or equipped so as not to develop excessive temperature or pressure.

**(C)** Refrigeration coils shall be installed in parallel with or on the downstream side of central furnaces to avoid condensation in the heating element, ~~unless the furnace has been specifically listed for downstream installation.~~ With a parallel flow arrangement, the dampers or other means used to control flow of air shall be sufficiently tight to prevent any circulation of cooled air through the furnace.

**(D)** Means shall be provided for disposal of condensate and to prevent dripping of condensate on the heating element. [NFPA 54:9.3.8]

### **904.9 Cooling Units Used with Heating Boilers.**

~~(A) Boilers, where used in conjunction with refrigeration systems, shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler.~~

(B) Where hot-water-heating boilers are connected to heating coils located in air-handling units where they can be exposed to refrigerated air circulation, such boiler piping systems shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle. [NFPA 54:9.3.9]

### **904.10 Equipment and Appliances on Roofs.**

{EDITOR'S NOTE: DELETE AND RESERVE SECTIONS 904.10.1 AND 904.10.2.}

#### **904.10.3 Access to Equipment and appliances on Roofs.**

~~904.10.3.1 Gas utilization e~~Equipment and Appliances located on roofs or other elevated locations shall be accessible. [NFPA 54-09:9.4.3.1]

~~904.10.3.2 In B~~buildings where the point of access is of more than fifteen (15) fourteen (14) feet (4.6 m 4,267.24 mm) in height shall have above grade, an inside means of access to the roof shall be provided, unless other means acceptable to the Authority Having Jurisdiction are used. [NFPA 54-09:9.4.3.2]

~~904.10.3.3~~ The inside means of access shall be a permanent or foldaway inside stairway or ladder, terminating in an enclosure, scuttle, or trapdoor. Such scuttles or trapdoors shall be at least twenty-two (22) inches × twenty-four (24) inches (560 mm × 610 mm) in size, shall open easily and safely under all conditions, especially snow, and shall be constructed so as to permit access from the roof side unless deliberately locked on the inside. At least ~~six (6)~~ 10 feet (4.8 3.048 m) of clearance shall be available between the access opening and the edge of the roof or similar hazard, or rigidly fixed rails or guards a minimum of forty-two (42) inches (1.1 m) in height shall be provided on the exposed side. Where parapets or other building structures are utilized in lieu of guards or rails, they shall be a minimum of forty-two (42) inches (1.1 m) in height.

An attic or furred space in which a warm-air furnace is installed shall be provided with a pull down stairway with a clear opening not less than 22 inches in width and a load capacity of not less than 350 pounds and an unobstructed passageway as large as the largest piece of the furnace and in no case less than thirty (30) inches by thirty (30) inches (762 mm × 762 mm) continuous from the opening to the furnace and its controls.

#### **904.10.4 Permanent ladders providing roof access shall:**

- (1) Have side railings which extend at least thirty (30) inches (762 mm) above the roof edge or parapet wall.
- (2) Have landings less than eighteen (18) feet (5486 mm) apart measured from the finished grade.

(3) Be at least fourteen (14) inches (356 mm) in width.

(4) Have rungs not more than fourteen (14) inches (356 mm) on center.

(5) Have a minimum of six (6) inch (152 mm) toe space.

**904.10.5 Platform.** A furnace located on a roof shall be installed on a substantial, level platform. When the roof has a slope greater than one (1) in twelve (12), a level working platform at least thirty (30) inches (762 mm) in depth and width shall be provided along the firebox and control sides of the furnace. Sides of a working platform facing the roof edge below shall be protected by a substantial railing forty-two (42) inches (1067 mm) in height with vertical rails not more than twenty-one (21) inches (533 mm) apart, except that parapets at least twenty-four (24) inches (610 mm) in height may be utilized in lieu of rails or guards.

#### **904.11 Appliances in Attics and Under-Floor Spaces.**

**904.11.1 Attic Access.** An attic or under-floor space in which an appliance is installed shall be accessible through an opening and passageway at least as large as the largest component of the appliance, and not less than ~~twenty-two~~ thirty (22 30) inches × thirty (30) inches (~~560-760~~ mm × 760 mm).

**904.11.2 Passageway Height.** Where the height of the passageway is less than six (6) feet (1.8 m), the distance from the passageway access to the appliance shall not exceed twenty (20) feet (6.1m) measured along the center line of the passageway.

**904.11.3 Passageway.** The passageway shall be unobstructed and shall have solid flooring not less than twenty-four (24) inches (610 mm) wide from the entrance opening to the appliance.

**904.11.4 Work Platform Surface.** A level working platform or grade surface not less than thirty (30) inches (760 mm) by thirty (30) inches (760 mm) shall be provided in front of the service side of the appliance.

**904.11.6 Furnace (Upright and Horizontal).** Upright furnaces may be installed in an attic or a furred or under-floor space more than five (5) feet (1,524 mm) in height, provided the required listings and furnace and duct clearances are observed. Horizontal furnaces may be installed in an attic or a furred or under-floor space, provided the required listings and furnace and duct clearances are observed.

**905.1 Clearance.** The installation of clothes dryers shall comply with the following requirements and all applicable requirements of Chapter 5:

{EDITOR'S NOTE: NO CHANGE TO THE REMAINDER OF 905.1.}

#### **905.4 Exhaust Ducts for Type 1 Clothes Dryers.**

**(A)**A clothes dryer exhaust duct shall not be connected into any vent connector, gas vent, chimney, crawl space, attic, or other similar concealed space.

{EDITOR'S NOTE: DELETE REMAINDER OF SECTION 905.4.}

**905.5 Exhaust Ducts for Type 2 Clothes Dryers.**

(A) Exhaust ducts for Type 2 clothes dryers shall comply with this section and Section 905.4.

{EDITOR'S NOTE: DELETE REMAINDER OF SECTION 905.5.}

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 905.6.}

**910.1 Prohibited installation. Application.** ~~Direct gas-fired industrial air heaters of the recirculating type are prohibited. shall be designed certified to be in compliance with the Standard for Recirculating Direct Gas-Fired Industrial Air Heaters, ANSI Z83.18. Unlisted direct gas-fired industrial air heaters of the recirculating type shall not be installed. [NFPA 54:9.9.1]~~

{EDITOR'S NOTE: DELETE REMAINDER OF SECTION 910.}

**TABLE 9-1**  
**Clearances to Combustible Material for Unlisted Furnaces, Boilers, and Air Conditioners**  
**Installed**  
**in Rooms That Are Large in Comparison with the Size of Equipment Appliance.**

<u>Equipment Appliance</u>	Minimum Clearance (in.)					
	Above and Sides of Furnace Plenum	Top of Boiler	Jacket Sides and Rear	Front	Draft Hood and Barometric Draft Regulator	Single-Wall Vent Connector
I Automatically fired, forced air or gravity system, equipped with temperature limit control that cannot be set higher than 250°F (121°C)	6		6	18	6	18
II Automatically fired heating boilers –steam boilers operating at not over 15 psi (103 kPa) and hot water boilers operating at 250°F (121°C) or less	6	6	6	18	18	18
III Central heating boilers and furnaces, other than in I or II	18	18	18	18	18	18
IV Air-conditioning <del>equipment</del> <u>appliance</u> .	18	18	18	18	18	18

**Note:**

See Section 903.3 for additional requirements for air-conditioning appliances and Section 904.1 for additional requirements for central heating boilers and furnaces.

**911.1 Clearances.** The installation of duct furnaces shall comply with the following clearance requirements:

(A) Listed duct furnaces shall be installed with clearances of at least six (6) inches (150 mm) between adjacent walls, ceilings, and floors of combustible material and the furnace draft hood. Furnaces listed for installation at lesser clearances shall be installed in accordance with their listings. In no case shall the clearance be such as to interfere with combustion air and accessibility. (See Sections 305.1 and 701.0.)

(B) ~~Unlisted duct furnaces are prohibited. shall be installed with clearances to combustible material in accordance with the clearances specified for unlisted furnaces and boilers in Table 9-1. Combustible floors under unlisted duct furnaces shall be protected in an approved manner. [NFPA 54:9.10.1]~~

**911.2 Installation Erection of Duct Furnaces Equipment.** Duct furnaces shall be ~~installed erected and firmly supported~~ in accordance with the manufacturers' instructions. [NFPA 54:9.10.10.2]

### **911.8 Installation in Commercial Garages.**

**911.8.1 Parking Structures.** ~~Gas utilization equipment Appliances~~ installed in enclosed, basement, and underground parking structures shall be installed in accordance with NFPA 88A, Standard for Parking Structures.

**911.8.2 Repair Garages.** ~~Gas utilization equipment Appliances~~ installed in repair garages shall be installed in a detached building or room, separated from repair areas by walls, ~~or~~ partitions, floors, or floor-ceiling assemblies that are constructed so as to prohibit the transmission of vapors and having a fire resistance rating of not less than one (1) hour, and that have no openings in the wall separating the repair area within eight (8) feet (2.4 m) of the floor. Wall penetrations shall be firestopped. Air for combustion purposes shall be obtained from outside the building. The heating room shall not be used for the storage of combustible materials.

#### **Exceptions:**

- (1) Overhead heaters where installed not less than eight (8) feet (~~2.4~~2,438 mm) above the floor shall be permitted.
- (2) Heating ~~equipment appliances~~ for vehicle repair areas where there is no dispensing or transferring of Class I or Class II flammable or combustible liquids or liquefied petroleum gas shall be installed in accordance with NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages.

### **913.0 Food Service ~~Equipment Appliance~~, Floor Mounted.**

**913.1 Clearance for Listed ~~Equipment Appliances~~.** Listed floor-mounted food service ~~equipment appliances~~, such as ranges for hotels and restaurants, deep-fat fryers, unit broilers, gas-fired kettles, steam cookers, steam generators, and baking and roasting ovens, shall be installed at least six (6) inches (150 mm) from combustible material except that at least a two (2) inch (50 mm) clearance shall be maintained between a draft hood and combustible material. Floor-mounted food service ~~equipment appliances~~ listed for installation at lesser clearances shall be installed in accordance with ~~its~~ their

listings and the manufacturer's instructions. ~~Equipment~~ Appliances designed and marked, "For use only in noncombustible locations," shall not be installed elsewhere. [NFPA 54:9.12.1]

**913.2 Clearance for Unlisted ~~Equipment~~ Appliances.** Unlisted floor-mounted food service ~~equipment~~ appliances shall be installed to provide a clearance to combustible material of not less than eighteen (18) inches (460 mm) from the sides and rear of the ~~equipment~~ appliance and from the vent connector and not less than forty-eight (48) inches (1.2 m) above cooking tops and at the front of the appliance ~~equipment~~.

Clearances for unlisted ~~equipment~~ appliances installed in partially enclosed areas such as alcoves shall not be reduced. Where clearances for unlisted ~~equipment~~ appliances installed in rooms that are not partially enclosed are reduced, the combustible material or the ~~equipment~~ appliance shall be protected as described in Table 5-3. [NFPA 54:9.12.2]

### **913.3 Mounting on Combustible Floor.**

(A) Listed floor-mounted food service ~~equipment~~ appliances that ~~is~~ are listed specifically for installation on floors constructed of combustible material shall be permitted to be mounted on combustible floors in accordance with ~~its~~ their listings and the manufacturer's instructions.

(B) Floor-mounted food service ~~equipment~~ appliances that ~~is~~ are not listed for mounting on a combustible floor shall be mounted in accordance with Section 913.4 or be mounted in accordance with one of the following:

(1) Where the ~~equipment~~ appliance is set on legs that provide not less than eighteen 18 in. (460 mm) open space under the base of the ~~equipment~~ appliance or where it has no burners and no portion of any oven or broiler within 18 in. (460 mm) of the floor, it shall be permitted to be mounted on a combustible floor without special floor protection, provided there is at least one sheet metal baffle between the burner and the floor.

(2) Where the ~~equipment~~ appliance is set on legs that provide not less than eight (8) inches (200 mm) open space under the base of the ~~equipment~~ appliance, it shall be permitted to be mounted on combustible floors, provided the floor under the ~~equipment~~ appliance is protected with not less than 3/8 inch (9.5 mm) insulating millboard covered with sheet metal not less than 0.0195 inch (0.5 mm) thick. The preceding specified floor protection shall extend not less than six (6) inches (150 mm) beyond the ~~equipment~~ appliance on all sides.

(3) Where the ~~equipment~~ appliance is set on legs that provide not less than four (4) inches (100 mm) under the base of the ~~equipment~~ appliance, it shall be permitted to be mounted on combustible floors, provided the floor under the ~~equipment~~ appliance is protected with hollow masonry not less than four (4) inches (100 mm) in thickness covered with sheet metal not less than 0.0195 inch (0.5 mm) thick. Such masonry courses shall be laid with ends unsealed and joints matched in such a way as to provide for free circulation of air through the masonry.

(4) Where the ~~equipment~~ appliance does not have legs at least four (4) inches (100 mm) high, it shall be permitted to be mounted on combustible floors, provided the

floor under the ~~equipment-appliance~~ is protected by two courses of four (4) inch (100 mm) hollow clay tile, or equivalent, with courses laid at right angles and with ends unsealed and joints matched in such a way as to provide for free circulation of air through such masonry courses, and covered with steel plate not less than 3/16 inch (4.8 mm) in thickness. [NFPA 54:8.12.3]

**913.4 Mounting on Noncombustible Floor.** Listed floor-mounted food service ~~equipment-appliances~~ that ~~is~~ are designed and marked, "For use only in noncombustible locations," shall be mounted on floors of noncombustible construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof, or on noncombustible slabs or arches having no combustible material against the underside thereof. Such construction shall in all cases extend not less than twelve (12) inches (300 mm) beyond the ~~equipment-appliance~~ on all sides. [NFPA 54:8.12.3]

**913.5 Combustible Material Adjacent to Cooking Top.** Any portion of combustible material adjacent to a cooking top section of a food service range, even though listed for close-to-wall installation, that is not shielded from the wall by a high shelf, warming closet, and so on, shall be protected as specified in Section 913.2 for a distance of at least two (2) feet (0.6m) above the surface of the cooking top. [NFPA 54:9.12.5]

**913.6 Use with Casters.** Floor-mounted ~~equipment-appliances~~ with casters shall be listed for such construction and shall be installed in accordance with ~~their listing and the accompanying manufacturer's installation instructions~~ for limiting the movement of the ~~equipment-appliance~~ to prevent strain on the connection. [NFPA 54:9.12.6]

**913.7 Level Installation.** Floor-mounted food service ~~equipment-appliances~~ shall be installed level on a firm foundation. [NFPA 54:9.12.7]

**913.8 Ventilation.** Means shall be provided to properly ventilate the space in which a food service ~~equipment-appliance~~ is installed to permit proper combustion of the gas. [NFPA 54:9.12.8]

#### **914.0 Food Service ~~Equipment-Counter Appliances.~~**

#### **916.2 Built-In Units.**

**(A) Installation.** Listed built-in household cooking appliances shall be installed in accordance with their listings and the manufacturers's instructions. The installation shall not interfere with combustion air, accessibility for operation, and servicing. Unlisted built-in household cooking appliances shall not be installed in or adjacent to combustible material.

