

CHAPTER 30

HEATING, VENTILATING AND AIR CONDITIONING CODE

Section

- 30.01 Administration.
- 30.02 Definitions.
- 30.03 General Conditions.
- 30.04 Electric Space Heating.
- 30.05 Active Solar Collector Systems. (Cr. by Ord. 8348, 5-25-84)
- 30.06 Warm Air.
- 30.07 Gas-fired Unit Heaters.
- 30.08 Setting and Assembling of Furnaces.
- 30.09 Warm Air Supply Ducts.
- 30.10 Return Air Duct Construction.
- 30.11 Air Filters.
- 30.12 Design of a Gravity Warm Air System.
- 30.13 Design of a Forced Warm Air System.
- 30.14 Steam and Hot Water Heating Systems.
- 30.15 Oil Burner Installations for Draft Burners.
- 30.16 Oil Tanks and Piping.
- 30.17 Stoker Installation.
- 30.18 Minimum Requirements for the Installation of Gas-Fired Heating Equipment and Piping.
- 30.19 Minimum Requirements for Gas-Fired Equipment and Installation of Gas-Fired Equipment.
- 30.20 Installation Requirements for Gas Conversion Burners.
- 30.21 Venting Requirements.
- 30.22 - 30.24 Reserved for Future Use.
- 30.25 Control Systems for Automatic Firing Equipment.
- 30.26 Commercial and Industrial Burners Over 10 Gallons Per Hour or 1,500,000 BTU Per Hour.
- 30.27 Reserved for Future Use.
- 30.28 Residential Air Conditioning.
- 30.29 Appendix No. 1.
- 30.30 Incinerators.
- 30.31 Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- 30.32 Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- 30.33 - 30.49 Reserved For Future Use.
- 30.50 Air Pollution.

30.01 ADMINISTRATION.

- (1) Purpose and Scope of This Code.
 - (a) The purpose of this code is to provide minimum regulations, provisions, and requirements in the City of Madison to insure safety and adequacy to persons and property wherever heating, ventilating, and/or air conditioning is installed and to all alterations or improvements, including replacement of any apparatus or device pertaining to heating, ventilating, and/or air conditioning
 - (b) The provisions of this code shall apply to every building, or portion of a building, devoted to a new use for which the requirements are in any way more stringent than the requirements covering the previous use. The provisions of this code shall be binding alike upon the owner of a building or premises, every person in charge of or responsible for or who causes the construction, repair alteration or improvement of any heating, ventilating and/or air conditioning devices, fixtures or equipment. (Am. by Ord. 11,783, 2-17-97)
 - (c) Wis. Admin. Code ch. ILHR 23 and all subsequent amendments, additions and recodifications thereto are hereby adopted, by reference, and shall apply to all new one- and two-family residential buildings as well as additions and alterations to all existing one- and two-family residential buildings, accessory buildings, and to new portions of moved buildings. If there are sections of this code that are more restrictive than Wis. Admin. Code ch. ILHR 23, then Wis. Admin. Code ch. ILHR 23 shall apply. If there are subjects covered in this code that are not covered in Wis. Admin. Code ch. ILHR 23, then this code shall apply. (Am. by Ord. 9298, 10-29-87)
 - (d) Wis. Admin. Code ch. ILHR 64 and all subsequent amendments, additions and recodifications thereto are hereby adopted by reference for all buildings and structures other than one (1) and two (2) family residential dwellings. (Am. by Ord. 9298, 10-29-87)
 - (e) Sections in this code that are more restrictive or not covered in Wis. Admin. Code ch. ILHR 64 shall be enforced over Wis. Admin. Code ch. ILHR 64. (Am. by Ord. 9298, 10-29-87)
- (2) Heating, Ventilating and Air Conditioning Inspector.
 - (a) To enforce the provisions of this code there is hereby authorized and established the position of Heating, Ventilating and Air Conditioning Inspector who shall be under the direction of the Director of the Building Inspection Division, and be responsible for the inspection of heating, ventilation, and smoke abatement problems as prescribed by this code. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
 - (b) The Heating, Ventilating and Air Conditioning Inspector shall have the power and authority at all reasonable times, for any proper purpose to enter upon any public or private premises and make inspections thereof, and to require the productions of the permit for any building, electrical, plumbing, heating or ventilation or to require license therefore. Any person interfering with or refusing entrance to said Inspector while in the performance of his prescribed duties shall be punished as provided in Section 30.01(14). (Am. by ORD-10-00058, 6-11-10)

- (3) Classes of Licenses.
- (a) A person who holds a valid certification under Sec. 101.178(3)(a) of Wisconsin Statutes may obtain a license under this ordinance without taking the examination established by Subsection (5).
 - (b) There shall be five (5) classes of licenses issued pertaining to heating in the City of Madison.
 - 1. Class B license shall be issued to a person desiring to install gas, oil, or coal conversion automatic equipment and controls in existing heating plants, and service, clean, and repair above-mentioned equipment, but shall not alter or repair any part of the distribution system.
 - 2. Class A-1 license shall be issued to a person desiring to enter into the business of installing, altering, or repairing warm air space heating equipment utilizing all types of energy.
 - 3. Class A-2 license shall be issued to a person desiring to enter into the business of installing, altering, or repairing steam or hot water equipment utilizing all types of energy.

Exception. Gas-fired unit heaters not connected to ductwork may be installed by a Class A-2 license holder.
 - 4. Class A-3 license shall be issued to a person licensed with the City of Madison as a Class A or AA Electrical Contractor as defined in Section 19.06 of the Madison General Ordinances who desires to enter into the business of installing, altering, or repairing electrical space heating equipment (of the electric resistance type installed in the zone of its occupancy).
 - 5. Class A-4 license shall be issued to a person desiring to enter into the business of installing, altering or repairing active solar heating equipment. This license is not required if the person has a North American Board of Certified Energy Practitioners (NABCEP) certification. (Am. by ORD-08-00122, 11-22-08)
- (Sec. 30.01(3) R., (4) Renumbered to (3) and Am. by Ord. 11,611, Adopted 5-21-96)
- (4) License Fees.
- (a) The fee for a new applicant for Class B license shall be seventy-five dollars (\$75). Renewal fee for each succeeding year shall be sixty dollars (\$60). (Am. by Ord. 9366, 12-21-87)
 - (b) The fee for a new applicant for Class A-1 license shall be one hundred twenty-five dollars (\$125). Renewal fee for each succeeding year shall be sixty dollars (\$60).
 - (c) The fee for a new applicant for Class A-2 license shall be one hundred twenty-five dollars (\$125). Renewal fee for each succeeding year shall be sixty dollars (\$60).
 - (d) The fee for a new applicant for Class A-3 license shall be seventy-five dollars (\$75). Renewal fee for each succeeding year shall be sixty dollars (\$60). (Am. by Ord. 9366, 12-21-87)
 - (e) The fee for a new applicant for Class A-4 license shall be seventy-five dollars (\$75). Renewal fee for each succeeding year shall be sixty dollars (\$60). (Am. by Ord. 9366, 12-21-87)
- (Renum. from (5) by Ord. 11,611, Adopted 5-21-96)
- (5) Licenses-How Obtained.
- (a) Examinations for heating licenses shall be given by the Building Inspection Division of the Department of Planning and Community and Economic Development on the second Monday in January, April, July and October. An examination may be given at any time upon a finding that there be a hardship involved and that a delay in writing the exam will result in an injustice to the applicant.

- (b) An application shall be filed with the Heating, Ventilating and Air Conditioning Inspector thirty (30) days prior to the date on which an examination is to be held. An application fee of sixty dollars (\$60) shall accompany application for Class B, Class A-3 and Class A-4 licenses. An application fee of one hundred twenty-five dollars (\$125) shall accompany application for Class A-1 and A-2 licenses. Application shall be made on forms furnished by the Building Inspection Division of the Department of Planning and Community and Economic Development, City of Madison, Municipal Building, Madison, Wisconsin.

Persons who are engaged in solar system installation shall hold an A-4 license or an NABCEP certification for solar thermal installers. The applicant must furnish evidence that s/he is engaged in such installation. Upon finding that the applicant is engaged in the solar system installations, if the applicant is not NABCEP certified, an A-4 license will be issued after the appropriate fee is paid and the bond has been furnished. (Am. by ORD-08-00122, 11-22-08)

- (c) The Director of the Building Inspection Division of the Department of Planning and Community and Economic Development, upon being satisfied as to the competency of the applicant, shall issue to the applicant a license authorizing the applicant to conduct a heating business for that branch of heating for which s/he has applied. The examination application fee shall constitute payment for the balance of the license year.

If the applicant for a license fails in her/his examination, one-half (1/2) of the application fee shall be refunded to the applicant. The applicant may write the examination the next time it is given, but if s/he fails to pass again, s/he must wait one (1) year before making application to again take the examination.

- (d) A person either individually, as a member of a firm, or as an officer or employee holding a license may apply for an inactive status if the following conditions are satisfied:
1. The person qualifies by examination or by state certification and pays the required fee for one (1) year on the basis of an active license.
 2. After holding a license for one (1) year, the licensee may establish an inactive status if not actively engaged in the business of heating equipment or where more than one (1) person holds an active license for the firm.
 3. The inactive licensee shall pay a renewal fee of fifteen dollars (\$15) per year to maintain inactive status.
 4. The inactive status cannot be renewed for more than a period of four (4) successive years.

(Sec. 30.01(6) Renum. to (5) and Am. by Ord. 11,611, 5-21-96; ORD-08-00109, 10-7-08)

(6) Prohibitions.