{EDITOR'S NOTE: NO CHANGE TO THE REMAINDER OF 916.2.}

**918.0 Incinerators, Commercial-Industrial.**

**918.1 General.** Incinerators for the reduction of refuse, garbage or other waste materials shall be installed in accordance with the provisions of this chapter. Materials and structural design shall meet the requirements of the Building Code. Nothing in this section shall be construed to authorize the construction, placement, or use of any incinerator that is prohibited by state or federal environmental regulations or by other ordinances of the jurisdiction.

**918.2 Incinerators, Commercial-Industrial.** Commercial-industrial-type incinerators shall be constructed and installed in accordance with NFPA 82, Standard on Incinerators and Waste and Linen Handling Systems and Equipment [NFPA 54:9.17]

**918.3 Small Domestic Type.** Incinerators of small uninsulated domestic type installed indoors shall be constructed, mounted, installed and vented according to the applicable requirements for room heating stoves burning solid fuel and room heaters burning liquid fuel as specified in Chapters 3, 7, 8 and 9 of this code, except that mounting shall be on a noncombustible and fire-resistive floor, and minimum clearances to combustible materials shall be thirty-six (36) inches (914 mm) above, forty-eight (48) inches (1219 mm) in front and thirty-six (36) inches (914 mm) in back and at sides. The requirements of this section also apply to incinerators installed as a part of other appliances.

Incinerators of small domestic type, or those that are a part of another appliance, that have been tested and approved by an approved agency and listed for installation on a combustible floor or with lesser clearances shall be installed in accordance with the conditions of their listings and shall be connected to a chimney complying with the requirements of Chapter 8.

**Exception:** Existing unlined chimneys having at least four (4) inch (102 mm) nominal brick walls may be used for the venting of domestic gas-fired freestanding incinerators when such chimneys meet the other requirements of this chapter and have been approved and inspected by the Authority Having Jurisdiction.

**919.2 Suspended Low-Intensity Infrared Tube Heaters.** Suspended low-intensity infrared tube heaters shall be connected to the building piping system with a connector listed for the application in accordance with ANSI Z21.24/CGA 6.10, *Connectors for Gas Appliances*.

**(A)** The connector shall be installed in accordance with the tube heater installation instructions, and shall be in the same room as the appliance.

**(B)** Only one connector shall be used per appliance. [NFPA 54:9.6.1.3]

**919.2 919.3 Clearance.** {EDITOR'S NOTE: NO CHANGE TO THE REMAINDER OF THIS SECTION.}

**919.3 919.4 Combustion and Ventilation Air.** {EDITOR'S NOTE: NO CHANGE TO THE REMAINDER OF THIS SECTION.}

**919.4 919.5 Installation in Commercial Garages and Aircraft Hangars.** {EDITOR'S NOTE: NO CHANGE TO THE REMAINDER OF THIS SECTION.}

**920.1 Listed Units.** ~~Listed open-top broiler units and hoods shall be installed in accordance with their listing and the manufacturers's installation instructions.~~

{EDITOR'S NOTE: DELETE AND REMAINDER OF SECTION 920.1.}

**920.2 Unlisted Units.** Unlisted open-top broiler units shall be installed in accordance with the manufacturer's instructions but shall not be installed in combustible material.

**920.3 Protection Above Domestic Units.** Domestic open-top broiler units shall be provided with a metal ventilating hood not less than 0.0122 inch (0.3 mm) thick with a clearance of not less than 1/4 inch (6 mm) between the hood and the underside of combustible material or metal cabinets. A clearance of at least twenty-four (24) inches (610 mm) shall be maintained between the cooking top and the combustible material or metal cabinet, and the hood shall be at least as wide as the open-top broiler unit and centered over the unit. Listed domestic open-top broiler units incorporating an integral exhaust system and listed for use without a ventilating hood need not be provided with a ventilating hood if installed in accordance with Section 916.1(B)(1).]

**920.4 Commercial Units.** Commercial open-top broiler units shall be provided with ventilation in accordance with Chapter 5.

{EDITOR'S NOTE: DELETE SECTION 922, IN ITS ENTIRETY AND RESERVE.}

{EDITOR'S NOTE: DELETE SECTION 923.0, INCLUDING 923.1 AND 923.2, AND RESERVE.}

{EDITOR'S NOTE: DELETE SECTION 924.1, INCLUDING 924.1.1, IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**924.1 Vented Freestanding.** Vented freestanding room heaters shall be installed with clearances from combustible material as set forth in Table 3-1.

**Exception:** Heaters listed for reduced clearances may be installed at the clearances specified on the required manufacturer's label.

Vented freestanding room heaters shall not be located so that a door can swing within less than twelve (12) inches (305 mm) of a warm-air outlet of the heater, measured at right angles to the outlet. Doorstops or door closers shall not be installed to obtain such clearance.

Vented freestanding room heaters shall be located at least thirty-six (36) inches (914 mm) below any part of a structure projecting over the heater. This projection shall include doors or windows that could project over the heater.

Vented freestanding room heaters shall be safely and securely installed to prevent accidental displacement.

{EDITOR'S NOTE: DELETE SECTION 924.2 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**924.2 Vented Overhead.** Vented overhead room heaters shall be safely and securely supported with hangers and brackets of noncombustible material and shall be installed with clearances from combustible material as specified on the required manufacturer's label.

**Exception:** Installation of overhead heaters in aircraft storage or servicing areas of aircraft hangars shall comply with requirements of Section 911.0.

{EDITOR'S NOTE: DELETE SECTION 924.3 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**924.3 Unvented.** Unvented fuel-burning room heaters and decorative appliances shall be prohibited.

{EDITOR'S NOTE: DELETE SECTION 924.4 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**924.4 Overhead Radiant Heaters.** Listed or approved unvented overhead room heaters may be installed in a Group A, B, F, M, S or U occupancy, provided the installation conforms to all the following requirements:

**924.4.1** All portions of the heater are located at least eight (8) feet (2438 mm) above the floor.

**924.4.2** At least two (2) unobstructed permanent openings are provided to the room or space containing such heaters. These openings shall open directly to the outside of the building through the floor, roof or wall. The minimum combined total area of these openings shall be at least one (1) square inch (645 mm<sup>2</sup>) for each 1000 Btu/h (293 W) input of the heater or heaters, with a minimum total area of 100 square inches (64516 mm<sup>2</sup>). One-half of the required openings shall be above the heater or heaters and one-half shall be located below the heater or heaters.

**Exception:** When approved by the Authority Having Jurisdiction, provisions may be made to exhaust the products of combustion to the exterior by mechanical means.

**924.4.3** Heaters shall be safely and securely supported with hangers and brackets of noncombustible material and installed with clearances from combustible material as specified on the required manufacturer's label.

**925.1** Stationary gas engines shall not be rigidly connected to the gas supply piping.

**926.2 Mounting-Installation on Combustible Floors.** Listed gas-fired toilets installed on combustible floors shall be listed for such installation.

**929.0 Appliances for Installation in Manufactured Housing.**

Appliances installed in manufactured housing after the initial sale shall be listed for installation in manufactured housing, or approved, and shall be installed in accordance with the requirements of this code and the manufacturers's installation instructions. Appliances installed in the living space of manufactured housing shall be in accordance with the requirements of Section 303 or 701.0, as applicable. [NFPA 54:9.30]

**931.1** An attic or furred space in which a warm-air furnace is installed shall be ~~accessible by an opening provided with a pull down stairway with a clear opening not less than 22 inches in width and a load capacity of not less than 350 pounds and an unobstructed passageway as large as the largest piece of the furnace and in no case less than thirty (30) inches by thirty (30) inches (762 mm × 762 mm) continuous from the opening to the furnace and its controls.~~

~~**Exception:** The access opening into the space may be twenty two (22) inches by thirty (30) inches (559 mm × 762 mm), provided the largest piece of equipment can be removed through the opening.~~

**932.0 Outdoor Open Flame Decorative Appliances.**

**932.1** Permanently fixed in place outdoor open flame decorative appliances shall be installed in accordance with the following. [NFPA 54-09:10.32]

**932.1.1 Listed Units.** Listed outdoor open flame decorative appliances shall be installed in accordance with the manufacturer's installation instructions. [NFPA 54-09:10.32.1]

**932.1.2 Unlisted Units.** Unlisted outdoor open flame decorative appliances shall be installed outdoors in accordance with the manufacturer's installation instructions and with clearances to combustible material of not less than thirty-six (36) inches (910 mm) from the sides. In no case shall the appliance be located under overhead combustible construction. [NFPA 54-09:10.32.2]

**932.1.3 Connection to the Piping System.** The connection to the gas piping system shall be in accordance with the Plumbing Code.

**933.0 Compressed Natural Gas (CNG) Vehicular Fuel Systems.**

The installation of compressed natural gas (CNG) fueling (dispensing) systems shall conform to NFPA 52, Compressed Natural Gas (CNG) Vehicular Fuel Systems Code. [NFPA 54-09:10.29]

**934.0 Fuel Cell Power Plants.**

Fuel cell power plants with a power output of less than 50 kW shall be listed and installed in accordance with the manufacturer's instructions. Fuel cell power plants with a power output of greater than 50 kW shall be installed in accordance with NFPA 853, Standard for the Installation of Stationary Fuel Cell Power Systems. [NFPA 54-09:10.31]

## CHAPTER 10

### STEAM AND HOT-WATER BOILERS

#### 1002.0 Scope.

The requirements of this chapter shall apply to the construction, installation, operation, repair, and alteration of all boilers and pressure vessels related to steam and hot-water boiler systems.

#### Exceptions:

- (1) Listed and approved potable water heaters with a nominal capacity of 120 gallons (454 L) or less having a heat input of 200,000 Btu/h (58.62 kW) or less used for hot water supply at a pressure of 160 psi (1103 kPa) or less and at temperatures not exceeding 210°F (99°C), as regulated by the Plumbing Code.
- (2) Pressure vessels used for unheated water supply, including those containing air that serves only as a cushion and is compressed by the introduction of water and tanks connected to sprinkler systems.
- (3) Portable unfired pressure vessels and Interstate Commerce Commission (I.C.C.) containers.
- (4) Containers for liquefied petroleum gases, bulk oxygen, and medical gas that are regulated by the Fire Code.
- (5) Unfired pressure vessels in Groups B, F, H, M, R, S, and U Occupancies having a volume of five (5) cubic feet (0.14 m<sup>3</sup>) or less and operated at pressures not exceeding 250 psi (1,724 kPa).
- (6) Pressure vessels used in refrigeration systems that are regulated by Chapter 11 of this code.
- (7) Pressure tanks used in conjunction with coaxial cables, telephone cables, power cables, and other similar humidity control systems.
- (8) Any boiler or pressure vessel subject to regular inspection by federal inspectors or licensed by federal authorities.
- (9) Boilers within the scope of NFPA 85, including associated fuel systems shall be designed and installed in accordance with NFPA 85, Boiler and Combustion Systems Hazards Code.
- (10) Coil-type hot water boilers where the water can flash into steam when released directly to the atmosphere through a manually operated nozzle may be exempted from the provisions of this section provided the following conditions are met.
  - A. There is no drum, header, or other steam space;
  - B. No steam is generated within the coil;
  - C. Tubing outside diameter does not exceed 1 inch (25.4 mm);

- D. Pipe size does not exceed NPS 3/4;
- E. Nominal water capacity does not exceed 6 gallons (22.71 L);
- F. Water temperature does not exceed 350°F (177°C); and
- G. Adequate safety relief valves and controls are provided.

**1004.1**

**-A-**

**ALTERATION.** A change in an original design or configuration.

**ASME CODE.** The American Society of Mechanical Engineers Boiler and Pressure Vessel Code with addenda, code cases, and interpretations adopted by the council of the Society.

**AUTHORIZED BOILER INSPECTOR.** An inspector employed by an inspection agency, holding a commission issued by the commissioner of the State of Texas Department of Licensing and Regulation.

**1004.3**

**-C-**

**CONDEMNED BOILER.** A boiler inspected and declared unfit for further service by the Authority Having Jurisdiction.

**1004.4**

**-D-**

No definitions.

**DEPUTY INSPECTOR.** An inspector appointed and deputized by the Authority Having Jurisdiction.

**DETACHED BOILER.** Any class of boiler that remains in its original installed location and has been permanently disconnected from its energy source (i.e. natural gas, electricity, etc.)

**1004.5**

**-E-**

No definitions.

**ELECTRIC BOILER.** A boiler in which the source of heat is electricity.

**EXTERNAL INSPECTION.** An inspection of the exterior of the boiler, its surroundings and its appurtenances.

**1004.9**

**-I-**

**INSPECTOR.** The Authority Having Jurisdiction, a deputy inspector, or an authorized inspector.

**INTERNAL INSPECTION.** As complete and thorough an inspection of the interior of a boiler as construction allows.

**1004.14**

**-N-**

No definitions.

**NATIONAL BOARD.** The National Board of Boiler and Pressure Vessel Inspectors.

**NATIONAL BOARD INSPECTION CODE.** The manual for boiler and pressure vessel inspectors published by the National Board of Boiler and Pressure Vessel Inspectors.

**NON-STANDARD BOILER.** A boiler that does not qualify as a standard boiler.

**1004.15**

**-P-**

**PORTABLE BOILER.** A boiler primarily intended for temporary use at a location.

**1004.17**

**-R-**

No definitions.

**REPAIR.** The work necessary to restore a boiler or a pressure vessel to a safe and satisfactory operating condition, provided there is no deviation from the original design.

**1004.18**

**-S-**

**SAFETY APPLIANCES.** Safety devices such as safety valves or safety relief valves (within the jurisdictional limits as prescribed by the Authority Having Jurisdiction) provided for the purposes of diminishing the danger of accidents.

**SECONDHAND BOILER.** A boiler for which both the location and ownership have changed.

**STANDARD BOILER.** A boiler that bears the Texas stamp, the ASME stamp, or the stamp of any jurisdiction that has adopted a standard of construction equivalent to that required by the State of Texas.

**1005.1 Safety Requirements.** The construction of boilers and pressure vessels used for steam and hot water boiler systems and the installation thereof shall conform to minimum requirements for safety from structural and mechanical failure and excessive pressures, as established by the Authority Having Jurisdiction in accordance with nationally recognized standards.

**1005.2 Controls.** Required electrical, mechanical, safety, and operating controls components shall carry approval of an approved testing agency or be accepted by the Authority Having Jurisdiction. Electrical controls shall be of such design and

construction as to be suitable for installation in the environment in which they are located.

**1005.3 Gauges and Indicators.** All steam boilers shall be provided with a pressure gauge and a water level glass. All water boilers shall be provided with a pressure gauge and a temperature indicator. All gauges and indicators shall be installed in accordance with nationally recognized standards.

**1005.4 Potable Water Boilers.** Permits and inspections pertaining to boilers used exclusively for the production of potable hot water shall be administered by the Plumbing Inspection Section staff of the Authority Having Jurisdiction. Reference Section 1002.0, Exception 1. Permits and inspections pertaining to boilers used for other than the production of potable hot water shall be administered by the Mechanical Inspection Section staff of the Authority Having Jurisdiction.

**1005.5 Welding.** Welding on pressure vessels or on boiler pressure-retaining boundaries shall be done by certified welders in conformity with nationally recognized standards. All such welding shall be subject to the approval of the Authority Having Jurisdiction.

**1005.6 Permit Required.** Except for work exempted by Section 112.2 of this code, a permit shall be obtained from the Authority Having Jurisdiction prior to installation, re-installation, alteration, repair or replacement of boilers and pressure vessels related to steam and hot water boiler systems. Alteration of safety control systems on automatic boilers or replacement, repair, or alteration of breeching, vent connector, vent pipe or chimney, and the conversion of solid fuel-fired boilers as permitted by Section 1013.0 shall also require a permit. See Chapter 1 for requirements for obtaining permits.

**1005.7 Moving Boilers.** Any owner, user, or person desiring to remove, transfer, or relocate any boiler in the jurisdiction shall first obtain a new permit to install and have that same boiler inspected or tested by the Authority Having Jurisdiction.

**1005.8 Reinstallation.** Any installed boiler in the jurisdiction may be reinstalled, provided an application is filed with the Authority Having Jurisdiction and a permit is granted. A permit to install shall be issued provided that the boiler shall be inspected internally, a hydrostatic pressure test will be applied if deemed necessary by the Authority Having Jurisdiction, and the Authority Having Jurisdiction determines that the boiler meets inspection and test requirements.

**Exception:** A horizontal return tubular boiler having continuous lap seam of more than 12 feet in length shall not be reinstalled for a gauge pressure in excess of 15 psi.

**1005.9 Secondhand Boilers.** All secondhand boilers shall be subject to inspection and shall be plainly numbered and tagged by the State of Texas for identification by the Authority Having Jurisdiction before they are coated with paint or other preservative or offered for sale.

**1005.10 Potable Water Boilers.** Permits and inspections pertaining to boilers used exclusively for the production of potable hot water shall be administered by the Plumbing Inspection Section staff of the Authority Having Jurisdiction. Permits and inspections pertaining to boilers used for other than the production of potable hot water

shall be administered by the Mechanical Inspection Section staff of the Authority Having Jurisdiction.

**1005.11 Boiler Nameplate.** A boiler nameplate shall be attached to each boiler. Lost or destroyed nameplates shall be replaced in accordance with The National Board Inspection Code.

**1005.12 Automatic Controls.** No low-pressure gas-fired boilers or furnace capable of consuming 200,000 Btu or more per hour shall be installed, and no boiler designed for other fuels having that Btu capacity shall be converted to the use of gas fuel unless equipped with either a thermostatic pilot light or other approved equipment constructed and adjusted so that no gas can flow through the main burner unless the pilot light is burning.

In the case of a steam boiler, it shall be equipped with a low-water cutoff and an excess pressure switch to close the main gas supply valve on a low-water condition or an excess pressure condition. In the case of a hot-water boiler, it shall be equipped with a low-water fuel cutoff and an excess temperature switch to close the main gas supply valve on a low-water condition or an excess temperature condition. In the case of a forced or mechanical draft boiler, a means to prove airflow shall be provided to prevent gas flow to the main burner in the absence of airflow.

The operation of the pilot safety device shall not depend on the closing of an electrical circuit to shut off the main gas supply to the boiler.

**1006.1 General.** All hot-water-heating systems shall be provided with an air expansion tank securely fastened to the structure. Supports shall be adequate to carry twice the weight of the tank filled with water without placing any strain on connecting piping.

All hot-water-heating systems incorporating hot water tanks or fluid relief columns shall be so installed as to prevent such items from freezing under normal operating conditions.

**1006.2 Systems with Open Expansion Tanks.** Systems equipped with an open expansion tank to satisfy thermal water expansion shall be provided with an indoor overflow from the upper portion of the expansion tank in addition to an open vent. The indoor overflow shall be carried within the building to a suitable plumbing fixture or plumbing drain to the basement.

**1006.3 Closed-Type Systems.** Systems of the closed type shall have an airtight tank or other suitable air cushion that will be consistent with the volume and capacity of the system, and shall be suitably designed for a hydrostatic test pressure of two and one-half (2-1/2) times the allowable working pressure of the system at the point the tank connects to the system. Expansion tanks for systems designed to operate at or above 30 psig shall be constructed in accordance with nationally recognized standards approved by the Authority Having Jurisdiction. Provisions shall be made for draining the tank without emptying the system, except for pressurized tanks.

### **1007.0 Safety and Safety Relief Valves Discharge.**

**1007.1 Safety and Safety Relief Valves.** All safety valves used on boilers in the jurisdiction shall conform to the prescribed or recommendatory rules of the ASME Code and the State of Texas Boiler Law and shall have the necessary provisions so that the safety valve can be sealed in such a manner that the pressure-relieving mechanism of the safety valve cannot be changed, altered or adjusted unless the seal is broken.

**1007.2 Authority to Set and Seal Safety Appliances.** All safety and safety relief valves for ASME Section I, Section IV, and Section VIII Division 1 boilers must be repaired, tested, set, and sealed by one of the following, provided the scope of the issued certificate of authorization covers the work to be performed:

1. An organization holding a valid V, HV, or UV certificate of authorization, as appropriate, issued by the American Society of Mechanical Engineers (ASME);
2. An organization holding a valid VR certificate of authorization issued by the National Board of Boiler and Pressure Vessel Inspectors; or
3. An organization holding a valid owner/operator certificate of authorization issued by the Texas Department of Licensing and Regulation.

**1007.3 Safety or Relief Valve Discharge.** The discharge from relief valves shall be piped to an approved location within eighteen (18) inches (457 mm) of the floor or to an open receptacle, and when the operating temperature is in excess of 212°F (100°C), shall be equipped with a splash shield or centrifugal separator. When the discharge from safety valves would result in a hazardous discharge of steam inside the boiler room, such discharge shall be extended outside the boiler room. No valve of any description shall be placed between the safety or relief valve and the boiler, nor on the discharge pipe between the safety valve and the atmosphere. Discharge piping shall not be connected to any other piping system, and the cross-sectional area shall not be less than the full area of the valve outlet, or the total areas of the valve outlets discharging thereinto, whichever is greater. See also Section 1011. Discharges from relief valves on industrial boilers shall be discharged to an approved location.

### **1008.0 Gas Shutoff Valves.**

An approved manual shutoff valve with handle shall be installed within 3 feet of the boiler gas train, upstream of all control devices on the main burner of a gas-fired boiler. The takeoff point for the gas supply to the pilot shall be upstream of the gas shutoff valve of the main burner and shall be valved separately. A union or other approved means of disconnect shall be provided immediately downstream of these shutoff valves

**1010.1 Hot Water Heating Boilers.** Hot water heating boilers, other than manually fired, shall be equipped with a low-water cutoff, except that a coil-type boiler or a water-tube boiler that requires forced circulation to prevent overheating of the coils or tubes shall have a flow-sensing device installed in the outlet piping in lieu of the low-water cutoff. The required low-water cutoff or flow switch, as applicable, shall be mounted so as to prevent damage to the boiler and to permit testing of the fuel-supply cutoff without

draining the heating system, except that such boilers used in Group R Occupancies of less than six dwelling units and Group U Occupancies need not be equipped with the low-water cutoff or flow switch.

**1010.2 Low-Water Fuel Cut Off and Feed Water Pump Control Combined in a Single Device.** Where such a device is used, an additional separate low-water fuel cutoff with manual reset shall be installed. The additional control shall be wired in series electrically with the existing low-water fuel cutoff.

**1010.3 Low-Water Fuel Cutoff Housed in Either the Water Column or Separate Chamber.** The installation shall be provided with a blow down pipe and valve not less than 3/4 inch pipe size. The arrangement shall be such that when the water column is blown down, the water level in it will be lowered sufficiently to activate the low-water fuel cutoff device.

**1010.4 Newly Installed Automatically Fired Hot Water Heating Boilers.** Such boilers, when installed in a forced circulation system, shall be equipped in the manner described in this section and Sections 1010.1 and 1010.2. A coil-type boiler or a water-tube boiler requiring forced circulation to prevent overheating of the coils or tubes shall have a device to prevent burner operation if the flow rate becomes inadequate to protect the boiler unit from overheating.

**1010.5 Water Feed Device.** Where a water feed device is used, it shall be constructed to prevent feed water from entering the boiler through the water column or separate chamber of the low-water fuel cutoff.

### **1011.0 Combustion Regulators — Safety Valves Retroactive Requirements.**

The following requirements shall be retroactive:

**1011.1** Every hot water-heating boiler, other than manually fired, shall be equipped with two temperature combustion regulators in series. Every steam heating boiler, other than manually fired, shall be equipped with a pressure combustion regulator and a low-water cutoff. (See Section ~~1011.0~~ 1010.0.)

**1011.2** Boilers and pressure vessels shall be provided with the required number, size and capacity of safety or relief valves to ensure positive relief of overpressure in accordance with nationally recognized standards, as applicable. Valves so employed shall be constructed, sealed and installed in accordance with nationally recognized standards, as applicable. See Section 1007.

### **1012.0 Automatic Boilers.**

Automatic boilers shall be equipped with controls and limit devices as set forth in Table 10-3. ~~Automatic boilers shall also be equipped with the following gauges, as applicable: oil temperature, oil suction pressure, high and low gas pressure, stack temperature, and windbox pressure.~~

Except as otherwise specified, ~~all gas-fired boilers exceeding 400,000 Btu/h (117 kW) input shall conform to nationally recognized standards approved by the Authority Having Jurisdiction.~~

The Authority Having Jurisdiction shall have the authority to approve solid-fuel-fired boilers that can meet the safety requirements for automatic gas- or oil-fired boilers.

### **1013.0 Clearance for Access.**

When boilers are installed or replaced, clearance shall be provided to allow access for inspection, maintenance, and repair. Passageways around all sides of boilers shall have an unobstructed width of not less than ~~eighteen (18) inches (457 mm)~~, 24 inches (610 mm).

Clearance for repair and cleaning may be provided through a door or access panel into another area, provided the opening is of sufficient size. A minimum clearance of 48 inches (1220 mm) shall be maintained between top of a boiler and any building component. A minimum of 12 inches (305 mm) shall be maintained between the bottom of a scotch-type or locomotive-type boiler mud rim or wet bottom to the foundation or floor. The boiler mud rim or bottom of a vertical boiler shall be not less than six inches (153 mm) from the ground.

**Exception:** Subject to the approval of the Authority Having Jurisdiction, boilers may be installed with a side clearance of less than ~~eighteen~~ twenty-four (1824) inches (~~457~~ 610 mm), provided that the lesser clearance does not inhibit inspection, maintenance, or repair.

~~Power boilers having a steam-generating capacity in excess of 5,000 pounds per hour (2,268 kg/h) or having a heating surface in excess of 1,000 square feet (93 m<sup>2</sup>) or input in excess of 5,000,000 Btu/h (1,465 kW) shall have a minimum clearance of seven (7) feet (2,134 mm) from the top of the boiler to the ceiling.~~

~~Steam-heating boilers and hot-water-heating boilers that exceed one of the following limits—5,000,000 Btu/h input (1465 kW); 5,000-poundsteam per hour (2268 kg/h) capacity; or 1,000 square foot (93 m<sup>2</sup>) heating surface—and power boilers that do not exceed one of the following limits—5,000,000 Btu/h input (1465 kW); 5,000-pound steam per hour (2268 kg/h) capacity; or 1,000-square-foot (1465 kW) heating surface—and all boilers with manholes on top of the boiler, except those described in the second and fourth paragraphs, shall have a minimum clearance of three (3) feet (914 mm) from the top of the boiler to the ceiling.~~

~~Package boilers, steam heating boilers, and hot water heating boilers with no manhole on top of the shell and not exceeding one of the above limits shall have a minimum clearance of two (2) feet (610 mm) from the ceiling.~~

### **1018.0 Drainage.**

~~For heating or hot water supply~~ all boiler applications, the boiler room shall be equipped with a floor drain or other means suitable for disposing of the accumulation of liquid

wastes incident to cleaning, recharging, and routine maintenance. No steam pipe shall be directly connected to any part of a plumbing or drainage system, nor shall any water having a temperature above 140°F (60°C) be discharged under pressure directly into any part of a drainage system. Pipes from boilers shall discharge by means of indirect waste piping, as determined by the Authority Having Jurisdiction or the boiler manufacturer's recommendations.

### **1019.0 Fuel Piping, Tanks, and Valves.**

~~Fuel piping shall conform to the Plumbing Code. Tanks, piping, and valves for oil-burning appliances shall be installed in accordance~~ Fuel oil piping shall conform to with NFPA 31, 1978, Standard for the Installation of Oil-Burning Equipment. That portion of the oil-burning system supplied on boilers and covered within the scope of NFPA 85 shall be installed in accordance with NFPA 85.