- (a) It shall be unlawful for any person with a Class A-1, A-2, A-3 or A-4 license to allow the use of her/his license directly or indirectly for others, except that a person with a Class A-1, A-2, A-3 or A-4 license may lawfully obtain permits for corporations or firms who are actively engaged in the heating contracting business with a recognized business location if said person is gainfully and regularly employed by such corporation or firm on a full-time basis in a supervisory position. The licensee and the contractor shall be jointly held responsible for the design, supervision, installation and performance of the system.

- (b) In the event that any person holding a heating license shall sever her/his connection with a heating firm and there is no other person who is licensed under the provisions of this code to conduct a heating business, the heating firm shall, within a period of forty-five (45) days, either employ a person licensed in their branch of heating or apply to the Director of the Building Inspection Division of the Department of Planning and Community and Economic Development for the required license according to the provisions of this code. Upon such application, an examination of the applicant shall be conducted under the hardship provisions of Section 30.01(5)(a) of the Madison General Ordinances. In the event that such applicant fails to obtain such license, then said firm shall employ a person licensed in their branch of heating within a period of forty-five (45) days after said applicant for license has been notified of her/his failure to meet the license requirements. If any work done by such firm pursuant to permits issued by the Heating, Ventilating and Air Conditioning Inspector shall fail to meet all requirements of the City ordinances and the regulations contained in Wis. Admin. Code Chapter ILHR 64, the Heating, Ventilating and Air Conditioning Inspector shall not issue further permits to such firm, until some member or employee of such firm shall have obtained a license to conduct a heating business in accordance with the provisions of this code.
- (c) No person either individually, as a member of a firm, or as an officer or employee of a corporation shall install, alter or repair any space heating equipment except those employees working for an authorized licensee, hereunder, unless such person shall have a license as required by this code. The Director of the Building Inspection Division, however, may issue a permit to the owner of a single-family residence only which the owner and the owner's immediate family solely occupies, for work to be done within said residence, if the person desiring such permit can prove (by oral examination conducted by the Building Inspection Division of the Department of Planning and Community and Economic Development) that s/he is competent to do such work, in conformity with all rules and regulations governing the installation of heating equipment in residences and such person shall pay the same fee as is required in the fee schedule.

(New Sec. 30.01(6) Cr. by Ord. 11,611, 5-21-96; ORD-08-00109, 10-7-08)

- (7) Renewal of Licenses. Every license shall expire on the thirtieth (30th) day of June following the date of its issue and may be renewed upon payment to the City Treasurer, the renewal fee pertaining to that class of license not later than the first day of July of the year in which the license expires. After July 1, the license will not be renewed and the licensee will be required to make application for and take the examination for a new license in the same manner as a new applicant before being issued a new license. Temporary licenses shall not be issued. (Am. by Ord. 11,611, Adopted 5-21-96)
- (8) Licensee Required to Give Bond. Every person licensed as an active Class A-1, A-2, A-3, A-4 or B heating contractor shall pay an additional seventy-five dollars (\$75) for which the City will guarantee in the amount of one thousand dollars (\$1,000) that such person shall comply with the Ordinances and laws relating to space heating and will pay costs and expenses that may be caused by the negligence of such person or her/his servants occasioned by her/his or their failure to comply with said laws and Ordinances up to the \$1,000 limit or give a bond to the City of Madison in the sum of one thousand dollars (\$1,000) at the time of license renewal with such sureties as the City attorney shall approve. Provided further that the person who holds the license for the corporation, the license shall indicate both the name of the licensee and the corporation. Persons with an A-1, A-2 or A-4 license need not file an additional bond. Persons licensed as Class A or AA Electrical Contractors need not file an additional bond to carry an A-3 Heating License. (Am. by Ord. 9995, 4-12-90)

(9) Permits, Plans, Specifications and Data.

- (a) It shall be unlawful for a person, firm, or corporation to construct, install, alter, or repair any heating, ventilating or exhaust system (and appurtenance), replace boiler and furnace, install stoker and conversion units in or for any building before securing a permit, except in cases of emergency the contractor may proceed with the work and file the application for a permit within twenty-four (24) hours (Sundays and holidays excepted). A heating permit will not be required for the installation of electric baseboard or bathroom heaters when installed as auxiliary heat; that is, to supplement the existing heating system designed and installed to satisfy the load requirements of the space to be heated. The reference to appurtenances shall include direct heaters, cooling coils, central residential air conditioning (cooling) and similar devices affecting the safety or operation of the heating system.
- (b) Permit Applications and Permit Card.
1. The application for a permit shall be made on forms provided by the Building Inspection Division of the Department of Planning and Community and Economic Development. The applicant shall be a qualified installer. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
 2. The Heating, Ventilating and Air Conditioning Permit Card shall be posted in a conspicuous place near the heating plant before starting work and shall not be removed until the final heating inspection has been made and the installation does conform with the requirements of this code. The permit card for electric space heating shall be posted near the electric service panel before work is started and shall not be removed until the final heating inspection has been made and the installation does conform with the requirements of the code.
- (c) Data Required as Part of the Permit Application. All drawings submitted for approval shall be accompanied by sufficient data and information for the Building Inspection Division of the Department of Planning and Community and Economic Development to determine if the capacity of the equipment and the performance of the equipment will satisfy the requirements of the ordinance. The following data shall be submitted.
1. Submit heat loss calculation in BTU per hour for each room to be heated.
 2. Include calculations for ventilation requirements.
 3. Submit one (1) or more copies of complete drawings. When the heating and ventilating drawings require approval of the Department of Commerce, one (1) or more approved copies shall be submitted with the application. (Am. by Ord. 12,322, Adopted 2-2-99)
 4. Summation of heating and ventilating load requirements.
 5. Installations shall be made to conform to approved drawings.
 6. Plot plan showing the location of the condensing unit for air conditioning.
 7. For solar systems, furnish an estimate of the amount of energy in BTU's to be delivered by the system on an annual basis, which estimate shall be based on an "F" chart analysis or another method appropriate to the system considered, and collector performance data as is determined by a recognized testing lab. (Cr. by Ord. 8348, 5-25-84)
 8. For solar systems, furnish the collector tilt and azimuth angle and a solar path shading diagram for the proposed collector location indicating the shading between the hours of 9:00 A.M. and 3:00 P.M. CST for the entire year. (Cr. by Ord. 8348, 5-25-84)

9. For solar systems, furnish a detailed drawing showing anchorage and bearing of collector supports. (Cr. by Ord. 8348, 5-25-84)

(Secs. 30.01(9)(c)9. & 11. R. and Sec. 30.01(9)(c)10. Renum. to 9. by ORD-08-00122, 11-22-08)

(d) Design Standards. The heating and ventilating design shall conform to methods and standards approved by the Building Inspection Division of the Department of Planning and Community and Economic Development when not in conflict with the Department of Commerce.

Note: The Building Inspection Division of the Department of Planning and Community and Economic Development will accept the method and standards recommended by American Society of Heating, Refrigeration, and Air Conditioning Engineers; National Warm Air Heating and Air Conditioning Association; Sheet Metal and Air Conditioning Association (SMACNA); and National Electrical Manufacturers' Association. (See Appendix No. 1 for acceptable standards).

1. Minimum design standards for all rooms in living quarters shall be seventy (70) degrees Fahrenheit except bathrooms, which shall be seventy-five (75) degrees Fahrenheit. The minimum outside design temperature shall be minus fifteen (-15) degrees Fahrenheit.

2. The total heat loss of a building including the basement shall be used in sizing heating units or electrical service for electrical space heating.

3. The proper "U" factors shall be selected and shall reflect the additional heat loss in areas located over unheated areas.

(Am. by Ord. 12,322, Adopted 2-2-99)

(e) Supplemental Permits. The license holder responsible for the work shall complete any supplemental permit mailed to her/him and return it to the Director of the Building Inspection Division prior to commencing work. Failure to return the supplemental permit prior to commencing work shall be deemed to be working without a permit. (Am. by Ord. 10,255, Adopted 5-7-91)

(Sec. 30.01(9)R.; (10) Renum. to (9) by Ord. 11,611, 5-21-96; Am. by ORD-08-00109, 10-7-08)

(10) Permit Fees. To be collected with building permit fees. Penalty for failure to obtain a permit before starting work shall be double the fees except as provided for emergencies as stated in Section 30.01(10)(a). (Am. by Ord. 11,946, 10-14-97)

HEATING, VENTILATING, AND AIR CONDITIONING PERMIT FEE SCHEDULES

SCHEDULE 1 NEW CONSTRUCTION		
Group I	The use group shall include new and additions to residential buildings in which families or households live or in which sleeping accommodations are provided for individuals with or without dining facilities excluding hotels, motels, and institutional buildings	\$.07 per sq. ft. of new building or addition. Minimum Fee \$20.00
Group II	The use group shall include new and additions to taverns, restaurants, cafeterias, retail establishments under 10,000 sq. ft. where manufactured products are bought and sold, repair garages, service stations taverns, restaurants, cafeterias, retail establishments under 10,000 sq. ft. where manufactured products are bought and sold, repair garages, service stations, churches, assembly halls, theaters, exhibition buildings, educational institutions, hospitals, nursing homes, places of detention, gymnasiums, arenas, laboratories, lodge halls, funeral homes, libraries, skating rinks, dance halls, and armories	\$.10 per sq. ft. of new building or addition. Minimum Fee \$20.
Group III	The use group shall include new and additions to warehouses, freight terminals, storage buildings, vehicle storage garages, refrigeration storage, factories, machine shops, electric substations, sewage treatment plants, heating plants, steam and electric generating plants, transformer vaults, and other buildings not classified in Groups I, II, III and IV, except one story but not limited to accessory buildings such as tool sheds, storage buildings having a floor area of less than eighty (80) square feet are exempt.	\$.05 per sq. ft. Minimum Fee \$20.00
	Residential Central Air Conditioning	\$32.00

NOTE: The air conditioning fee is in addition to the calculated fee for the heating plant installation. The air conditioning fee is applicable to one and two family dwelling installations. The heating plant fee covers all heating units and distribution system installations.