### **1020.0 Air for Combustion and Ventilation.**

Air for combustion and ventilation shall be provided in accordance with Chapter 7 of this code. Mechanical ventilating systems supplying air for combustion to rooms containing boilers shall supply not less than 15 cubic feet of air for each cubic foot of gas burned. The ventilation fan(s) shall be interlocked with the boiler controls.

**1021.1 Operating Instructions.** ~~Hot water boiler installations, u~~Upon completion all boiler installations shall have controls set, adjusted, and tested by the installing contractor. A complete control diagram of a permanent legible type, together with complete boiler operating instructions, shall be furnished by the installer for each installation.

**1021.2 Manufacturer's Instructions.** The installation of each boiler covered by this chapter shall conform to the conditions of approval as specified in the manufacturer's installation instructions pertaining to safety and to the requirements of this chapter. The installer shall leave the manufacturer's instructions attached to the boiler or readily available for the benefit of the inspector.

### **1022.0 Inspections and Tests.**

**1022.1 Inspections and Tests.** An installation for which a permit is required shall not be put into service until it has been inspected and approved by the Authority Having Jurisdiction.

It shall be the duty of the ~~owner or his~~ permit holder or his/her authorized representative to notify the Authority Having Jurisdiction that the installation is ready for inspection and test. It also shall be the duty of the ~~owner or his,~~ permit holder or the authorized representative of either to assure that ~~post in a conspicuous position on the installation a notice in substantially the following form: "Warning! This installation has not been inspected and approved by the Authority Having Jurisdiction and shall not be~~

~~covered or concealed until so inspected and approved,” and it shall be unlawful for anyone other than the Authority Having Jurisdiction to remove such notice. the installation is not covered, or concealed, or operated until so inspected and approved by the Authority Having Jurisdiction. The Authority Having Jurisdiction shall require such tests as it deems necessary to determine that the installation complies with the provision of this section. Such tests shall be made by the ~~owner~~ permit holder or his authorized representative in the presence of the Authority Having Jurisdiction.~~

**Exception:** On installations designed and supervised by a registered professional engineer, the Authority Having Jurisdiction ~~shall have the authority to permit inspection and testing by such engineer~~ may accept the written report bearing the engineer’s seal of a hydrostatic test performed and/or witnessed by said engineer.

~~When the owner or his authorized representative requests inspection of a boiler prior to its installation, the Authority Having Jurisdiction shall make such inspection.~~

**1022.2 Inspection Codes and Standards.** All inspections or tests shall be made in compliance with the prescribed or recommendatory rules or instructions of this code, the ASME Code and the National Board Inspection Code as applicable. The installation or repair of gas and potable water piping and/or accessories shall be subject to the provisions of the Plumbing Code.

**1022.3 Hydrostatic tests.** A hydrostatic test is required for each secondhand boiler or detached boiler being placed back into service. Such boilers shall be tested by hydraulic pressure, in accordance with the National Board Inspection Code, at 50 percent greater than their allowed safe working pressure. If for any reason or on account of leakage the boiler will not hold this pressure, the owner shall have all repairs made before the boiler is placed into service and the inspector shall witness a second test upon receipt of notification that repairs have been made. If upon making the second test, the boiler is still defective, the Authority Having Jurisdiction shall, for each subsequent test, collect an additional inspection fee as herein provided for, but in no case shall the Authority Having Jurisdiction approve the boiler for use until fully satisfied of safe condition of such boiler. The installer or owner shall supply the equipment and labor to conduct the hydrostatic test on the boiler.

When there is a question or doubt about the condition of a boiler, the inspector may require a hydrostatic test, as follows:

**1022.3.1** In preparing a boiler for a hydrostatic test, the boiler shall be filled with water to the stop valve and all air vented off. If the boiler to be tested is connected with other boilers that are under pressure, such connections shall be blanked off unless they have double stop valves on all connection pipes with a drain between.

**1022.3.2** During a hydrostatic test of a boiler, the safety valve or valves shall be removed or each valve disc shall be held to its seat by means of a testing clamp and not by screwing down the compression screw under the spring.

**1022.3.3** The temperature of the water used to apply a hydrostatic test shall be between 70E and 120EF.

**1022.3.4** When a hydrostatic test is to be applied, the pressure shall be as follows:

1022.3.4.1 For all cases involving the question of tightness, the pressure shall be equal to the set pressure of the safety valve or valves having the lowest setting.

1022.3.4.2 For all cases involving the question of safety, the pressure shall be equal to one and one-half times the maximum allowable working pressure.

1022.3.4.3 The pressure applied for a hydrostatic test shall not exceed one and one-half times the maximum allowable working pressure. In no case shall the test pressure be exceeded by more than 2 percent.

**1022.4 Inspection, Non-standard Boilers.** The Authority Having Jurisdiction shall designate the manner of inspection for non-standard boilers, frequency of inspection, the form of inspection report, and the information reported.

**1022.5 Special Inspections.** The Authority Having Jurisdiction may provide a special inspection as requested by owners, operators, installers, and manufacturers of boilers. The service may include surveys required for certification to assemble, install, or repair boilers within this jurisdiction. Special inspection fees shall be charged in accordance with Section 117 of the Building Code.

**1022.6 Authorized Inspection.** Inspection of repairs of pressure retaining boundaries of boilers and pressure vessels covered by insurance may be made by employees of the insuring company who hold commissions from the National Board of Boiler and Pressure Vessel Inspectors, subject to approval of the Authority Having Jurisdiction. Approved insuring company inspectors shall make reports on prescribed forms on inspections authorized by the Authority Having Jurisdiction. The reports shall be filed in the office of the Authority Having Jurisdiction.

### **1023.0 Temporary Operating Permit.**

~~It shall be unlawful to operate a boiler or pressure vessel without first obtaining a valid operating permit to do so from the Authority Having Jurisdiction. Such permit shall be displayed in a conspicuous place adjacent to the boiler or vessel. The operating permit shall not be issued until the equipment has been inspected and approved by the Authority Having Jurisdiction.~~

~~**Exception:** The operation only of steam-heating boilers, low-pressure hot-water-heating boilers, hot water supply boilers, and pressure vessels in Group R Occupancies of less than six dwelling units and in Group U Occupancies~~

An installer of a boiler installed by authority of a permit issued under the provisions of this code may operate the boiler and its appurtenances for a limited period of time for the purpose of cleaning, testing and adjusting, prior to passing final inspection, upon the following conditions:

1. The installer in whose name the permit is issued shall request the Authority Having Jurisdiction to inspect the system for approval of such operation.
2. If upon inspection the system is approved for operation as described herein, the Authority Having Jurisdiction shall indicate in writing on said permit that a

temporary operation is approved for the purpose of cleaning, testing, and adjusting for a period 30 working days from date of inspection.

3. On or before the expiration date of the temporary operating permit, the system shall be given a final inspection and if the system fails to be approved, a reinspection fee will be charged for each subsequent inspection until the system is finally approved as complying with the requirements of this code.
4. Should the cleaning, testing, and adjusting of a boiler system not be completed within the time stipulated on the temporary operating permit, the Authority Having Jurisdiction may extend the time for just cause.

### **1024.0 Maintenance Inspection Repairs.**

~~The Authority Having Jurisdiction shall inspect all boilers and pressure vessels operated under permit at such intervals as deemed necessary, but not less frequently than noted below:~~

~~1024.1 Power boilers and miniature boilers shall be inspected externally annually. Where construction and operating conditions permit, they shall, in addition, be subject to inspection internally annually.~~ **General.** Repairs, changes, or alterations made on a boiler shall conform with the prescribed or recommended rules of the ASME Code and the National Board Inspection Code and shall be subject to inspection (visual and/or hydrostatic test) by the Authority Having Jurisdiction before the boiler is coated with paint or other preservatives.

~~1024.2 Steam-heating boilers and hot-water heating boilers shall be inspected externally annually. Where construction and operating conditions permit, they shall, in addition, be subject to inspection internally annually.~~ **Major Repair.** The term "major repair" as used herein shall be considered as one upon which the strength of a boiler would depend. Where a major repair is necessary, it shall be subject to the approval of the Authority Having Jurisdiction. Repairs to all boilers and their appurtenances shall conform as nearly as practicable to the requirements of the National Board Inspection Code. See Section 1024.6.

~~1024.3 Automatic steam-heating boilers shall be inspected externally biennially. Where construction and operating conditions permit, they shall, in addition, be subject to inspection internally biennially.~~ **Repairs by Welding Fusion.** All repairs by welding shall be completed in accordance with the recommended rules for repair by fusion welding to power boilers published in the National Board Inspection Code.

~~1024.4 Unfired pressure vessels shall be inspected externally biennially. When subject to corrosion and construction permits, they shall, in addition, be subject to inspection internally biennially.~~ **Re-ending and Piecing Tube.** Re-ending or piecing tubes or pipes in either fire-tube or water-tube boilers is permitted, provided the thickness of the tube or pipe has not been reduced by more than 10 percent from that required by the ASME Code for the pressure to be carried.

~~Inspection of boilers and pressure vessels covered by insurance may be made by employees of the insuring company holding commissions from the National Board of~~

~~Boiler and Pressure Vessel Inspectors, subject to approval of the Authority Having Jurisdiction. Approved insuring company inspectors shall make reports on prescribed forms on inspections authorized by the Authority Having Jurisdiction. The reports shall be filed in the Authority Having Jurisdiction office. Company inspectors shall notify the Authority Having Jurisdiction of suspension of insurance because of dangerous conditions, new insurance in effect, and discontinuance of insurance coverage.~~

**1024.5 Repairs and Renewal of Fittings and Appliances.** Whenever repairs are made to fittings or appliances or it becomes necessary to replace them, the work must comply with this Code and ASME Code and National Board Inspection Code for new installations.

**1024.6 Repair/Alteration Forms.** Completed State of Texas R-1 welder forms for a boiler repair and/or alteration shall be submitted to the inspector before final approval.

**1024.7 Leaks or Cracks.** If there is evidence of a leak or crack, or any defect, the covering of the boiler shall be removed to satisfy the inspector as to the safety of the boiler. If the covering cannot be removed at that time, the inspector may order operation of the boiler to be discontinued until such time as the covering can be removed and a proper examination made.

## **1026.0 Electrical Boilers**

**1026.1 Installation.** Installation shall comply with the provisions of this chapter. All electrical wiring, devices, and components shall be in compliance with the Electrical Code and the State of Texas Boiler Law.

**1026.2 Safety Relief Capacity.** The minimum safety or safety relief valve relieving capacity for electric boilers shall be 3 ½ pounds of steam per hour per kilowatt input.

## **1027.0 New and Existing Boiler Installations.**

**1027.1 New installations.** New boiler installations, including reinstalled boilers, shall be in accordance with the requirements of the latest revision of the applicable section of the ASME Code and this code. Secondhand boilers shall meet all the requirements for new installations, including code construction and stamping requirements and shall be hydrostatically tested if deemed necessary by the Authority Having Jurisdiction.

**1027.2 Existing installations.** The maximum allowable working pressure for standard boilers shall be determined in accordance with the applicable provisions of the edition of the ASME Code under which they were constructed and stamped. In no case shall the maximum pressure of an existing nonstandard boiler be increased to a greater pressure than would be allowed for a new boiler of the same construction.

**1027.3 Makeup water connection to steam boilers.** Approved backflow preventers shall be installed in accordance with the Plumbing Code.

**1027.4 Boiler Discharge to Plumbing Systems.** No steam pipe shall connect to any part of a drainage or plumbing system, nor shall any water above 140EF (60EC) be

discharged into any part of a drainage system. Such pipes shall be indirectly connected by discharging into an interceptor, blowoff pit or similar appurtenances prior to delivery into the drainage system.

{**EDITOR'S NOTE: NO CHANGE** TO THE REMAINDER OF **TABLE 10-3** AND FOOTNOTES NOT LISTED.}

**FOOTNOTES FOR TABLE 10-3 (Continued)**

- 1 Fuel input shall be determined by one of the following:
  - (a) The maximum burner input as shown on the burner nameplate or as otherwise identified by the manufacturer.
  - (b) The nominal boiler rating, as determined by the ~~building official~~ Authority Having Jurisdiction, plus twenty-five percent (25%).
- 3 In boiler groups B, C, and D a 90-second main burner flame failure limit may apply if continuous pilots are provided on manufacturer assembled boiler-burner units that have been approved by an approved testing agency as complying with nationally recognized standards approved by the ~~building official~~ Authority Having Jurisdiction. Boiler groups F and G equipped to re-energize their ignition systems within 0.8 second after main burner flame failure will be permitted thirty (30) seconds for group F or fifteen (15) seconds for group G to reestablish their main burner flames.
- 9 Every automatic low-pressure steam-heating boiler, ~~small power boiler~~, and power steam boiler shall be equipped with two high-steam pressure limit controls interlocked to shut off the fuel supply to the main burner with manual reset on the control, with the higher setting and two low-water-level limit controls, one of which shall be provided with a manual reset device and independent of the feed water controller. Coil-type flash steam boilers may use two high-temperature limit controls, one of which shall be manually reset in the hot water coil section of the boiler instead of the low-water level limit control.
- 11 Control and limit device systems shall be grounded with operating voltage not to exceed 150 volts, except that, upon approval by the ~~building official~~ Authority Having Jurisdiction, existing control equipment to be reused in an altered boiler control system may use 220 volt single phase with one side grounded, provided such voltage is used for all controls. Control and limit devices shall interrupt the ungrounded side of the circuit. A readily accessible means of manually disconnecting the control circuit shall be provided with controls so arranged that when they are de-energized, the burner shall be inoperative.

## CHAPTER 11

### REFRIGERATION

#### 1101.0 Scope.

Part I of this chapter covers refrigeration systems. Refrigeration systems, equipment, and devices ~~for new buildings, including the replacement of parts, alterations, and substitution of a different refrigerant,~~ shall conform to the requirements of this chapter and other applicable provisions of this code. Replacement of existing refrigeration systems, conversion to a different refrigerant or installation of a new refrigeration system into an existing building shall conform to the requirements of this chapter as modified by Section 1126.

Occupied spaces within refrigerated areas shall comply with this chapter and the applicable portions of the Building Code.

Part II covers cooling towers.