When an application is submitted for a property where only the shell of the property is to be completed, the fee will be calculated at 50% of the total fee for that particular fee group. When an application is submitted for construction of the interior of a building where the shell of the building has been previously granted a permit, the fees shall be based on the square footage of that space as a percentage of the entire square footage of the subject building and that fee shall be calculated at 50% of the total fee for that particular fee group. (Sec. 30.01(11) Schedule I Am. by Ord. 11,796, Adopted 2-18-97; Ord. 12,566, 5-3-00; Ord. 13,743, 12-15-04)

SCHEDULE 2

REPLACEMENT HEATING PLANTS AND CONVERSION BURNERS

BTUH	Replacement
Up to 60,000	\$21.00
60,001 - 165,000	27.00
165,001 - 300,000	30.00
300,001 - 500,000	62.00
500,001 - 3,000,000	85.00

Over 3,000,000 BTUH Loss - Additional fifteen dollars (\$15.00) per 1,000,000 BTUH for new systems.

Note: Replacement is intended to mean that the heating unit is being replaced and there will be no work performed on the distribution system beyond the plenums or beyond the immediate connections to the boiler.

In no case shall the fee exceed those as calculated for new construction as listed in Schedule 1.
(Title Am. by Ord. 11,392, Adopted 11-7-95)

SCHEDULE 3

ADD-ON AIR CONDITIONING

\$25.00 regardless of size

Note: This schedule is not intended to cover window units. The fee in this schedule is intended to cover add-on installations for one- and two-family dwellings.
(Am. by Ord. 11,392, Adopted 11-7-95)

SCHEDULE 4

HEATING, COOLING, INDUSTRIAL OR COMMERCIAL EXHAUST VENTILATION SYSTEMS

For any heating, cooling, industrial or commercial exhaust ventilation systems, the Fee Schedule will be based on the dollar value of the installation as listed.

\$10.00 per \$1,000 of estimated cost. \$25.00 minimum fee.

Note: This schedule is intended to cover the repair or replacement of any heating work and any work not covered by other schedules. It also covers cooling systems which use the distribution system to satisfy required ventilation. The schedule is intended to cover all required exhaust systems installations.
(Schedule 4 Am. by Ord. 11,392, Adopted 11-7-95)

SCHEDULE 5

OIL TANKS

Oil Tanks - Each Tank \$35.00
(Sched 6 Renumb to 5 and Am. by Ord. 11,392, Adopted 11-7-95)

SCHEDULE 6

MISCELLANEOUS FEES

Oil or Wood Burning Stoves (Free Standing)	\$16.00
If ductwork is added--add fee for ductwork as indicated in Schedule 4.	
Chimney - installed with wood burning equipment	\$5.00
Chimney - installed separately	\$16.00
Solar equipment used in conjunction with primary distribution system (use Fee Schedule 4 based on ductwork installation cost).	
Active Solar Collectors: \$.12 per square foot of Collector Area. Minimum fee \$50.00	

(Sched 7 Renumb to 6 and Am. by 11,392, Adopted 11-7-95)
(Sec. 30.01(11) Renum. to (10) by Ord. 11,611, Adopted 5-21-96)

(11) Inspection.

- (a) In any new building or addition, immediately upon completion of those portions of the installation which are thereafter to be concealed or covered, the heating contractor shall notify the Heating, Ventilating and Air Conditioning Inspector on forms furnished by the Building Inspection Division of the Department of Planning and Community and Economic Development that said portions of the installations are ready for inspection; and it shall be unlawful for any person, firm or corporation to lath over, plaster or cover up any heating work before such work has been inspected and a rough inspection card posted. The Heating, Ventilating and Air Conditioning Inspector shall have the right and authority to order the removal of all such lath, plaster, or other covering which may have been placed over such work as has not been inspected. The Heating, Ventilating and Air Conditioning Inspector shall make inspections within two (2) working days after notice.

Final inspection on new installations is to be made upon completion of such work.

Inspection of repairs, replacement or conversion work is to be made upon completion of such work. The heating contractor shall notify the Heating, Ventilating and Air Conditioning Inspector as soon as the installation is complete and ready for inspection. A heating contractor who calls for an inspection and the work is not completed may be assessed twenty-five dollars (\$25) per inspection. Pursuant to Section 29.09, Madison General Ordinances, it is unlawful to occupy a building or permit a building to be occupied until final inspections have been made and a Certificate of Occupancy has been issued.

(Am. by ORD-08-00109, 10-7-08)

- (b) Failure or neglect to comply with the provisions of the Heating, Ventilating and Air Conditioning Code and of the permit issued under this code shall be considered a violation of this code.
- (c) The Department of Planning and Community and Economic Development shall keep an accurate account of all unpaid inspection fees incurred for inspection services rendered. If the fees are not paid within the specified time, the Department shall fail to renew the contractor's license.

(Sec. 30.01(11) R., (12) Renum. to (11) and Am. by Ord. 11,783, 2-17-97)

- (12) Signs on Vehicles. Every heating and air conditioning contractor vehicle in use for the sale or service of heating and air conditioning equipment in the City of Madison shall display a sign of 225 square inches. The company name letters shall be at least two inches high. Failure to comply will subject the company to penalties in Madison General Ordinances Section 30.01(15). All existing legible vehicle signs will be allowed to remain as of the effective date of this ordinance. (Sec. 30.01 (13) Renum. to (12) by Ord. 11,783, 2-17-97)
- (13) Compliance Inspection Fees.
- (a) Any person who shall fail or neglect to comply with any lawful order of the Director of the Building Inspection Division issued pursuant to the provisions of this chapter may be assessed seventy-five dollars (\$75) per compliance inspection, as defined in Sec. 27.03(2), MGO, that does not result in compliance with the order. A thirty-five dollar (\$35) charge may be assessed when an inspector fails to gain entry to carry out a compliance inspection. (Am. by ORD-11-00057, 4-7-11)
- (b) The Department of Planning and Community and Economic Development shall keep an accurate account of all unpaid inspection fees incurred for compliance inspection services rendered and report the same to the Finance Director, who shall annually prepare a statement of these special charges at each lot or parcel of land and report the same to the City Clerk, and the amount therein charged to each lot or parcel of land shall be by said Clerk entered in the tax roll as a special charge against said lot or parcel of land, and the same shall be collected in all respects like other special charges upon real estate as provided in Wis. Stat. § 66.0627. (Am. by ORD-11-00037, 3-8-11)
- (Cr. by ORD-10-00058, 6-11-10)
- (14) Penalty. Any person who shall violate any of the provisions of this chapter or who shall neglect or refuse to comply with a lawful order of the Director of the Building Inspection Division or her/his designee, issued pursuant to the provisions of this chapter, shall be fined not less than \$10 nor more than \$100 for each and every violation thereof. Each day of violation shall constitute a separate offense. These penalties are pursuant to Sec. 101.02(13), Wis. Stats., for building code violations.
- Madison General Ordinances violations bear the following penalties for violations in a twelve-month period: First offense, fifty dollars (\$50) to three hundred dollars (\$300); second offense, three hundred dollars (\$300) to six hundred dollars (\$600); third offense, six hundred dollars (\$600) to one thousand dollars (\$1000). The offenses covered under this section are: Performing heating work without a license; performing heating work without a permit; failure to call for a heating inspection and failure to have a proper sign on vehicle. (Sec. 30.01 (14) Renum. to (13) by Ord. 11,783, 2-17-97; Ord. 13,760, 12-14-04; ORD-08-00109, 10-7-08; Renum. to (14) by ORD-10-00058, 6-11-10)

30.02 DEFINITIONS.

Active Solar Collector. An active solar collector is a device that transforms light energy from solar radiation into heat energy. (This definition does not include passive solar devices or installations.) (Cr. by Ord. 8348, 5-25-84)

Active Solar Thermal System. An active solar thermal system is an auxiliary heating system using solar collectors to augment the building's primary heat source for space or water heating. (This definition does not include passive solar greenhouses.) (Cr. by Ord. 8348, 5-25-84)

Air Conditioner, Unitary. A unitary air conditioner consists of one (1) or more factory-made assemblies which normally include an evaporator, or cooling coil, a compressor and condenser combination, and may include a heater function as well; where such equipment is provided in more than one (1) assembly, the separated assemblies are described to be used together.

Air Conditioning. The simultaneous control of the temperature, humidity, air motion, and air distribution within an enclosure, where human comfort and health are involved. A reasonable air purity with regard to dusts, bacteria, and odors is also included.

Air Infiltration. The leakage of air into a house through cracks and crevices and through doors, windows and other openings, caused by wind pressure and/or temperature difference.

Boiler. A closed vessel in which a liquid is heated or vaporized and built in conformance with the A.S.M.E. Boiler Construction Code.

Boiler, High Pressure. A boiler furnishing steam at pressure in excess of fifteen (15) pounds per square inch gauge.

Boiler Hot Water and Low Pressure Steam. A boiler furnishing hot water at pressure not more than thirty (30) pounds per square inch gauge or steam at pressures not more than fifteen (15) pounds per square inch gauge.

Building. Any structure built for the support, shelter or enclosure of persons, animals, chattels, or movable property of any kind, and which is permanently affixed to the land.

Central Heating Equipment. Equipment used to generate heat which is distributed by means of pipes or ducts to furnish heat to areas other than those in which the equipment is located.

Coefficient of Heat Transmission (Overall) -U-. The amount of heat transmitted from air to air in one (1) hour per square foot of the wall, floor, roof, or ceiling for a difference in temperature of one (1) degree Fahrenheit between the air on the inside and outside of the wall, floor, roof or ceiling.