**1104.0 Classification of Refrigeration Systems.** Refrigeration systems shall be classified according to the degree of probability that a leakage of refrigerant could enter a normally occupied area space. Normally occupied space does not include refrigeration machinery rooms, engine rooms, boiler rooms, switchgear rooms and similar spaces that are normally accessible only to authorized personnel.

**1105.2 Volume of Occupied Space.** The quantity of refrigerant in a single, independent circuit of a high-probability system shall not exceed the amounts shown in Table 11-1 based on the volume of the occupied space. The volume of the smallest, enclosed, occupied space shall be used to determine the permissible quantity of refrigerant in a system that is located in, serves, or passes through such space.

#### Exceptions:

- (1) If the airflow to any enclosed space served by a portion of an air-duct system cannot be shut off or reduced below one-quarter of its maximum, the cubical contents of the entire space served by that portion of the air-duct system ~~shall~~ may be used to determine the permissible quantity of refrigerant in the system.
- (2) Refrigerated process or storage areas meeting the requirements of Section 1105.3.

**1105.3.1** The refrigerated room or space is equipped with a refrigerant vapor detection and alarm system complying with Section 1121.0, with alarm enunciating devices located as required for machinery rooms in Section 1107.4.

{EDITOR'S NOTE: DELETE SECTION 1105.4, INCLUDING 1105.4.1 AND 1105.4.2, AND RESERVE.}

**1106.1 Human Comfort.** Cooling systems used for human comfort shall comply with the return-air and outside-air provisions for furnaces in Sections 904.7 and 904.8 of this code. ~~Cooling equipment used for human comfort in dwelling units shall be sized to satisfy the calculated loads determined in accordance with the reference standards in Chapter 17 or other approved methods.~~

**1106.3 Access.** An unobstructed readily accessible opening and passageway not less than ~~thirty-six (36)~~ twenty-four (24) inches (~~914~~ 609.6 mm) in width and six (6) feet ~~eight (8)~~ six (6) inches (~~203~~ 198.1.2 mm) in height shall be provided and maintained to the compressor, valves required by this chapter, or other portions of the system requiring routine maintenance.

**Exceptions:**

- (1) Refrigerant evaporators, suspended overhead, may use portable means of access.
- (2) Air filters, brine control or stop valves, fan motors or drives, and remotely de-energized electrical connections may be provided access by an unobstructed space not less than thirty (30) inches (762 mm) in depth, width, and height. When an access opening is immediately adjacent to these items and the equipment can be serviced, repaired, and replaced from this opening, the dimensions may be reduced to twenty-two (22) inches (559 mm) by thirty (30) inches (762 mm) provided the largest piece of equipment can be removed through the opening.
- (3) Cooling equipment, using Group A1 refrigerants or brine, located in an attic or furred space may be provided an access by a minimum opening and passageway thereto of not less than twenty-two (22) inches × thirty (30 ) inches.
- (4) Cooling or refrigeration equipment, using Group A1 or B1 refrigerants or brine, located on a roof or on an exterior wall of a building, may be provided access as for furnaces in Section 904.10 of this code.

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 1106.4.}

**1106.6 Electrical.** Electrically energized components of refrigeration systems shall be listed and conform to the Electrical Code.

**1106.8 Prohibited Locations.** Refrigeration systems or portions thereof shall not be located within a required exit enclosure. Refrigeration compressors exceeding five (5) horsepower (3.68 kW) rating that contain other than A1 refrigerants shall be located at least ten (10) feet (3048 mm) from an exit opening in a Group A; Group B; Group E;

Group F; ~~Group H;~~ Group I; Group R, Division 1 or 2; or Group S Occupancy, unless separated by a one-hour fire-resistive ~~occupancy-rated fire barrier separation~~.

The installation of air handling and refrigeration units within the same room is prohibited.

**1106.10 Condensate.** Condensate from air-cooling coils shall be collected and drained to an approved location. Drain pans and coils shall be arranged to allow thorough drainage and access for cleaning. ~~Where temperatures can drop below freezing, heat tracing and insulation of condensate drains shall be installed.~~ Primary drain piping inside buildings shall be insulated for the first 15 feet horizontally from the drain pan. The insulation shall be a minimum of ½ inch in thickness.

**1107.1 When Required.** Refrigeration systems shall be provided with a refrigeration machinery room when any of the following conditions exist:

**1107.1.1 Where required.** ~~The quantity of refrigerant in a single, independent refrigerant circuit of a system exceeds Table 11-1 amounts. A refrigeration machinery room is not required if all components of an A1 or B1 refrigeration system are located outdoors at least 10 feet from a door, operable window or ventilation intake opening into a building and at least 5 feet from any property line not adjoining a public way. In other than the foregoing outdoor locations, all interior or exterior refrigeration systems shall be provided with a refrigeration machinery room when any of the following conditions exist:~~

**1107.1.1.1** The quantity of refrigerant in a single system exceeds Table 11-1 amounts.

**1107.1.1.2** Absorption refrigeration equipment is used.

**1107.1.1.3** A Group A1 system having an aggregate compressor horsepower of 100 or more is used; or

**1107.1.1.4** The system contains other than a Group A1 refrigerant.

**Exception:** Refrigeration machinery rooms shall house all refrigerant-containing portions of the system other than the piping and evaporators permitted by Section 1105.3, discharge piping required of this chapter, and cooling towers regulated by Part II of this chapter, and their essential piping.

{**EDITOR'S NOTE: DELETE THE REMAINDER OF SECTIONS 1107.1.2, 1107.1.3, AND 1107.1.4.**}

**1107.2 Dimensions.** Refrigeration machinery rooms shall be of such dimensions that all system parts are readily accessible with adequate space for maintenance and operations. An unobstructed walking space at least ~~three (3) two (2) feet (914-609.6 mm)~~ in width and six (6) feet ~~eight-six (8-6) inches (2032-1981.2 mm)~~ in height shall be maintained throughout, allowing free access to at least two sides of all moving machinery and approaching each stop valve. Access to refrigeration machinery rooms shall be restricted to authorized personnel and posted with a permanent sign.

**Exception:** Existing installations being modified need not comply if, in the opinion of the building official, compliance creates undue hardship.

**1107.4 Refrigerant Vapor Alarms.** Machinery rooms shall have approved refrigerant vapor detectors located in an area where refrigerant from a leak is likely to concentrate and shall activate visual and audible alarms. Alarms shall be activated at a value not greater than one-half the immediately dangerous to life or health (IDLH), or measurement consistent therewith; the PEL, or measurement consistent therewith; or 25 percent of the LFL, whichever is less. A refrigerant vapor detection system and alarm system for the specific refrigerant(s) shall be installed and shall utilize alarm-signaling devices providing a sound pressure level of at least 15 dBA above the operating ambient noise level within the room and providing a distinctive visual alarm both inside and outside the machinery room at each entrance. The refrigerant sensor(s) shall energize the emergency ventilation system upon detection of refrigerant levels as specified in Section 1108.5 and automatically de-energized refrigeration machines and other motorized equipment in the room.

**1107.5 Separation.** Refrigeration machinery rooms shall be separated from other portions of the building as required in ~~the special hazards provisions Table 508.2~~ Incidental Use Areas of the Building Code. Penetrations shall be sealed to inhibit the passage of refrigerant vapor.

**1108.2.1** Continuously maintain the refrigeration machinery room at ~~0.05-inch (12.44 Pa) water gauge~~ a negative pressure relative to adjacent spaces, ~~calculated by:~~

$$Q = 2610A_e \sqrt{\Delta p} \quad \text{(Equation 11-1)}$$

**Exception:** Refrigeration machinery rooms located in entirely detached structures and more than twenty (20) feet (6,096 mm) from property lines or openings into buildings.

**1108.2.2** Continuously provide ~~0.5-0.10~~ 0.5-0.10 cubic foot per minute of airflow per gross square foot (2.54 L/s/m<sup>2</sup>) of floor area within the refrigeration machinery rooms as calculated by:

$$Q = 0.5-0.1A_{gf} \quad \text{(Equation 11-2)}$$

**1108.2.3** Limit the temperature rise within the refrigeration machinery room to a maximum of ~~104°F (40°C)~~ 18°F (-8°C) as calculated by:

$$Q = \sum q / (18)(1.08) \Delta T \quad \text{(Equation 11-3)}$$

**1108.2.4** Provide emergency purge of escaping refrigerant as calculated by:

$$Q = 100\sqrt{G} \quad \text{(Equation 11-4)}$$

**WHERE:**

$q$  = Btu/h of all heat-producing equipment.

$Q$  = air-flow rate, cubic feet per minute (cfm).

~~$\Delta p$  = pressure difference, inches water gage.~~

~~$A_e$  = equivalent leakage area, square feet (see the Building Code).~~

$A_{gf}$  = gross floor area, square feet.

~~$\Delta T$  = temperature difference between machinery room and supply air ( $^{\circ}$ F).~~

$G$  = refrigerant mass in largest system, lbs.

{EDITOR'S NOTE: DELETE SECTION 1108.3 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}

**1108.3 Emergency exhaust intakes.** Emergency exhaust intakes shall be located within 12 inches of the floor unless the refrigerant is lighter than air.

**1108.5 Emergency Control of the Ventilation Systems.** Fans providing emergency purge ventilation for refrigerant escape shall have a clearly identified switch ~~of the break-glass type~~ providing "on"-only control immediately adjacent to within two feet of the strike side of the door and inside or outside of each refrigerant machinery room exit. Switches located outside the machinery room shall be of the break-glass type. Purge fans shall also respond automatically to the refrigerant concentration detection system set to activate the ventilation system at no more than 25 percent of the LFL or 50 percent of the IDLH, or a measure equivalent thereto, whichever is less. An emergency purge control shall be provided with a manual reset only.

{EDITOR'S NOTE: DELETE AND RESERVE SECTION 1108.6.}

**1108.7 Ventilation Discharge.** Exhaust from mechanical ventilation systems shall be discharged at least ~~twenty (20)~~ fifteen (15) feet (6,096 4572 mm) from a property line or openings into buildings. For other than Group A1 and Group B1 refrigerants listed in Table 11-1, ~~Discharges~~ capable of exceeding 25 percent of the LFL, or 50 percent of the IDLH, shall be equipped with approved treatment systems to reduce the discharge concentrations to these values or lower.

**Exception:** When an approved engineering analysis of plume dispersion demonstrates that the limiting values will not be exceeded at the property line.

**1108.8 Fans.** Fans and associated equipment intended to operate the emergency purge of other than Group A1 or Group B1 refrigerants shall meet the requirements for a Class I, Division 1 hazardous location as specified in the Electrical Code, and shall be spark resistant and of AMCA Division B rating or better.

**1108.9 Ventilation Intake.** Make-up air intakes to replace the exhaust air shall be provided to the refrigeration machinery room directly from outside the building. Intakes shall be located as required by other sections of the code, and For other than Group A1 or Group B1 Refrigerants, intakes shall be fitted with backdraft dampers or similar approved flow-control means to prevent reverse flow. Distribution of make-up air shall be arranged to provide thorough mixing within the refrigeration machinery room to prevent short circuiting of the make-up air directly to the exhaust.

**1109.1 General.** Equipment, piping, ducts, vents, or similar devices that are not essential for the refrigeration process, maintenance and operation of the equipment, or for the illumination, ventilation, or fire protection of the room shall not be placed in or pass through a refrigeration machinery room.

Equipment essential to the refrigeration process often includes, but is not always limited to, the following:

**1109.1.3** Pumps, associated water treatment piping, and automatic control valves for refrigerant, condenser water, and brine or chilled water.

**1109.1.12** Control air compressor and accessories.

**1109.2 Electrical.** Electrical equipment and installations shall comply with the Electrical Code. The refrigeration machinery room shall not be required to be a hazardous (classified) location except as provided in Section 1108.8 or wherein the refrigerant is other than Class 1.

**1109.3 Storage.** Storage of materials in a refrigeration machinery room shall be as permitted in the Fire Code. Refrigerants in excess of the amounts within an approved refrigeration system may be stored in a refrigeration machinery room in their original DOT containers or in vessels stamped in accordance with ASME Section 8. Such storage shall not exceed an amount equal to the total amount of refrigerant contained within all refrigeration machines in the machinery room.

**1109.4 Emergency Control.** For machinery rooms containing other than Group A1 and/or Group B1 refrigerants ~~Aa~~ clearly identified switch of the break-glass type providing "off"-only control of electrically energized equipment and devices within the refrigeration machinery room shall be provided immediately adjacent to and within 2 feet of the strike side of the door inside or outside of each refrigeration machinery room exit. Switches located outside the machinery room shall be of the break-glass type. In addition, emergency shut off shall also be automatically activated when the concentration of refrigerant vapor exceeds 25 percent of the LFL.

**1110.1.1** For refrigerant pipe insulation see Table 11-5.

**TABLE 11-5**  
**Minimum Pipe Insulation<sup>a</sup>**

<b>Fluid</b>	<b>≤1.5 inch</b>	<b>&gt;1.5-inch – 4-inch<sup>d</sup></b>	<b>&gt;4 inch<sup>d</sup></b>
<u>Steam and Steam Condensate</u>	<u>1 ½"</u>	<u>3</u>	<u>4</u>
<u>Heating Hot Water</u>	<u>1 ½"</u>	<u>2</u>	<u>2</u>
<u>Service Hot Water</u>	<u>1"</u>	<u>2</u>	<u>2</u>
<u>Chilled Water, Brine or Refrigerant</u>	<u>1"</u>	<u>1 ½"</u>	<u>2</u>
<b>Footnotes:</b>			
<b>a</b>	Based on insulation having a conductivity (k) not exceeding 0.27 Btu per inch/hour•ft <sup>2</sup> ° F.		
<b>b</b>	These thicknesses are based on energy efficiency considerations only. Additional insulation is sometimes required relative to safety issues/surface temperatures.		
<b>c</b>	These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.		
<b>d</b>	Nominal pipe size.		

**1110.2 Nonferrous Materials.** Copper and brass refrigeration piping, valves, fittings, and related parts used in the construction and installation of refrigeration systems shall be approved-suitable for the intended use.

**1110.3 Ferrous Materials.** Iron and steel refrigeration piping, valves, fittings, and related parts shall be approved-suitable for the intended use. Pipe more than two (2) inches (50 mm) iron pipe size shall be electric-resistance welded, submerged arc welded or seamless pipe.