Conduction (Thermal). The transmission of heat through and by means of matter.

Convection. The transmission of heat by circulation (either natural or forced) of a liquid or gas such as air. If natural, it is caused by the difference in weight of hotter and colder fluid.

Convactor. A concealed radiator. An enclosed heating unit located (with enclosure) either within, adjacent to, or exterior to the room or space to be heated, but transferring heat to the room or space mainly by the process of convection. A shielded heating unit is also termed a convactor. If the heating unit is located exterior to the room or space to be heated, the heat is transferred through one (1) or more ducts or pipes.

Conversion Oil Burner. A burner for field installation in heating appliances such as boilers, furnaces, etc. It may be furnished with or without a primary safety control. Under special circumstances it may be installed for firing ovens, water heaters, ranges, special furnaces, and the like. A burner of this type may be a pressure atomizing gun type, a horizontal or vertical rotary type or a mechanical or natural draft vaporizing type.

Converter. A piece of equipment for heating water with steam without mixing the two. It may be used for supplying hot water for domestic purposes or for a hot water heating system.

Draft Regulator. A device which functions to maintain a desired draft in the fired appliance by automatically reducing the chimney draft to the desired value.

Furnace Room. A room in which heat generating equipment is installed.

One-Pipe System (Hot Water). A hot water heating system in which one (1) pipe serves both as a supply main and also as a return main. The heating units have separate supply and return pipes but both are connected to the same main.

One-Pipe System (Steam). A steam heating system consisting of a main circuit in which the steam can condensate flow in the same pipe. There is but one connection to each heating unit which must serve as both the supply and the return.

Panel Heating Systems. A heating system in which heat is transmitted by both radiation and convection from panel surfaces to both air and surrounding surfaces.

Radiant Heating. A heating system in which the heating is by radiation only. Sometimes applied to panel heating system.

Radiation. The transmission of heat in a straight line through space.

Radiator. A heating unit located within the room to be heated and exposed to view. A radiator transfers heat by radiation to objects “it can see” and by conduction to the surrounding air which in turn is circulated by natural convection.

Register. A grille with a built-in damper or shutter.

Square Foot of Heating Surface. Equivalent direct radiation (EDR). By definition that amount of heating surface which will give off two hundred forty (240) BTU per hour when filled with a heating medium at two hundred fifteen (215) degrees Fahrenheit and surrounded by air at seventy (70) degrees Fahrenheit. The equivalent square foot of heating surface may have no direct relation to the actual surface area.

Steam Heating System. A heating system in which the heating units give up their heat to the room by condensating the steam to them by a boiler or other source.

Steam Trap. A device for allowing the passage of condensate and air but preventing the passage of steam. See Thermostatic Trap.

Thermostat. An instrument which responds to changes in temperature and which directly or indirectly controls the room temperature.

Thermostatic Trap. A steam trap which opens by a drop in temperature such as when cold condensate or air reaches it and closes it when steam reaches it. The temperature sensitive element is usually a sealed bellows or series of diaphragm chambers containing a small quantity of volatile liquid.

Two-Pipe System (Steam or Water). A heating system in which one (1) pipe is used for the supply main and another for the return main. The essential feature of a two-pipe hot water system is that each heating unit receives a direct supply of the heating medium which cannot have served a preceding heating unit.

Unit Heater. A direct-heating, factory-made, encased assembly including a heating element, fan and motor, and directional outlet.

Vacuum Heating System (Steam). A one (1) or two (2) pipe system equipped with the necessary accessory apparatus to permit the pressure in the system to go below atmospheric.

Vapor Heating System (Steam). A two-pipe heating system which operates under pressure at or near atmospheric and which returns the condensation to the boiler or receiver by gravity.

Ventilation. Air circulated through a room for ventilating purposes. It may be mechanically circulated with a blower system or it may be natural circulation through an open window, etc.

Vent Valve (Steam). A device for permitting air to be forced out of a heating unit or pipe and which closes against water and steam.

Vent Valve (Water). A device permitting air to be pushed out of a pipe of heating unit but which closes against water.

Wet Return (Steam). That part of a return main of a steam heating system which is completely filled with water of condensation.

30.03 GENERAL CONDITIONS.

- (1) Space heaters shall not be installed in any living quarters unless the combustion air supply is taken from the outside directly to the unit. Space heaters which are presently installed without an outside combustion air supply directly to the unit must be removed by June 1, 1975, or shall be provided with an outside combustion air supply directly to the unit by the above specified time. The above subsection shall be enforced over the Wis. Admin. Code Sec. ILHR 64.21. All other provisions of Wis. Admin. Code Sec. ILHR 64.21 shall apply where applicable. (Am. by Ord. 9298, 10-29-87)
- (2) For isolation of fire hazards, refer to the Madison General Ordinances, Sec. 29.20(15)(b). (R. & Recr. by Ord. 4891, 2-13-75)
- (3) In addition to the requirements contained in the manuals and pamphlets listed in Appendix No. 1 which shall be classed as minimum standards of this code, the installation of all heating equipment and piping shall conform to the requirements set forth in the following sections of this code.
- (4) Poor workmanship, design or methods of installation likewise shall be sufficient cause for the condemnation of the whole or any part of the system.
- (5) Combustion Air.

- (a) One and Two-Family Residences. The provisions herein apply to appliances installed in buildings and which require air for combustion, ventilation, and dilution of flue gases from within the building. They do not apply to (1) sealed combustion system appliances which are installed so that all air for combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere, or (2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and dilution of flue gases.

Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Appliances shall be located so as not to interfere with proper circulation of air within the confined space. When buildings are so tight that normal infiltration does not provide the necessary air, outside air shall be introduced.

While all forms of building construction cannot be covered in detail, air for combustion, ventilation and dilution of flue gases for gas appliances vented by natural draft normally may be obtained by application of one of three methods listed below:

All air from inside buildings.

All air from outdoors.

Ventilation air from inside buildings - combustion and draft hood dilution air from outdoors.

1. Appliances Located in Unconfined Spaces. In unconfined spaces in buildings of conventional frame, masonry, or metal construction, infiltration normally is adequate to provide air for combustion, ventilation, and dilution of flue gases.

If the unconfined space is within a building of unusually tight construction, air for combustion, ventilation, and dilution of flue gases shall be obtained from outdoors or from spaces freely communicating with the outdoors. A permanent opening or openings having a total free area of not less than one (1) square inch per five thousand (5,000) BTU per hour of total input rating of all appliances shall be provided. Ducts may be used to convey make-up air from the outdoors and shall be of the same cross-section area as the free area of the openings to which they connect. The ducts may be connected to the cold air return of the heating system only if they connect directly to the outside air. The minimum dimension of rectangular air ducts shall be not less than three (3) inches.

2. Appliances Located In Confined Spaces.

- a. All Air From Inside Buildings. The confined space shall be provided with two (2) permanent openings, one (1) commencing within twelve (12) inches of the top and one (1) commencing within twelve (12) inches of the bottom of the enclosure. Each opening shall have a minimum free area of one (1) square inch per one thousand (1,000) BTU per hour of the total input rating of all appliances in the enclosure. The openings must freely communicate with interior areas having in turn adequate infiltration from the outside.

- b. All Air From Outdoors. The confined space shall be provided with two (2) permanent openings, one (1) commencing within twelve (12) inches of the top and one (1) commencing within twelve (12) inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with outdoors or spaces (crawl or attic) that freely communicate with outdoors.

When directly communicating with the outdoors each opening shall have a minimum free area of one (1) square inch per four thousand (4,000) BTU per hour of total input rating of all appliances in the enclosure.

When communicating with the outdoors through vertical ducts each opening shall have a minimum free area of one (1) square inch per four thousand (4,000) BTU per hour of total input rating of all appliances in the enclosure.

When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of one (1) square inch per two thousand (2,000) BTU per hour of total input rating of all appliances in the enclosure. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than three (3) inches.

c. Ventilation Air From Inside Buildings - Combustion and Draft Hood Dilution Air From Outdoors. The confined space shall be provided with two (2) openings located and sized as in Section 30.03(5)(a)2.a. In addition, there shall be one (1) opening directly communicating with outdoors or spaces (crawl or attic) that freely communicate with outdoors. This opening shall have a minimum free area of one (1) square inch per five thousand (5,000) BTU per hour of total input of all appliances in the enclosure. Ducts may be used to convey make-up air and shall be of the same cross-section area as the free area of the openings to which they connect. The ducts may be connected to the cold air return of the heating system only if they connect directly to outside air. The minimum dimension of rectangular air ducts shall not be less than three (3) inches.

(b) (R. by Ord. 10,255, Adopted 5-7-91)

(6) Where kitchen and bathroom exhaust ventilation is provided, ductwork shall extend to the exterior of the building. The termination of the ductwork shall be into an approved weatherproof hood.

30.04 ELECTRIC SPACE HEATING. The construction, arrangement, installation, alteration, repair and servicing of equipment which directly converts electrical energy into heat energy shall be governed by the provisions set forth, when such equipment is installed as a heating system intended to heat any space, room, or building for the comfort, health, or welfare of the occupants.

(1) Requirement for Equipment.

(a) All heat generating and emission units, and all control devices shall be in accordance with the Standard for Safety of Electric Heating Appliances established by Underwriters' Laboratories, Incorporated, or any other nationally recognized inspection board or laboratory.

(b) The total rating (or adjusted rating) of heat emission devices in each room or space to be heated shall equal or exceed the calculated heat loss of such room or space.

(c) The total rating (or adjusted rating) of the heat emission devices shall equal or exceed the calculated aggregate heat loss of all rooms or spaces heated where used as living quarters. The output of each heat generating and emission unit shall be computed at the location where the electrical energy is converted to heat energy. The conversion of electrical energy to heat energy shall be considered at not greater than 3413 BTU kilowatt hour.

(d) All heat generating and emission units are to be considered as constant loads and the conductor shall be capable of carrying one hundred twenty-five percent (125%) of the rated current. Where the labeled voltage of a heat generating or emission unit is greater or less than five percent (5%) of the service voltage, an adjusted rating of the heat generating or emission unit shall be used in determining the output.

$$\text{Adjusted} = \frac{(\text{Service Voltage})^2}{(\text{Label Voltage})^2} \times \text{Nameplate Rating}$$

(2) Electrical Service Capacity.

When the primary or exclusive source of energy for space heating is electrical, and the energy is converted directly from electrical energy, the minimum installed electrical service for heating shall equal in kilovolt ampere capacity the total calculated heat loss of the living quarters of the building design conditions. This will require that service conductors and service equipment capacity be provided to supply the total equivalent kilovolt ampere necessary to effect the calculated heat loss, regardless of whether heating devices are installed in all rooms or spaces regarded as living quarters in the initial installation. The service capacity shall be designed to accommodate the heating load in addition to the normal connected load of the building.

Load Limitations of Circuits.

1. No single heating unit (except floor furnaces or forced air heaters) of more than five (5) kilowatts shall be installed in any one room of a building. Where the calculated heat loss of room exceeds the equivalent capacity of a five (5) kilowatt heating unit (except floor furnaces and forced air heaters) there shall be installed two (2) or more heating units per room.
2. All electric heating units of more than one thousand six hundred fifty (1,650) watts rated capacity shall be equipped with two hundred thirty-two (232) forty (40) volt single phase elements, except in areas where the nominal standard is two hundred eight (208) volts. Heating units served at one hundred twenty (120) volts shall not exceed one thousand six hundred fifty (1,650) watts each or an aggregate capacity of three thousand three hundred (3,300) watts.
3. Receptacles installed in electric heating units shall not be connected to the heating circuit.

(3) Nameplate Required (All Systems). The manufacturer's nameplate shall be attached to the heating unit in a location which is accessible when the unit is in the installed position. The nameplate shall indicate the manufacturer's name, and the rating in amperes or watts and the voltage of the unit.

(4) General Installation Requirements.

- (a) All appliances shall be located in such a manner that continuous operation of the appliance will not raise the temperature of surrounding combustibles more than ninety (90) degrees above normal room temperature, when measured with mercury thermometers or conventional bead-type thermocouples.
- (b) All stationary or fixed electric heaters shall be permanently connected.
- (c) Every electrical heating device shall have a manual means for disconnecting all ungrounded conductors. A branch circuit switch pullout, or circuit breaker may be used as the disconnecting means if readily accessible to the user. Thermostats which are an integral part of the heater may not be used as the sole disconnect. One of the following disconnecting means shall be required in addition to such switch.
 1. Single-family dwelling - the main switch may be used as the primary means of disconnect.
 2. Two-family dwelling - same conditions apply as single-family residence.
 3. Three (3) apartments or more - the circuit disconnect must be in the apartment or on the same floor.
 4. Commercial or industrial - the branch circuit switch or breaker where readily accessible to the user or an approved thermostat is used as described below.
 5. Thermostat used as disconnecting means - a thermostat or combination thermostat and switch will qualify as a disconnecting means provided it contains an identified "off" position, will not energize any conductors while in the "off" position, without being manually moved from said "off" position, and opens all ungrounded conductors simultaneously.

- (d) Portable electric heaters shall not be used in lieu of central heating systems. A central heating system shall mean "Equipment used to generate heat which is distributed by means of pipes, ducts or any other permanently connected source of heat used to furnish heat to an area".
- Exception: Portable electric heaters may be used during the time the central heating system is being repaired or replaced providing the portable electric heaters comply with Sec. 30.04(12) and the use of portable heaters will not exceed 72 hours excluding weekends and holidays.
(Cr. by Ord.4830, 1-16-75)
- (5) Thermostat Requirements. Each space to be heated shall be controlled by one (1) or more thermostats and must meet the requirements of Sec. 30.04(4)(c)5. Maximum load of each thermostat shall be five (5) kilowatts.
- (6) Radiant Glass Heaters - Wall Type.
- (a) Heaters shall be installed on exterior walls where practical. Radiant type heaters shall not be installed on partitions which will cause such heaters to face an exposed outside wall, unless such installation is approved by the Heating, Ventilating, and Air Conditioning Inspector.
 - (b) Radiant glass heaters shall not be installed in floors.
 - (c) Radiant glass heaters shall not be installed on ceilings unless approved for ceiling mounting, in which case they shall comply with the requirements of prefabricated panels, where mounted tightly against the ceiling.
- (7) Convection, Resistance, and Fan-Forced Units.
- (a) Baseboard, wall, and standard fan-forced units shall be installed on exterior walls where practical.
 - (b) Floor drop-in units shall be installed in close proximity to exterior walls.
 - (c) Reverse flow fan-forced units shall be installed on interior partitions.
- (8) Electric Panel Heating Resistance - Cable Type.
- (a) Resistance cable shall not be installed in walls.
 - (b) Cables may be installed in ceilings or poured masonry floors. Cables shall not be extended beyond the room in which they originate. Cables shall not be installed in closets, over cabinets, under walls or partitions, or over walls or partitions where embedded. This requirement shall not prohibit low temperature heat sources in closets to control relative humidity.
 - (c) Cables shall be separated at least eight (8) inches from lighting fixtures, outlet and junction boxes, and two (2) inches from ventilating openings and other such openings in room surfaces. Sufficient area shall be provided to assure that no heating cables will be covered by surface-mounted lighting units.
 - (d) Cables must not be plastered over until the Electrical Inspector has inspected the installation.
- (9) Electric Panel - Prefabricated Conductive Materials.
- (a) Prefabricated conductive panels shall not extend beyond the room in which they originate.
 - (b) Panels shall not be installed on walls unless approved by the Electrical Inspector.
 - (c) Panels shall be separated at least eight (8) inches from lighting fixtures, outlets, and junction boxes, and two (2) inches from ventilating openings and other such openings in room surfaces. Sufficient area shall be provided to assure that no heating panels will be covered by surface-mounted lighting areas.

- (10) Electric Central Heating Systems. Central heating systems of the forced warm air, gravity warm air, steam or hot water type, shall be installed in accordance with the applicable sections of the Heating, Ventilating and Air Conditioning Code.
Resistance electric heating elements shall be controlled so that not more than five (5) kilowatts can be switched on simultaneously.
- (11) Electric Floor Furnaces. Self-contained heating units in the form of electric floor furnaces shall be installed in accordance with applicable sections of the Heating, Ventilating and Air Conditioning Code.
Thermostatic control shall be provided within the heated space, except that no thermostatic control shall switch any combination of heating elements totaling more than five (5) kilowatts simultaneously.
- (12) Electrical Heaters, Portable. All portable electric heaters shall be provided with a three (3) wire cord and grounding type cap. The entire unit shall be in accordance with the Standards for Safety of Electrical Heating Appliances established by Underwriters' Laboratories, Incorporated, in their Bulletin No. UL 499, dated June, 1962, a copy of which is on file for inspection in the office of the Electrical Inspector.
A thermostatic control shall be provided in each heated space, except that no individual thermostat shall switch any combination of heaters totaling more than five (5) kilowatts.
- (13) Other Permanently Placed Electric Heaters. Nothing in the regulations contained in Chapter 30 of the General Ordinances of the City of Madison shall prohibit the installation of other types of permanently placed electrical heat generating and emission units not presently covered herein when such units are approved by the Electrical Inspector and installed in a manner approved by such inspector, provided they meet the general provisions of Chapter 30 of the Madison General Ordinances of the City of Madison. No individual thermostatic control shall switch any combination of heaters totalling more than five (5) kilowatts.

30.05 ACTIVE SOLAR COLLECTOR SYSTEMS.

- (1) Orientation Guidelines.
 - (a) For solar systems used only for winter space heating, the collector tilt angle measured from the horizontal shall be 55° to 90°, and the azimuth angle measured from due south shall be 25° or less.
 - (b) For solar systems which are not utilized during the months of November, December, January, or February, the collector tilt angle measured from the horizontal shall be 14° to 45°, and the azimuth angle measured from due south shall be 35° or less.
 - (c) For solar systems used the entire year for space heating or water heating, the collector tilt angle measured from the horizontal shall be 45° to 60°, and the azimuth angle measured from due south shall be 30° or less.
 - (d) Any variations from the orientation guidelines above must be consented to and acknowledged by the owner in writing prior to installation of the solar system. (Am. by ORD-08-00122, 11-22-08)
- (2) (R. by ORD-08-00122, 11-22-08)
- (3) Collector Mounting. Every solar collection system shall be securely anchored to prevent damage to the collector(s) and structure to which they are attached. Fully engineered mounting and rack details showing collector attachment and support anchorages shall be approved by the Department before installation. The collectors shall be installed according to the manufacturer's instructions.
- (4) Roof Support. Every solar collection system installed on a roof shall be analyzed to determine if the roof system is strong enough to support the collector system and any anticipated snow loads. Details showing roof structure reinforcements shall be approved by the Department before installation.
- (5) Corrosion. All materials used in the manufacturing and installation of active solar systems shall be of corrosion-resistant material. All connections shall be made with compatible materials.
- (6) Sensors. All sensors and controllers installed in active solar systems shall be located to provide for servicing, be installed according to the control manufacturer's instructions and be protected from damage. All sensor wiring shall be securely attached and protected from damage and moisture.
- (7) Liquid Systems - Piping and Penetration.
 - (a) When three (3) or more collectors are installed in any one system, a reverse flow piping configuration shall be used unless an alternate flow configuration is recommended by the manufacturer.
 - (b) No permanent piping shall connect the solar system with potable water.
 - (c) All piping used in the solar loop supply and return and within ten (10) feet of the collector shall be made and assembled of materials that can withstand antifreeze solution at temperatures of up to 350°F. The remaining solar loop piping shall be made and assembled of materials that can withstand antifreeze solution of 200° F.
Note: CPVC Piping has performed poorly in certain installations.
 - (d) All solar loop building penetrations shall be made using weatherproof devices which will allow for expansion and contraction. All penetrations into the building shall be weatherproofed to prevent leaks, insects and drafts from entering the building.
 - (e) All of the components of a closed loop solar collector system shall be sized to provide adequate flow to the collectors.
 - (f) The solar loop shall incorporate a check valve downstream of the heat exchanger if collectors are mounted above the storage tank.
 - (g) Automatic air vents shall be disconnected from the solar loop by a ball valve.
(Sec. 30.05(7) Am. by ORD-08-00122, 11-22-08)

(8) Air Systems: Ducting and Penetration.