**1111.4 Visual Inspection.** Refrigerant piping and joints shall be exposed to view for visual inspection and acceptance by the Authority Having Jurisdiction prior to being covered or enclosed.

**Exception:** Copper tubing enclosed in iron or steel piping, conduit, molding, or raceway, provided there are no fittings or joints concealed therein.

**1111.7 Joints.** Iron or steel pipe joints shall be of approved-suitable threaded, flanged, or welded types. Exposed threads shall be tinned or coated with an approved-suitable corrosion inhibitor. Copper or brass pipe joints of iron pipe size shall be of approved-suitable threaded, flanged, or brazed types. Copper tubing joints and connections shall be approved-suitable flared, lapped, swaged, or brazed joints.

**1111.8 Identification.** ~~Piping shall meet the reference standard for identification.~~ The type of refrigerant, function, and pressure shall be indicated with labels affixed at 20 feet intervals for exposed piping and at each side of a penetration of a wall or partition.

**1112.4 Identification.** Stop valves shall be identified by engraved brass tags with a minimum diameter of 1 inch (25.4 mm) by tagging in accordance with the reference standard for identification. A valve chart shall be mounted under glass at an approved location near the principal entrance to a refrigeration machinery room.

**Exception:** Stop valves that are furnished as an integral part of manufactured refrigeration equipment.

**1117.8 Discharge Location.** Pressure-relief devices shall discharge to the atmosphere unless otherwise prohibited by this chapter at a location at least fifteen (15) feet (4,572 mm) above the adjoining grade level and at least ~~twenty (20) feet (6,096 mm)~~ fifteen (15) feet (4,572 mm) from an opening into a building or a property line not adjoining a public way. The discharge termination shall be fitted with an approved diffuser directed to prevent spray of discharged refrigerant on personnel or entry of foreign material or water into the discharge piping. Discharge piping connected to the discharge side of a fusible plug or rupture member shall have provisions to prevent internal plugging of the pipe caused by the fusible plug or rupture member function.

**Exceptions:**

- (1) Systems containing less than 110 pounds (49.9 kg) of a Group A1 refrigerant.
- (2) A pressure-relief valve may discharge into the low side of the system if the pressure-relief valve is of a type not affected by back pressure, provided the low side is equipped with pressure-relief devices of equal relieving capacity. The low-side pressure relief device shall be set and discharged as required by this section. Fusible plugs or rupture members shall not be used for pressure relief into the low side.

**1119.1 General.** Systems containing other than Group A1 or B1 refrigerants shall discharge to atmosphere only through an approved flaring device. For water treatment requirements, also see the Fire Code.

**Exceptions:**

- (1) Ammonia systems complying with Section 1120.0.
- (2) Ammonia absorption systems with a nominal rating of 5 tons or less ~~serving a single dwelling unit.~~
- (3) When the Authority Having Jurisdiction determines upon review of a rational engineering analysis that significant fire, health, or environmental hazard would not result from the proposed atmospheric release.
- (4) Lithium bromide absorption system using water as the refrigerant.

**1120.0 Ammonia Discharge.**

Ammonia shall discharge into a tank of water that shall be used for no purpose except ammonia absorption. At least one (1) gallon (3.785 L) of fresh water shall be provided

for each pound (454 g) of ammonia in the system. The water used shall be prevented from freezing without the use of salt or chemicals. The tank shall be substantially constructed of not less than 1/8 inch (3.2 mm) or No. 10 MSG steel. The horizontal dimensions of the tank shall be equal to or less than one-half the height. The tank shall have a hinged cover or, if of the enclosed type, shall have a vent hole at the top. Pipe connections shall be through the top of the tank. The discharge pipe from the pressure-relief valves shall discharge ammonia in the center of the tank near the bottom but not more than thirty (30) feet (9,144 mm) below the surface of the water.

**Exception:** An ammonia-water absorption unit system installed outdoors with a nominal rating of 5 tons or less serving a dwelling unit, provided the discharge is shielded and dispersed.

**1121.1 General.** When required by this chapter, approved refrigerant vapor detection and alarm systems shall utilize alarm signaling devices providing a sound pressure level of at least 15 dB above the operating ambient noise sound pressure level of the space in that they are installed and providing an approved, distinctive audible and visual alarm. Alarms shall be activated within the space and as required in Section 1121.3 whenever the refrigerant vapor PEL is exceeded. In other than machinery rooms, such systems shall also automatically stop the flow of refrigerant to evaporators within the space and stop the flow of refrigerant in all supply lines leaving the machinery room whenever the refrigerant vapor concentration is detected at or above 50 percent of the IDLH or 25 percent of the LEL. For other than Group A1 and Group B1 refrigerants appearing in Table 11-1 ~~D~~etection of refrigerant vapor concentrations at or above 25 percent of the LEL shall automatically de-energize all electrical power within the space that does not meet the requirement for a Class I, Division 1, Group D electrical installation.

**1121.3 Annunciation.** Detection and alarm systems shall be annunciated for all refrigerants at an approved location in accordance with the Fire Code and annunciated remotely if the fire alarm system is remotely annunciated.

**1122.2** In a refrigeration machinery room and for a direct refrigerating system of more than ten (10) horsepower (7.457 kW), there shall be a permanent sign ~~at an approved location~~ located on or adjacent to the primary machinery room door and on each condensing unit in 1/2 inch high letters giving the following information:

~~1122.2.1 Name of contractor installing equipment.~~

~~1122.2.2~~ Name and number designation of refrigerant in system.

1122.2.2 ~~1122.2.3~~ Pounds of refrigerant in system.

**1123.2 Field Tests.** Refrigerant-containing parts of a system that is field erected shall be tested and proved tight to the satisfaction of the Authority Having Jurisdiction after complete installation and before operation. The high and low sides of each system shall

be tested and proved tight at not less than the lower of the pressure in Table 11-4 or the setting of the pressure-relief device.

**Exceptions:**

- (1) Compressors, condensers, evaporators, coded pressure vessels, safety devices, pressure gages, control mechanisms, and systems that are factory tested.
- (2) Refrigeration systems containing Group A1 refrigerant R-22, not exceeding twenty-five (25) tons of refrigeration capacity (17.58–87.9 kW), and field piped using approved, factory-charged line sets may be proved tight by observing retention of pressure on a set of charging gages and soaping connections while the system is operating.

**1125.0 Storage of Refrigerants and Refrigerant Oils**

Refrigerants and refrigerant oils not charged within the refrigeration system shall be stored as required by the Fire Code and Section 1109.3.

**1126.0 Requirements for Modifications to Existing Buildings.**

**1126.1 General.** The requirements of this section shall apply retroactively to existing refrigeration systems, equipment or devices where a substitution of a different refrigerant, or replacement or addition of a refrigeration system or equipment occurs, and:

- (1) The quantity of refrigerant in the largest system in the room exceeds the allowable quantities per Table 11-1; or
- (2) The replaced, converted or altered system contains Group A1 refrigerant and has an aggregate horsepower of 100 or more for a single refrigerant system; or
- (3) The system contains other than Group A1 refrigerant.

**Exception:** Absorption systems, see Section 1128.

**1126.2 Permits.** Regardless of exemptions to the permit requirement set forth in Section 112, a mechanical permit shall be obtained for the replacement or addition of equipment or for conversion to another Group A1 refrigerant if mechanical refrigerating equipment is greater than 25 horsepower or conversion to a refrigerant other than Group A1 refrigerant in a system of any size.

**1126.3 System Selection.** Refrigerants used in replaced, added or refrigerant-converted systems shall be limited in application in accordance with Table 11-2 and the requirements of Section 1105.

**1126.4 Refrigerant Sensor and Alarms.** A refrigerant vapor detection system and alarm system for the specific refrigerant (refer to Section 1107.4) shall be installed and shall utilize alarm signaling devices providing a sound pressure level of at least 15 dBA above the operating ambient noise level within the room and providing a distinctive visual alarm both inside and outside the machinery room at each entrance. The

refrigerant sensor shall energize the emergency ventilation system upon detection of refrigerant levels as specified in Section 1108.5.

**1126.5 Ventilation.** Both continuous and emergency ventilation shall be provided in accordance with Section 1108 to serve the machinery room.

**Exception:** In the event that compliance with Sections 1108.7 and 1108.9 are physically impractical, a system designed to minimize the hazard of contaminated exhaust shall be prepared and submitted for approval to the building official by a registered professional engineer licensed to practice as such in the State of Texas. Such design is subject to the provisions of Sections 105, 106, and 107 of this code.

**1126.6 Over pressure Protection.** Pressure vessels of replaced, added or refrigerant-converted refrigeration machinery shall be provided with over-pressure protection as specified in Sections 1113, 1114, 1119, and 1120 of this chapter.

**1126.7 Machinery Room Construction.** Refer to Section 1107.5. Construction joints and penetrations shall be sealed to restrict passage of refrigerant vapor.

**Exception:** Where it is found to be physically impractical to rehabilitate a machinery room to comply with the above requirement (one or two hour construction), an evaluation and report by a registered professional engineer or registered architect licensed to practice in the State of Texas shall be submitted to the building official for approval, clearly stating measures necessary to attain a reasonably complete fire-rated separation and to minimize the possibility of refrigerant escaping the machinery room into other parts of the building. Such design is subject to the provisions of Sections 105, 106, and 107 of this code.

**1126.8 Equipment Identification.** Equipment in the machinery rooms shall be identified as indicated in Section 1122 of this chapter.

**1126.9 Ductwork.** New ductwork, except for ventilation as required by this chapter and combustion air, is not permitted in an existing refrigeration machinery room. Where it is impractical to relocate existing duct or where it is necessary to add ductwork for combustion air, all joints and seams in both new and existing ductwork shall be sealed substantially air tight. Refer to Section 602.4.

## **1127.0 Boilers in Existing Machinery Rooms**

**1127.1 Isolation.** Boilers and other heat-producing appliances shall be isolated from the machinery room by walls or partitions that create a reasonably distinct and separate atmosphere from the refrigeration machinery room. Combustion air shall be taken from other than refrigeration machinery rooms in accordance with Chapter 7 of this code. Partitions, doors and other components of the structure shall be made of materials as required for not less than a one-hour occupancy separation.

### **Exceptions:**

- (1) Where it is physically impractical to comply with the above requirement, an evaluation report by a registered engineer or registered architect licensed to practice in the State of Texas shall be presented to the building official for

approval. The walls, partitions and doors need not comply with the requirements set forth for a fire barrier, but may consist of one hour material designed and constructed to isolate the machinery room from the boilers to create a reasonably distinct and separate atmosphere within the respective rooms.

- (2) Where it is found to be physically impractical to construct a separation of boilers and refrigeration machinery containing Group A1 or Group B1 refrigerant, a registered professional engineer licensed to practice in the State of Texas shall evaluate the effect that ventilation, both emergency and continuous, will have on the operation of boilers within the refrigeration machinery room. A report, including a statement clearly indicating that a boiler will operate safely shall be submitted to the building official for review and approval prior to placing the boilers and ventilation into operation simultaneously. If the registered professional engineer determines that the required continuous ventilation will not have a detrimental effect on the operation of boilers but that emergency ventilation will have a detrimental effect on boiler operation, an electrical interlock designed to shut off the fuel supply to boilers when emergency ventilation is energized may be used in lieu of isolation of the boilers from the machinery room.

**1127.2 Engines in Existing Refrigeration Machinery Rooms.** Engines are permitted in refrigeration machinery rooms provided:

1. The refrigerant classification is Group A1 or Group B1 only;
  2. Combustion air is taken from outside the building and to the engine in substantially sealed ducts or pipes;
  3. Insulation is provided for all hot surfaces subject to a temperature of 800E F or higher;
  4. Ventilation is provided to dissipate the radiant heat from the engines to keep the room below 120E F; and
- (5) There is no open flame or spark.

**1127.3 Switchgear and Related Equipment in Machinery Room.** Switchgear and related equipment may remain in an existing machinery room provided:

1. The refrigerant classification is Group A1 or Group B1 only.
2. The switchgear or related equipment possesses no clearance or work hazard in regard to the refrigeration machinery or the electrical switchgear.

**1127.4 Emergency Control.** Emergency control in accordance with Section 1109.4 shall be provided for the refrigeration equipment and existing air-handling equipment except machinery room ventilation fans.

**1128.0 Absorption Refrigeration.**

**1128.1 Lithium Bromide Absorption Refrigeration.** Lithium bromide absorption refrigeration equipment using water as the refrigerant and steam or hot water as the

energy source is exempt from refrigeration machinery room requirements and may be located in the same room with refrigeration equipment requiring a machinery room.

**1128.2 Direct Fired Absorption Refrigeration.** Direct fired absorption refrigeration equipment shall be installed in a room constructed as required for a boiler of similar Btu input. This equipment shall not be installed in a refrigeration machinery room.

**1128.3 Ammonia Absorption Refrigeration.** Ammonia absorption refrigeration equipment larger than 5 tons shall be installed in a refrigeration machinery room with the relief piped in accordance with Section 1120.