- (a) All ducts used in the solar loop shall be made and assembled of materials that will not distort or deteriorate from temperature, pressure, or exposure.
- (b) All solar loop duct building penetrations shall be made using weatherproof devices which will allow for expansion and contraction. All penetrations into the building shall be weatherproofed to prevent leaks, insects and drafts from entering the building.
- (c) All of the components of a solar collector duct system shall be sized to provide adequate airflow to the collectors.
- (d) The solar loop ductwork from the mechanical equipment (i.e. risers to the collector(s), and manifold(s) if used) shall be leak tested with a calibrated blower and the recorded leakage at one-inch water column shall not exceed ten percent (10%) of the system design airflow rate.

Note: The City will accept silicone caulk, Hard Cast or equivalent as sealants for metal ducts and Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) approved aluminum tape or approved equivalent as sealants for fiberglass ducts. All ducts in unconditioned spaces shall be sealed with one of the above. Duct tape is not approved for solar application.

- (e) All ductwork shall be fabricated and installed to meet SMACNA standards.
- (f) Back-draft dampers or motorized dampers shall be installed so as to prevent air passage through the collectors except when solar energy is being collected.
- (g) The system shall be designed and installed to prevent cold airflow across the water heating coil. If mechanical dampers are used to meet this requirement, they shall meet a leakage test not to exceed five percent (5%) of the system design air flow rate at one-inch water column.
- (h) All systems shall incorporate a secondary freeze protection system in case of mechanical failure. An electrical freeze sensor which activates the pump to circulate fluid through the domestic coil will meet this requirement.
- (i) Systems incorporating domestic heating shall be equipped with a summer bypass to the solar storage during the non-heating season.
- (j) All air systems used for space heating shall incorporate the use of a high efficiency air filter installed in the cold air riser duct to the collectors. The air filter shall have a minimum average efficiency of thirty percent (30%) as rated by the filter manufacturer.

(9) Liquid Systems - Pipe Insulation.

- (a) All pipe insulation in the solar collection system shall be at least R-5 in insulating value.
- (b) Exterior pipe insulation shall resist ultraviolet and environmental degradation and shall be covered by material providing weather resistance, UV protection and mechanical abuse protection. Exterior insulation joints, seams and connections shall be sealed to prevent entry of moisture. Fiberglass and elastomer insulation shall not be used for exterior solar application.
- (c) Solar supply loop shall be insulated with three hundred degree (300°F) rated insulation approved for solar applications.

Note: One-inch thickness of urethane and phenolic foam, with appropriate cover will meet the requirements of Subsection (b) above.

(Sec. 30.05(9) Am. by ORD-08-00122, 11-22-08)

(10) Air Systems - Duct Insulation and Piping.

- (a) Ductwork located in unheated spaces shall be insulated to a minimum value of R-7.
- (b) Ductwork located in heated spaces shall be insulated to a minimum value of R-3.

Note: It is recommended that all duct chases be insulated to a minimum insulating value of R-11. Some acceptable materials for insulation include: fiberglass duct wrap, fiberglass duct liner, fiberglass duct board.

- (c) A vapor barrier, if installed, shall not be located on the cold side of the ductwork.
- (d) All domestic water piping used in conjunction with a solar air system shall meet the piping requirements for liquid systems.

Exception: The cold-water inlet to the storage tank need not be insulated beyond two (2) feet from the storage tank.

(11) Heat Transfer Fluids.

- (a) Every solar collection system using fluids for heat transfer shall have a label attached to the storage/transfer tank indicating what fluid is contained in the collection system, its freezing point, Ph and installation date.
- (b) The fluid contained in a non-drain down system shall be able to withstand temperatures of at least -30°F before freezing.
- (c) Instructions shall be attached to the system indicating the fluid manufacturer's recommendations for proper checking and maintenance procedure.
- (d) Only fluids recommended by the manufacturer for use in solar systems shall be used in solar systems. Ethylene glycol shall not be used for solar systems due to its toxicity.
- (e) The heat transfer fluid used in the collectors shall be isolated from the potable water supply through the use of an approved double wall heat exchanger.

(12) Valves, Vents and Dampers.

- (a) Adequately sized pressure relief valves shall be located on all storage tanks within the system. The pressure relief valve shall be piped to discharge fluids within ten (10) inches of the floor.
- (b) All closed loop solar collector systems filled with antifreeze fluids shall be provided with a bleed valve installed at the highest point in the piping system.
- (c) All closed loop solar collection systems shall be provided with a pressure relief valve in the solar loop piping. The relief valve shall be piped to a safe location to avoid personal injury or damage to the building.
- (d) All closed loop solar collector systems filled with antifreeze fluid shall be pumped from the bottom of the collector array to the top of the collector array during normal operation. A check valve shall be provided in the system to prevent flow in the opposite direction.
- (e) Controls, dampers and valves shall be marked to identify their function.

- (13) Storage Tanks - Liquid Systems.
- (a) Storage tanks shall be located in heated (+50°F) areas whenever possible.
 - (b) Storage tanks located in unheated areas (+49°F or less) shall be insulated to an overall value of R-20 or greater. The insulation shall be permanently fastened in place.
 - (c) Storage tanks installed in heated spaces shall be insulated to an overall value of R-11 or greater. The insulation shall be permanently fastened in place.
 - (d) Heat traps shall be included on all supply and discharge lines for the storage tank. (Cr. by ORD-08-00122, 11-22-08)
 - (e) Storage tanks shall be located to provide for proper servicing.
 - (f) All storage tanks shall be designed and installed to withstand all anticipated loads and environmental conditions.
 - (g) All air vented tanks shall be covered.
(Sec. 30.05(13)(d)-(f) Renum. to (e)-(g) by ORD-08-00122, 11-22-08)
 - (h) Storage tanks shall have a tempering valve adjustable to 120°F downstream from the regular water heater and heat trap. (Cr. by ORD-08-00122, 11-22-08)
- (14) Storage - Air Systems.
- (a) Storage systems shall be located in heated (+50°F) areas whenever possible.
 - (b) Storage systems located in unheated areas (+49°F or less) shall be insulated to an overall value of R-38 or greater. The insulation shall be permanently fastened in place.
 - (c) Storage systems installed in heated spaces shall be insulated to an overall value of R-11 or greater. The insulation shall be permanently fastened in place.
 - (d) All storage systems shall be designed and installed to withstand all anticipated loads and environmental conditions.
 - (e) If rock is utilized for thermal storage, it shall be washed before it is placed into the storage area.
 - (f) If phase change storage materials are utilized in an air storage system, the storage materials shall be placed in sealed containers.
 - (g) When a rock storage system is utilized, an inlet plenum and an outlet plenum shall be provided.
- (15) Monitoring and Manuals.
- (a) Every active liquid solar system shall have a thermometer installed on the storage tank, to measure the temperature of the fluid in the storage tank. A single tank system would not be considered as having a storage tank.
 - (b) A pressure gauge shall be installed in the solar loop. (Cr. by ORD-08-00122, 11-22-08)
 - (c) The solar loop supply and return and the discharge line of the tempering valve shall have thermometers. (Cr. by ORD-08-00122, 11-22-08)
 - (d) Arrows shall be placed on the piping/ducting of the solar collector loop to indicate the direction of the fluid/air flow. (Renum. by ORD-08-00122, 11-22-08)
 - (e) Suppliers and installers of solar systems shall supply manuals to the owner explaining the operation and maintenance of the installed solar equipment. The manufacturer's name and model number of all major components shall be furnished to the owner. (Renum. by ORD-08-00122, 11-22-08)
- (16) Site Built and Non-Standard Systems. The intent of this code is not to inhibit or discourage site built and non-standard systems but to insure that they are adequately designed and installed. Site built collectors shall conform to the provisions of this code, except 30.01(10)(c)7.b.
(Sec. 30.05 Cr. by Ord. 8348, 5-25-84; Sec. 30.05(5) Rep., Secs. 30.05(6) through (17) Renum. (5) through (16) by ORD-08-00122, 11-22-08)

30.06 WARM AIR.

- (1) Selection of Furnace or Rooftop Unit Size. The furnace or rooftop unit shall be selected to satisfy the maximum hourly BTU requirement of the building and shall have a register delivery rating determined by a recognized authority. If the manufacturer's rating is given as a rating at the bonnet, the rating at the register shall be determined by the following method:

To obtain the register rating on a gravity furnace, the BTU rating at the bonnet shall be reduced by twenty-five percent (25%); on forced warm air furnaces, bonnet rating shall be reduced by fifteen percent (15%).
- (2) Selection of Blower Capacity. The blower shall be selected to furnish the required CFM air delivery against the total static pressure of the system, equal to or greater than the sum or the CFM requirements of all spaces to be heated.
- (3) Selection of Ducts, Registers, Intakes.
 - (a) Gravity system less than one hundred fifty thousand (150,000) BTU per hour. The system of branches, risers, fittings, registers, intakes and trunk ducts to be installed shall meet the minimum requirements resulting from the use of Manual No. 5, of the N.W.A.H.A.C. Association, as listed in Appendix No. 1.
 - (b) Forced warm air system not in excess of one hundred twenty thousand (120,000) BTU per hour. The system of branches, risers, fittings, registers, intakes and trunk ducts to be installed shall meet the minimum requirements resulting from use of Manual No. 7, of N.W.A.H.A.C. Association, as listed in Appendix No. 1.
 - (c) Forced warm air system in excess of one hundred twenty thousand (120,000) BTU per hour. The system of branches, risers, fittings, registers, intakes and trunk ducts to be installed shall meet the minimum requirements resulting from the use of Tables of Manual No. 9, N.W.A.H.A.C. Association as listed in Appendix No. 1.
 - (d) Individual return air intakes in new residential construction shall be installed from each room excepting bathrooms, kitchens and utility rooms. This shall include all heated recreation and playrooms. In kitchens with a dining area, return air intake shall be installed. However, in the case of one (1) story dwellings with either a crawl space or a full basement, and where baseboard warm air heating is used, direct return airs may be eliminated from the bedrooms providing:
 1. Air is transferred at the floor level to a return air grille located in the connecting hall or corridor.
 2. The free area of the said return air grilles shall be sized to equal one hundred percent (100%) of the required area of the supply ducts.
 3. The said grille to be located at the floor level with a velocity not to exceed five hundred ninety-nine (599) feet per minute.
 4. Air shall not be transferred from one habitable room through another habitable room.
 - (e) Selection of the return air ducts size shall be sized for at least one hundred percent (100%) of the area of the supply duct system. Where return air is taken from more than one (1) story and where high sidewall returns are used, at least fifty percent (50%) of those located on the lowest story must be located at the floor level.

(4) Furnace Location and Mounting.

- (a) Accessibility. Furnaces shall be so located that all parts which require periodical service or replacement are easily accessible with a minimum clearance of twenty-four (24) inches, except for a closet installation, a door or access panel which will open the full size of equipment may be used.
- (b) Pipeless Furnaces.
Placement. Locate so that no door, drapery, or similar object can be nearer than twelve (12) inches to any portion of the floor, furnace or register.
- (c) Floor Furnaces.
1. Placement. Locate so that no door, drapery, or similar object can be nearer than twelve (12) inches to any portion of the floor, furnace or register.
 2. Bracing. The floor around the furnace shall be braced and headed with a framework of material not lighter than the joists. The inside dimensions of the framework shall be approximately one-half (1/2) inch longer and one-half (1/2) inch wider than the furnace to be installed.
 3. Support. Means shall be provided to support the furnace when the floor grille is removed.
 4. Clearance. The bottom of the floor furnace shall have at least a six (6) inch clearance from the ground, obtained, when necessary, by excavating the ground below and to the sides to form a "basin-like" pit under the furnace so that there is a six (6) inch clearance beneath the furnace and a twelve (12) inch clearance on all sides, except the control side, which shall have an eighteen (18) inch clearance.
 5. Seepage Pan. Whenever the excavation exceeds twelve (12) inches and water seepage is apparent under the house, a water-tight copper pan, concrete pit, or other suitable material shall be used. If of copper, it shall be made of not less than sixteen (16) ounces sheet copper. The pan shall extend at least four (4) inches above the ground level, with a twelve (1) inch clearance from the furnace on all sides, except the control side, which shall have an eighteen (18) inch clearance.
 6. Access. Adequate provision shall be made for easy access to the furnace under the house by means of an opening in the foundation wall or through a trap door of at least thirty by thirty (30 x 30) inches, located at some convenient point in the house, and a clear, unobstructed passageway to the furnace at least thirty by thirty (30 x 30) inches.
 7. Appliance Alterations. All gas floor furnaces, including those having single or dual wall register outlets, shall be installed without alterations, extensions, or changes of any kind in the furnace.
 8. Upper Floor Installations. Gas floor furnaces may be installed in an upper floor provided the furnace assembly projects below into a utility room, closet, garage, or similar nonhabitable space. In such installations, the furnace shall be enclosed completely, with provisions for service, with furnace clearances of six (6) inches on all sides and bottom, and with the enclosure constructed of Portland cement plaster on metal lath or material of equal fire resistance. Sufficient air for combustion must be supplied.

- (d) Recessed Heaters.
1. Installation. Recessed heaters shall be installed in accordance with Sections 30.18, 30.19, 30.20 and 30.21 of the Madison General Ordinances.
 2. Location. Recessed heaters shall be located so as not to cause a hazard to walls, floors, curtains, furniture, doors, etc. Recessed heaters installed between bathroom and adjoining rooms shall not circulate air from bathroom to other parts of the building.
- (e) Mounting Furnaces.
1. For Incombustible Floor. Furnaces shall be mounted on a firm, level base of brick, cement or other incombustible material; tightly sealed at the bottom of the casing, or suspended or supported in a rigid manner. Said base shall be directly on the ground or adequately supported.
 2. High Boy, Forced Air Furnace on Combustible Floor. Automatically fired, forced warm air furnaces may be mounted on a combustible floor provided they are so arranged that the fan and fan chamber occupies the entire area beneath the firing chamber and forms a well ventilated air space between the firing chamber and the floor.
 3. Furnaces With Legs on Combustible Floor. Warm air furnaces and heaters which have four (4) inches or more of open space under the base of the appliance may be mounted on combustible floors, provided the appliance is such that flame or hot gases do not come in contact with its base, and further provided, the floor under the appliance is protected with not less than one-fourth (1/4) inch of asbestos mill board or equally covered with sheet metal of not less than No. 24 U.S. gauge. The above specified floor protection shall extend not less than the clearances specified in Section 30.06(4)(f) 2, 3, and 4 of the Madison General Ordinances.
 4. Downflow Furnace on Combustible Floor. A downflow furnace installed in a combustible floor must be set over a plenum of proper size, and both the furnace and the plenum must be supported by a base of one (1) inch thick asbestos mill board, building tile or cinder block. The plenum must be suspended from the top of the noncombustible base, and a clearance of at least one (1) inch must be provided between the outer sides of the plenum and the wood framing around the opening in the floor. This one (1) inch space must be filled with noncombustible insulation.

When oil-fired equipment is to be installed, the floor protection must extend beyond the burner and must be covered with a drip pan at least one (1) inch deep to prevent oil saturation of the combustible floor.

On all downflow furnaces there shall be installed an additional high limit control to close down the burner if there should be blower failure.

(f) Installation Clearances.

1. Furnace Clearances, by Temperature. Locate furnace so as to maintain a clearance sufficient to prevent surface temperatures of adjacent combustible materials, not to exceed one hundred seventy-five (175) degrees Fahrenheit.
2. Furnace Clearance, by Inches. No Protection. Except as otherwise provided, warm air furnaces and heat exchangers shall be installed to provide a clearance to woodwork or other combustible material, whether plastered or unplastered, not less than as shown in Table 1.

Note 1. Front clearance shall be sufficient for servicing the burner and furnace.

Note 2. Listed limit control that cannot be set higher than two hundred fifty (250) degrees Fahrenheit installed not more than ten (10) inches above the top surface of heat exchanger in a supply plenum that extends at least twelve (12) inches above the top surface of the heat exchanger.

Note 3. Barometric draft control operated by draft intensity and permanently set to limit the draft to a maximum intensity of thirteen-hundredths (0.13) inches of water gauge.

Note 4. Clearance above supply ducts within three (3) feet of the plenum shall be not less than one (1) inch. See Section 30.06(4)(f)5. of the Madison General Ordinances.

Note 5. Clearance above supply ducts within six (6) feet of the plenum shall be not less than that specified above the bonnet or plenum. See Section 30.06(4)(f)5. of the Madison General Ordinances.

Note 6. Clearance above horizontal supply ducts within three (3) feet of the plenum shall be not less than eighteen (18) inches, and beyond six (6) feet, not less than one (1) inch.

3. Furnaces in Closets, etc. Furnaces shall not be installed in a confined space such as an alcove or closet unless specifically approved for such installation and then only when installed in compliance with the approval and with the clearance from the walls and ceiling of the alcove or closet, not less than specified regardless of the type of construction.