**{EDITOR'S NOTE: DELETE TABLE 11-1 IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING.}**

**TABLE 11-1**  
**Refrigerant Groups<sup>1</sup>, Properties<sup>2</sup>, and Allowable Quantities<sup>3</sup>**  
**[ASHRAE 34: Table 1]**

Refrigerant	Chemical Formula	Chemical Name <sup>4</sup> (Composition for Blends)	Safety Group <sup>1</sup>	POEL <sup>5</sup> (ppm)	IDLH <sup>6</sup> (ppm)	Pounds per 1000cf of Space <sup>7</sup>
R-11	CCl <sub>3</sub> F	Trichlorofluoromethane	A1	C1000 <sup>8</sup>	<del>4,000</del> <sup>4b</sup> 2,000	<del>4.60</del> 0.39
R-12	CCl <sub>2</sub> F <sub>2</sub>	Dichlorodifluoromethane	A1	1,000	<del>40,000</del> 15,000	<del>42.00</del> 5.6
R-13	CClF <sub>3</sub>	Chlorotrifluoromethane	A1	1,000 <sup>10</sup>	67,000	<del>48.00</del> -
R-13B1	CBrF <sub>3</sub>	Bromotrifluoromethane	A1	1,000	<del>57,000</del> 40,000	<del>22.00</del> -
R-14	CF <sub>4</sub>	Tetrafluoromethane (carbontetrafluoride)	A1	1,000 <sup>10</sup>	67,000	25
R-21	CHCl <sub>2</sub> F	Dichlorofluoromethane	B1	10 <sup>14</sup>	5,000	-
R-22	CHClF <sub>2</sub>	Chlorodifluoromethane	A1	1,000 <sup>4b 14</sup>	42,000 <sup>11</sup>	9.4 13
R-23	CHF <sub>3</sub>	Trifluoromethane	A1	- 1,000 <sup>10</sup>	-	- 7.3
R-30	CH <sub>2</sub> Cl <sub>2</sub>	Dichloromethane (methylene chloride)	B2	C1000 <sup>8</sup>	2,300	-
R-32	CH <sub>2</sub> F <sub>2</sub>	Difluoromethane (methylene fluoride)	A2	1,000 <sup>13</sup>	-	4.8
R-40	CH <sub>3</sub> Cl	Chloromethane (methyl chloride)	B2	100	2,000	-
R-50	CH <sub>4</sub>	Methane	A3	1,000 <sup>10</sup>	-	-
R-113	CCl <sub>2</sub> FCClF <sub>2</sub>	1,1,2-trichloro-1, 2, 2 -trifluoroethane	A1	1,000	<del>4,500</del> 2,000	<del>4.90</del> 1.2
R-114	CClF <sub>2</sub> CClF <sub>2</sub>	1,2-dichloro-1,1,2,2 -tetrafluoroethane	A1	1,000	<del>50,000</del> 15,000	<del>9.40</del> 8.7
R-115	CClF <sub>2</sub> CF <sub>3</sub>	Chloropentafluoroethane	A1	1,000 <sup>14</sup>	-	47
R-116	CF <sub>3</sub> CF <sub>3</sub>	Hexafluoroethane	A1	1,000 <sup>10</sup>	-	34
R-123	CHCl <sub>2</sub> CF <sub>3</sub>	2,2-dichloro-1,1,1, -trifluoroethane	B1	<del>1,000</del> 50 <sup>13</sup>	4,000 <sup>11</sup>	<del>4.60</del> 3.5
R-124	CHClFCF <sub>3</sub>	2-chloro-1,1,1,2 -tetrafluoroethane	A1	- 1,000 <sup>13</sup>	-	- 3.5
R-125	CHF <sub>2</sub> CF <sub>3</sub>	Pentafluoroethane	A1	1,000 <sup>13</sup>	-	23
R-134a	CH <sub>2</sub> FCF <sub>3</sub> CF <sub>3</sub> CH <sub>2</sub> F	1,1,1,2-tetrafluoroethane	A1	1,000 <sup>4b 13</sup>	50,000 <sup>11</sup>	<del>16.00</del> 13
R-141b	CH <sub>3</sub> CCl <sub>2</sub> F	1,1-dichloro-1-fluoroethane	A1	500 <sup>13</sup>	-	0.78
R-142b	CH <sub>3</sub> CClF <sub>2</sub>	1-chloro-1,1-difluoroethane	A2	1,000 <sup>13</sup>	-	5.1
R-143a	CH <sub>3</sub> CF <sub>3</sub>	1,1,1-trifluoroethane	A2	1,000 <sup>13</sup>	-	4.5
R-152a	CH <sub>3</sub> CHF <sub>2</sub>	1,1-difluoroethane	A2	1,000 <sup>13</sup>	-	2.0
R-170	CH <sub>3</sub> CH <sub>3</sub>	Ethane	A3	1,000	6,400	0.504
R-E170	CH <sub>3</sub> OCH <sub>3</sub>	Dimethyl ether	A3	1,000 <sup>10</sup>	-	1.0
R-218	CF <sub>3</sub> CF <sub>2</sub> CF <sub>3</sub>	Octafluoropropane	A1	1,000	-	43
R-227ea	CF <sub>3</sub> CHFCF <sub>3</sub>	1,1,1,2,3,3,3-heptafluoropropane	A1	1,000	-	36
R-236fa	CF <sub>3</sub> CH <sub>2</sub> CF <sub>3</sub>	1,1,1,3,3,3-hexafluoropropane	A1	- 1,000 <sup>13</sup>	-	- 21
R-245fa	CHF <sub>2</sub> CH <sub>2</sub> CF <sub>3</sub>	1,1,1,3,3-pentafluoropropane	B1	- 300 <sup>13</sup>	-	- 12
R-290	CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>	Propane	A3	1,000	4,400 2,100	0.50 0.56
R-C318	-(CF <sub>2</sub> ) <sub>4</sub> -	Octafluorocyclobutane	A1	1,000 <sup>10</sup>	-	41
R-400	zeotrope	R-12/114 (50/50)	A1	- 1,000 <sup>10</sup>	-	- 10
R-400	zeotrope	R-12/114 (60/40)	A1	1,000	-	11
R-401A	zeotrope	R-22/152a/124 (53.0/13.0/34.0)	A1	- 1,000 <sup>10</sup>	-	- 6.6
R-401B	zeotrope	R-22/152a/124 (61.0/11.0/28.0)	A1	- 1,000 <sup>10</sup>	-	- 7.2
R-401C	zeotrope	R-22/152a/124 (33.0/15.0/52.0)	A1	- 1,000 <sup>10</sup>	-	- 5.2

**Table-TABLE 11-1 (Continued)**  
**Refrigerant Groups<sup>1</sup>, Properties<sup>2</sup>, and Allowable Quantities<sup>3</sup> (continued)**  
**[ASHRAE 34: Table 1]**

R-402A	zeotrope	R-125/290/22 (60.0/2.0/38.0)	A1	= 1,000 <sup>10</sup>	-	= 8.5
R-402B	zeotrope	R-125/290/22 (38.0/2.0/60.0)	A1	= 1,000 <sup>10</sup>	-	= 15
R-403A	zeotrope	R-290/22/218 (5.0/75.0/20.0)	A1	= 1,000 <sup>10</sup>	-	= 7.6
R-403B	zeotrope	R-290/22/218 (5.0/56.0/39.0)	A1	= 1,000 <sup>10</sup>	-	= 18
R-404A	zeotrope	R-125/143a/134a (44.0/52.0/4.0)	A1	= 1,000 <sup>10</sup>	-	= 31
<u>R-405A</u>	<u>zeotrope</u>	<u>R-22/152a/142b/C318 (45.0/7.0/5.5/42.5)</u>		<u>1,000<sup>10</sup></u>	-	<u>16</u>
<u>R-406A</u>	<u>zeotrope</u>	<u>R-22/600a/142b (55.0/4.0/41.0)</u>	<u>A2</u>	<u>1,000<sup>10</sup></u>	-	<u>4.7</u>
R-407A	zeotrope	R-32/125/134a (20.0/40.0/40.0)	A1	= 1,000 <sup>10</sup>	-	= 18
R-407B	zeotrope	R-32/125/134a (10.0/70.0/20.0)	A1	= 1,000 <sup>10</sup>	-	= 20
R-407C	zeotrope	R-32/125/134a (23.0/25.0/52.0)	A1	= 1,000 <sup>10</sup>	-	= 17
R-407D	zeotrope	R-32/125/134a (15.0/15.0/70.0)	A1	= 1,000 <sup>10</sup>	-	= 15
R-407E	zeotrope	R-32/125/134a (25.0/15.0/60.0)	A1	= 1,000 <sup>10</sup>	-	= 16
R-408A	zeotrope	R-125/143a/22 (7.0/46.0/47.0)	A1	= 1,000 <sup>10</sup>	-	= 21
R-409A	zeotrope	R-22/124/142b (60.0/25.0/15.0)	A1	= 1,000 <sup>10</sup>	-	= 7.1
R-409B	zeotrope	R-22/124/142b (65.0/25.0/10.0)	A1	= 1,000 <sup>10</sup>	-	= 7.3
R-410A	zeotrope	R-32/125 (50.0/50.0)	A1	= 1,000 <sup>10</sup>	-	= 25
<u>R-410B</u>	<u>zeotrope</u>	<u>R-32.125 (45.0/55.0)</u>	<u>A1</u>	<u>1,000<sup>10</sup></u>	=	<u>24</u>
<u>R-411A</u>	<u>zeotrope</u>	<u>R-1270/22/152a (1.5/87.5/11.0)</u>	<u>A2</u>	<u>980<sup>10</sup></u>	-	<u>2.9</u>
<u>R-411B</u>	<u>zeotrope</u>	<u>R-1270/22/152a (3.0/94.0/3.0)</u>	<u>A2</u>	<u>980<sup>10</sup></u>	-	<u>2.8</u>
<u>R-412A</u>	<u>zeotrope</u>	<u>R-22/218/143b (70.0/5.0/25.0)</u>	<u>A2</u>	<u>1,000<sup>10</sup></u>	-	<u>5.1</u>
<u>R-413A</u>	<u>zeotrope</u>	<u>R-218/134a/600a (9.0/88.0/3.0)</u>	<u>A2</u>	<u>1,000</u>	-	<u>5.8</u>
<u>R-414A</u>	<u>zeotrope</u>	<u>R-22/124/600a/142b (51.0/28.5/4.0/16.5)</u>	<u>A1</u>	<u>1,000<sup>10</sup></u>	-	<u>6.4</u>
<u>R-414B</u>	<u>zeotrope</u>	<u>R-22/124/600a/142b (50.0/39.0/1.5/9.5)</u>	<u>A1</u>	<u>1,000</u>	-	<u>6.0</u>
<u>R-415A</u>	<u>zeotrope</u>	<u>R-22/152a (82.0/18.0)</u>	<u>A2</u>	<u>1,000</u>	-	<u>12</u>
<u>R-415B</u>	<u>zeotrope</u>	<u>R-22/152a (25.0/75.0)</u>	<u>A2</u>	<u>1,000</u>	-	<u>9.3</u>
R-416A	zeotrope	R-134a/124/600 (59.0/39.5/1.5)	A1	= 1,000	-	= 3.9
<u>R-417A</u>	<u>zeotrope</u>	<u>R-125/134a/600 (46.6/50.0/3.4)</u>	<u>A1</u>	<u>1,000</u>	-	<u>3.5</u>
<u>R-418A</u>	<u>zeotrope</u>	<u>R-290/22/152a (1.5/96.0/2.5)</u>	<u>A2</u>	<u>1,000</u>	-	<u>13</u>
<u>R-419A</u>	<u>zeotrope</u>	<u>R-125/134a/E170 (77.0/19.0/4.0)</u>	<u>A2</u>	<u>1,000</u>	-	<u>19</u>
<u>R-420A</u>	<u>zeotrope</u>	<u>R-134a/142b (88.0/12.0)</u>	<u>A1</u>	<u>1,000</u>	-	<u>12</u>
<u>R-421A</u>	<u>zeotrope</u>	<u>R-125/134a (58.0/42.0)</u>	<u>A1</u>	<u>1,000</u>	-	<u>17</u>
<u>R-421B</u>	<u>zeotrope</u>	<u>R-125/134a (85.0/15.0)</u>	<u>A1</u>	<u>1,000</u>	-	<u>21</u>
<u>R-422A</u>	<u>zeotrope</u>	<u>R-125/134a/600a (85.1/11.5/3.4)</u>	<u>A1</u>	<u>1,000</u>	-	<u>18</u>
<u>R-422B</u>	<u>zeotrope</u>	<u>R-125/134a/600a (55.0/42.0/3.0)</u>	<u>A1</u>	<u>1,000</u>	-	<u>16</u>

**TABLE 11-1 (Continued)**  
**Refrigerant Groups <sup>1</sup>, Properties<sup>2</sup>, and Allowable Quantities<sup>3</sup> (continued)**  
**[ASHRAE 34: Table 1]**

R-422C	zeotrope	R-125/134a/600a (82.0/15.0/3.0)	A1	1,000	-	18
R-422D	zeotrope	R-125/134a/600a (65.1/31.5/3.4)	A1	1,000	-	16
R-423A	zeotrope	R-134a/227ea (52.5/47.5)	A1	1,000	-	19
R425A	zeotrope	R-32/134a/227ea (18.5/69.5/12.0)	A1	1,000	-	16
R426A	zeotrope	R-125/134a/600/601a (5.1/93.0/1.3/0.6)	A1	990	-	5.2
R427A	zeotrope	R-32/125/143a/134a (15.0/25.0/10.0/50.0)	A1	1,000	-	18
R428A	zeotrope	R-125/143a/290/600a (77.5/20.0/0.6/1.9)	A1	1,000	-	23
R-429A	zeotrope	R-E170/152a/600a (60.0/10.0/30.0)	A3	1,000	-	0.81
R-430A	zeotrope	R-152a/600a (76.0/24.0)	A3	1,000	-	1.3
R-431A	zeotrope	R-290/152a (71.0/29.0)	A3	1,000	-	0.69
R-432A	zeotrope	R-1270/E170 (80.0/20.0)	A3	710	-	0.13
R-433A	zeotrope	R-1270/290 (30.0/70.0)	A3	880	-	0.34
R-434A	zeotrope	R-125/143a/134a/600a (63.2/18.0/16.0/2.8)	A1	1,000	-	20
R-435A	zeotrope	R-E170/152a (80.0/20.0)	A3	1,000	-	1.1
R-436A	zeotrope	R-290/600a (56.0/44.0)	A3	1,000	-	0.5
R-436B	zeotrope	R-290/600a (52.0/48.0)	A3	1,000	-	0.5
R-437A	zeotrope	R-125/134a/600/601 (19.5/78.5/1.4/0.6)	A1	990	-	5
R-500	azeotrope	R-12/152a (73.8/26.2)	A1	1,000 <sup>10</sup>	47,000 <sup>10-11</sup>	42-7.6
73.8%	$\text{CCl}_2\text{F}_2$	Dichlorodifluoromethane				
26.2%	$\text{CH}_3\text{CHF}_2$	1,1-difluoroethane				
R-501	azeotrope	R-22/12 (75.0/25.0)	A1	1,000	-	13
R-502	azeotrope	R-22/115 (48.8/51.2)	A1	1,000 <sup>10</sup>	65,000 <sup>11</sup>	49.00-21
48%	$\text{CHClF}_2$	Chlorodifluoromethane				
51.2%	$\text{CClF}_2\text{CF}_3$	1-chloro-1,1,2,2,2-pentafluoroethane				
R-503	azeotrope	R-23/13 (48.81/51.19)	-	1,000	67,000	15.00 -
R-504	azeotrope	R-32/115 (48.2/51.8)	-	1,000	-	29
R-507A	azeotrope	R-125/143a (50.0/50.0)	A1	= 1,000 <sup>10</sup>	-	= 32
R-508A	azeotrope	R-23/116 (39.0/61.0)	A1	= 1,000 <sup>10</sup>	-	= 14
R-508B	azeotrope	R-23/116 (46.0/54.0)	A1	= 1,000 <sup>10</sup>	-	= 13
R-509A	azeotrope	R-22/218 (44.0/56.0)	A1	= 1,000 <sup>10</sup>	-	= 24
R-510A	azeotrope	R-E170/600a (88.0/12.0)	A3	1,000	-	0.87
R-600	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$	butane	A3	<del>800</del> 1,000	3400	0.51-0.1
R-600a	$\text{CH}(\text{CH}_3)_2\text{CH}_3$	isobutane (2-methyl propane)	A3	<del>800</del> 1,000	3400	0.51-0.6
R-601	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	pentane	A3	600	-	0.2

**Table-TABLE 11-1 (Continued)**  
**Refrigerant Groups<sup>1</sup>, Properties<sup>2</sup>, and Allowable Quantities<sup>3</sup> (continued)**  
**[ASHRAE 34: Table 1]**

R-601a	$(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$	2-methylbutane (isopentane)	A3	600	-	0.2
R-611	$\text{HCOOCH}_3$	methyl formate	B2	100	-	-
R-702	$\text{H}_2$	hydrogen	A3	-	-	-
R-704	He	helium	A1	-	-	-
R-717	$\text{NH}_3$	ammonia	B2	<del>5,012</del> 50 <sup>12</sup>	500-300	<del>0.022</del> 0.014
R-718	$\text{H}_2\text{O}$	water	A1	-	-	= footnote <sup>15</sup>
R-720	Ne	Neon	A1	-	-	-
R-728	$\text{N}_2$	nitrogen	A1	-	-	-
R-740	Ar	Argon	A1	-	-	-
R-744	$\text{CO}_2$	Carbon Dioxide	A1	5,000	<del>50,000</del> 40,000	<del>5.70</del> 4.5
R-764	$\text{SO}_2$	sulfur dioxide	B1	5	100	-
R-1150	$\text{CH}_2=\text{CH}_2$	ethene (ethylene)	A3	200	5,200	0.38
R-1270	$\text{CH}_3\text{CH}=\text{CH}_2$	propene (propylene)	A3	500	3,400	0.1

**Notes:** For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.0283m<sup>3</sup>.

- <sup>1</sup> Refrigerant safety group designation is in accordance with Section 11023.0.
- <sup>2</sup> Refrigerant properties are those needed for this chapter.
- <sup>3</sup> Allowable quantities are for high-probability systems under Section 11034.0 only.
- <sup>4</sup> Chemical name shown is the preferred name. The popular name is shown in parenthesis.
- <sup>5</sup> OEL is the Occupational Exposure Limit. The value shown is the PEL is that designated in 29 CFR 1910.1000 unless otherwise indicated.
- <sup>6</sup> IDLH is that designated by NIOSH unless otherwise designated. If no value is shown, use the value listed under pounds per 1000 cf of space. Use the following formula to convert from pounds per 1000 cf of space to ppm. ppm = pounds per 1000 cf of space / (0.00002557 × M), where M equals the molar mass of the refrigerant in g/mole.
- <sup>7</sup> Pounds of refrigerant in a high-probability system per 1000 cubic feet (28.3 kg / m<sup>3</sup>) of occupied space. See Section 1104.0. This column does not apply to refrigerant machinery rooms or areas covered by Section 11067.0. If no value is listed, use zero (0) unless sufficient data can be provided to determine the value as described in Section 7 of ASHRAE Standard 34-2007.
- <sup>8</sup> The POEL value shown is the TLV-C recommended by ACGIH.
- <sup>9</sup> The IDLH value shown is reduced from that designated by NIOSH in light of cardiac sensitization potential.
- <sup>10</sup> A PEL has not yet been established; the value given was determined in a consistent manner.
- <sup>11</sup> An IDLH has not yet been established; the value given was determined in a consistent manner.
- <sup>12</sup> OSHA PEL is 50 ppm; ACGIH TLV-TWA is 25 ppm.
- <sup>13</sup> The OEL value shown is the WEEL recommended by AIHA
- <sup>14</sup> The OEL value show is the ACGIH TLV-TWA
- <sup>15</sup> Quantity is unlimited when R-718 (water) is used as the refrigerant.

1 lb. = 0.454 kg, 1 ft<sup>3</sup> = 0.0283 m<sup>3</sup>

## Part II – Cooling Towers

### **~~1126.0~~ 1129.0 General.**

Cooling towers, evaporative condensers, and fluid coolers shall be readily accessible. When located on roofs, such equipment having combustible exterior surfaces shall be protected with an approved automatic fire-extinguishing system.

### **~~1127.0~~ 1130.0 Support and Anchorage.**

Cooling towers, evaporative condensers, and fluid coolers shall be supported on noncombustible grillage designed in accordance with the Building Code. Seismic restraints shall be as required by the Building Code.

### **~~1128.0~~ 1131.0 Water Supply.**

Water supplies and backflow protection shall be as required by the ~~Uniform~~ Plumbing Code.

### **~~1129.0~~ 1132.0 Drainage.**

Drains, overflows, and blow-down provisions shall have indirect connection to an approved disposal location. Discharge of chemical waste shall be as approved by the appropriate regulatory authority.

### **~~1130.0~~ 1133.0 Chemical Treatment Systems.**

Chemical treatment systems shall comply with the Fire Code. When chemicals used present a contact hazard to personnel, approved emergency eye-wash and shower facilities shall be installed.

### **~~1131.0~~ 1134.0 Location.**

Cooling towers, evaporative condensers, and fluid coolers shall be located such that their plumes cannot enter occupied spaces. Plume discharges shall be at least five (5) feet (1,524 mm) above or twenty (20) feet (6,096 mm) away from any ventilation inlet to a building. Location on the property shall be as required for buildings by the Building Code.

### **~~1132.0~~ 1135.0 Electrical.**

Electrical systems shall be in accordance with the Electrical Code. Equipment shall be provided with a vibration switch to shut off fans operating with excessive vibration. In

climates commonly subject to electrical storms, lightning protection shall be provided on roof-mounted equipment.

**~~1133.0~~ 1136.0 Refrigerants and Hazardous Fluids.**

Equipment containing refrigerants as a part of a closed-cycle refrigeration system shall comply with Part I of this chapter. Equipment containing other fluids that are flammable, combustible, or hazardous shall comply with the Fire Code.

## **CHAPTER 12**

### **HYDRONICS**

**{EDITOR'S NOTE: DELETE SECTION 1201.2.1.4.2.1 IN ITS ENTIRETY.}**

**{EDITOR'S NOTE: DELETE AND RESERVE SECTION 1201.3 AND DELETE ALL SUBSECTIONS STARTING WITH 1201.3.}**

## **CHAPTER 13**

### **FUEL GAS PIPING**

#### **1301.0 Scope. General.**

For provisions pertaining to Fuel Gas piping, refer to Chapter 12 of the Plumbing Code.

{EDITOR'S NOTE: DELETE THE REMAINDER OF THIS CHAPTER IN ITS ENTIRETY.}

## **CHAPTER 14**

### **PROCESS PIPING**

{EDITOR'S NOTE: DELETE AND RESERVE THIS CHAPTER IN ITS ENTIRETY.}

**CHAPTER 15**  
**SOLAR SYSTEMS**

{EDITOR'S NOTE: DELETE AND RESERVE THIS CHAPTER IN ITS ENTIRETY.}

## CHAPTER 16

### STATIONARY FUEL CELL POWER PLANTS

#### **1602.0 Stationary Engine Generators.**

Stationary engine generators shall be tested in accordance with UL 2200, *Standard for Stationary Engine Generator Assemblies*, and shall be installed in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and the manufacturer's installation instructions.

## CHAPTER 17 STANDARDS

{EDITOR'S NOTE: ADD/CHANGE THE FOLLOWING IDENTIFIED STANDARDS IN ALPHABETICAL ORDER. }

<u>Standard Number</u>	<u>Standard Title [UMC References]</u>
<u>ASTM E 814-<del>2006</del>-2002</u>	<u>Fire Tests of Through Penetration Fire Stops; Certification: Fire Testing-building Materials, Fire Testing-Hose Stream Test, Structural Analysis/Applications; See Sections 507.2.5, 507.2.6, 928.1 (c).</u>
<u>ASTM E 2336-2004</u>	<u>Standard Test Method for Fire-Resisting Grease Duct Enclosure Systems; Field Fabricated Grease Duct; See Section 507.2.6</u>
<u>CAN/ULC S102.2 - M88</u>	<u>Standard Method of Test For Surface Burning Characteristics of Floor Coverings, and Miscellaneous Materials and Assemblies (Tunnel Test)</u>
<u>SMACNA, <del>1995</del> 2005 Addendum 1, 11/97</u>	<u>HVAC Duct Construction Standards – Metal and Flexible</u>

Table 17-1 continues...

## APPENDIX D

{EDITOR'S NOTE: SUBSTITUTE THE FOLLOWING TABLE FOR THE EXISTING TABLE OF THE SAME NAME. }

### Approximate Minimum Thickness (inch) for Carbon Sheet Steel Corresponding to Manufacturer's Standard Gauge and Galvanized Sheet Gauge Numbers

<u>Gage No.</u>	<u>Steel</u>	<u>Stainless Steel</u>	<u>Aluminum</u>
7	.179	-	-
8	.164	.172	-
9	.150	.156	-
10	.135	.141	-
11	.120	.125	-
12	.105	.109	-
13	.090	.094	.072
14	.075	.078	.064
15	.067	.070	.057
16	.060	.063	.051
17	.054	.056	.045
18	.048	.050	.040
19	.042	.044	.036
20	.036	.038	.032
21	.033	.034	.028
22	.030	.031	.025
23	.027	.028	.023
24	.024	.025	.020
25	.021	.022	.018
26	.018	.019	.017
27	.016	.017	.014
28	.015	.016	-
29	.014	.014	-
30	.012	.013	-
31	-	.011	-

{**EDITOR'S NOTE:** INSERT THE FOLLOWING TABLE.}

**METRIC / INCH CONVERSION CHART**

<b>Metric / Inch Conversion Chart</b>					
<b>Millimeters</b>	<b>Fractions</b>	<b>Inches</b>	<b>Millimeters</b>	<b>Fractions</b>	<b>Inches</b>
<u>.397</u>	<u>1/64</u>	<u>.015625</u>	<u>13.097</u>	<u>33/64</u>	<u>.515625</u>
<u>.794</u>	<u>1/32</u>	<u>.03125</u>	<u>13.494</u>	<u>17/32</u>	<u>.53125</u>
<u>1.191</u>	<u>3/64</u>	<u>.046875</u>	<u>13.891</u>	<u>35/64</u>	<u>.546875</u>
<u>1.588</u>	<u>1/16</u>	<u>.0625</u>	<u>14.288</u>	<u>9/16</u>	<u>.5625</u>
<u>1.984</u>	<u>5/64</u>	<u>.078125</u>	<u>14.684</u>	<u>37/64</u>	<u>.573125</u>
<u>2.381</u>	<u>3/32</u>	<u>.09375</u>	<u>15.081</u>	<u>19/32</u>	<u>.59375</u>
<u>2.778</u>	<u>7/64</u>	<u>.109375</u>	<u>15.478</u>	<u>39/64</u>	<u>.609375</u>
<u>3.175</u>	<u>1/8</u>	<u>.125</u>	<u>15.875</u>	<u>5/8</u>	<u>.625</u>
<u>3.572</u>	<u>9/64</u>	<u>.140625</u>	<u>16.272</u>	<u>41/64</u>	<u>.640625</u>
<u>3.969</u>	<u>5/32</u>	<u>.15625</u>	<u>16.669</u>	<u>21/32</u>	<u>.65625</u>
<u>4.366</u>	<u>11/64</u>	<u>.171875</u>	<u>17.066</u>	<u>43/64</u>	<u>.671875</u>
<u>4.762</u>	<u>3/16</u>	<u>.1875</u>	<u>17.462</u>	<u>11/16</u>	<u>.6875</u>
<u>5.159</u>	<u>13/64</u>	<u>.203125</u>	<u>17.859</u>	<u>45/64</u>	<u>.703125</u>
<u>5.556</u>	<u>7/32</u>	<u>.21875</u>	<u>18.256</u>	<u>23/32</u>	<u>.71875</u>
<u>5.953</u>	<u>15/64</u>	<u>.234375</u>	<u>18.653</u>	<u>47/64</u>	<u>.734375</u>
<u>6.350</u>	<u>1/4</u>	<u>.25</u>	<u>19.050</u>	<u>3/4</u>	<u>.75</u>
<u>6.747</u>	<u>17/64</u>	<u>.265625</u>	<u>19.447</u>	<u>49/64</u>	<u>.765625</u>
<u>7.144</u>	<u>9/32</u>	<u>.28125</u>	<u>19.844</u>	<u>25/32</u>	<u>.78125</u>
<u>7.541</u>	<u>19/64</u>	<u>.296875</u>	<u>20.241</u>	<u>51/64</u>	<u>.796875</u>
<u>7.938</u>	<u>5/16</u>	<u>.3125</u>	<u>20.638</u>	<u>13/16</u>	<u>.8125</u>
<u>8.334</u>	<u>21/64</u>	<u>.328125</u>	<u>21.034</u>	<u>53/64</u>	<u>.828125</u>
<u>8.731</u>	<u>11/32</u>	<u>.34375</u>	<u>21.431</u>	<u>27/32</u>	<u>.84375</u>
<u>9.128</u>	<u>23/64</u>	<u>.359375</u>	<u>21.828</u>	<u>55/64</u>	<u>.859375</u>
<u>9.525</u>	<u>3/8</u>	<u>.375</u>	<u>22.225</u>	<u>7/8</u>	<u>.875</u>
<u>9.922</u>	<u>25/64</u>	<u>.390625</u>	<u>22.622</u>	<u>57/64</u>	<u>.890625</u>

{**EDITOR'S NOTE:** REMAINDER OF APPENDIX D TO REMAIN AS SET FORTH IN 2006 UMC.}