TABLE NO. 1

	Minimum Clearance, Inches Above and Sides of Bonnet or Plenum	Jacket Sides and Rear	Front Note 1
I. Listed or unlisted automatically fired, forced air or gravity system, equipped with 250 degrees Fahrenheit temperature limit control installed in accordance with Note 2.			24
Burning Liquid Fuel (See Note 4)	1	6	24
Burning Gas Fuel (See Note 4)	1	6	18
Utilizing Electricity (See Note 4)	1	6	18
II. Listed automatically fired, forced air or gravity system, equipped with limit control not conforming to Note 2, but that will limit outlet air temperature to 250 degrees Fahrenheit (See Note 5).			
Burning Liquid Fuel	2	6	24
Burning Gas Fuel	2	6	18
Utilizing Electricity	2	6	18
III. Steam or Hot Water Heat Exchanger. Steam not over 15 pounds gauge pressure and hot water not more than 250 degrees Fahrenheit.	1	1	1
IV. Automatically stoker fired, forced air system equipped with 250 degrees Fahrenheit temperature limit control installed in accordance with Note 2 and barometric draft control (See Notes 3 and 5).			
Burning Solid Fuel	6	6	48
V. Furnaces other than above (See Note 6)			
Burning Liquid Fuel	18	18	48
Burning Gas Fuel	18	18	18
Burning Solid Fuel	18	18	48

TABLE NO. 2

REDUCTION OF CLEARANCES WITH SPECIFIED FORMS OF PROTECTION

Type of protection applied to & covering all surfaces of combustible material w/in distance specified as required clearance w/no protection (See Figs. 7, 8, 9)	Where required clearance w/no protection from appliance, vent connector, or single wall metal pipe is:									
	36"		18"		12"		9"		6"	
	Allowable Clearances w/Specified Protection, inches									
	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear
a) 3-1/2" thick masonry wall w/out ventilated air space	--	24	--	12	--	9	--	6	--	5
b) 1/2" insulation board over 1" glass fiber or mineral wool batts	24	18	12	9	9	6	6	5	4	3
c) 0.024 (24 gauge) sheet metal over 1" glass fiber or mineral wool batts reinforced w/wire on rear face w/ventilated air space	18	12	9	6	6	4	5	3	3	3
d) 3-1/2" thick masonry wall w/ventilated air space	--	12	--	6	--	6	--	6	--	6
e) 0.024 (24 gauge) sheet metal w/ventilated air space	18	12	9	6	6	4	5	3	3	2
f) 1/2" thick insulation board w/ventilated air space	18	12	9	6	6	4	5	3	3	3
g) 0.024 (24 gauge) sheet metal w/ventilated air space over 0.024 (24 gauge) sheet metal w/ventilated air space	18	12	9	6	6	4	5	3	3	3
h) 1" glass fiber or mineral wool batts sandwiched between two sheets 0.024 (24 gauge) sheet metal w/ventilated air space	18	12	9	6	6	4	5	3	3	3

NOTES APPLICABLE TO TABLE 2

1. Reduction of clearances from combustible materials shall not interfere with combustion air, draft hood clearance and relief, and accessibility of servicing.
2. All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the appliance, disregarding any intervening protection applied to the combustible material.
3. Spacers and ties shall be of noncombustible material. No spacer or tie shall be used directly opposite appliance or connector.
4. With all clearance reduction systems using a ventilated air space, adequate provision for air circulation shall be provided as described. (See Figures 7 and 8.)
5. There shall be at least 1 inch between clearance reduction system and combustible walls and ceilings for reduction systems using ventilated air space.
6. If a wall protector is mounted on a single flat wall away from corners, adequate air circulation may be provided by leaving only the bottom and top edges or only the side and top edges open with at least 1 inch air gap.
7. Mineral wool batts (blanket or board) shall have a minimum density of 8 lb/ft³ and a minimum melting point of 1500/F.
8. Insulation material used as part of clearance reduction system shall have a thermal conductivity of 1.0 (Btu-in)/(sq ft-hr-F) or less.
9. There shall be at least 1 inch between the appliance and the protector. In no case shall the clearance between the appliance and the combustible surface be reduced below that allowed in the table.
10. All clearances and thicknesses are minimum; larger clearances and thicknesses are acceptable.

(Sec. 30.06(4)(f)3. Table 2 R. & Re-Cr. by Ord. 10,255, Adopted 5-7-91)

4. Furnace Clearances - By Inches - With Protection. Warm air furnaces may be installed with clearances to woodwork or other combustible material, as shown in Table 2, where the combustible material or the appliance is protected as described in Table 2.
5. Duct Clearances. All parts of the supply system exposed to radiated heat from a furnace or surface, the temperature of which may be higher than two hundred fifty (250) degrees Fahrenheit, shall be constructed, insulated, shielded, or otherwise arranged, so that the temperature of the combustible construction adjacent to the supply system is not raised above one hundred seventy-five (175) degrees Fahrenheit.

Horizontal Supply Duct Clearances. Within a distance of three (3) feet of the plenum of systems classified under Items I and III of Table 1, the clearance shall be not less than one (1) inch. Beyond three (3) feet, no clearance is required.

Within a distance of six (6) feet of the plenum of a system classified under Items II, IV, and V of Table 1, the clearances shall be not less than specified above the bonnet of plenum. Beyond six (6) feet, no clearance is required.

From ducts of furnaces classified under Item IV of Table 1, the clearance shall be not less than six (6) inches out to six (6) feet and one (1) inch beyond six (6) feet to a point where there is a change of direction equivalent to ninety (90) degrees or more.

Where a horizontal supply duct passes through or pierces a partition or enclosure constructed of combustible material, the clearance shall be not less than specified in this section.

The ends of the space providing this clearance may be closed with a thimble and collar or the wall surfaces extended to the duct with incombustible building material such as plaster on metal lath.

Vertical Supply Ducts, Risers, Boots and Register Box Clearance. Where a duct, riser, boot or box in a system that does not require an eighteen (18) inch clearance above the supply plenum or bonnet enters a floor, partition or enclosure constructed of combustible material within the distance from the plenum specified in this section, the clearance from such duct, riser or boot shall be not less than the distance required above the furnace bonnet of plenum (See Table 1) or the duct shall change direction equivalent to at least ninety (90) degree turns before entering such floor, partition or enclosure. The above does not apply to pipeless furnaces covered hereinafter in this section.

Where a supply duct enters the floor of the first story above that in which the furnace is located, the space around the duct at such points shall be sealed with asbestos cement or other incombustible material.

Pipeless Furnace Registers. Where registers are installed in the floor over the furnace (as in the "pipeless" furnace) the register box shall be constructed double with an air space not less than four (4) inches between except where the warm air passage is surrounded by a cold air passage.

Where warm air ducts are exposed in closets, they shall be covered with not less than one-fourth (1/4) inch air seal asbestos or its equivalent in approved fire-resistive insulating covering, properly protected against injury.

30.07 GAS-FIRED UNIT HEATERS.

- (1) Support. Suspended type gas-fired heaters shall be safely and adequately supported with due consideration given to their weight and vibration characteristics.
- (2) Clearances. Listed gas-fired heaters shall be installed with minimum clearances of six (6) inches between the appliance, projecting flue box or draft hood and combustible construction. The control side of a unit heater shall be spaced not less than eighteen (18) inches from any wall or partition.

Unlisted unit heaters shall be installed with clearances to combustible construction of not less than eighteen (18) inches, or in accordance with Section 30.06(4)(f)2. of the Madison General Ordinances. Combustible floors under unlisted floor mounted heaters shall be protected in an approved manner.

- (3) Negative Pressure. The location of any unit heater or the ductwork attached thereto, shall be such that a negative pressure will not be created in the room in which the unit heater is located.
- (4) Ductwork. A unit heater shall not be attached to a warm air duct system unless listed for such installation.

30.08 SETTING AND ASSEMBLING OF FURNACES.

- (1) Assembly. Warm air furnaces shall be located on a solid foundation or support and in a workmanlike manner. All sections and joints shall be properly fitted and sealed gas tight.
- (2) Casings. Warm air furnaces shall be enclosed in metal casings or equivalent noncombustible material.

Sheet metal casings, including plenums or bonnets shall be made of metal sheets not lighter than No. 26 U.S. Standard Gauge, or equal. They shall fit the casings and casing rings closely, so as to be dust tight and shall be securely fastened to the front. The casing shall be lined from the top of the casing down to a line on a level with the grate.

When side collars are used, the casing top or bonnet must be of sufficient height so that the largest warm air pipe can be taken from side without ovaling. In no case shall a distance less than eight (8) inches be maintained between the top of the furnace and the top of the bonnet or plenum.

30.09 WARM AIR SUPPLY DUCTS.

- (1) Materials. All gravity and forced warm air ducts shall be constructed entirely of noncombustible material equivalent in structural strength and durability to the following:
 - (a) Metal Gauges: Ducts Not Enclosed in Partitions.

ROUND DUCTS

Diameter Inches	Minimum Wt. of Tin	Minimum Thickness Galv. Iron U.S. Gauge	Minimum Thickness Aluminum B & S Gauge
Less than 12	121C (107 lb.)	30	26
12 or more	1X (135 lb.)	28	26

RECTANGULAR DUCTS

Width Inches	Minimum Thickness Galv. Iron U.S. Gauge	Minimum Thickness Aluminum B & S Gauge
Less than 14	28	26
14 or more	26	24

- (b) Metal Gauges: Ducts Enclosed in Partitions.

Width	Minimum Weight of Tin	Minimum Thickness Galv. Iron U.S. Gauge	Minimum Thickness Aluminum B & S Gauge
14 or less	1C (107 lb.)	30	26
Over 14	1X (135 lb.)	28	26

- (2) Supply Ducts in Concrete Slab. All supply ducts shall be completely encased in not less than two (2) inches of concrete. Where the slab is less than two (2) feet below grade, edge insulation consisting of at least one (1) inch thickness of waterproof insulation shall be installed to a depth of at least two (2) feet. Insulation shall be placed in back of all boots.
- (3) Vibration Isolation. Vibration isolation connectors in duct systems shall be made of woven asbestos or approved flameproofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved incombustible material. Vibration isolation connectors of fabric shall not exceed ten (10) inches in length.

- (4) Cross Braking. All gravity or forced warm air ducts, eighteen (18) inches or wider, and forty-eight (48) inches or over in length, shall be cross braked on top and bottom and shall have standing seams or angle iron braces.
- (5) Ducts Through Masonry. No warm air duct, round or rectangular, shall come in tight contact with cold masonry walls.
- (6) Duct Linings. Linings used inside of ducts shall be fire-resistive.
Note: The use of flameproof fabric of metal or mineral and listed in Building Materials List published by Underwriters' Laboratories, Inc. is acceptable.
- (7) Joints and Seams. Joints and seams of all ducts shall be securely fastened and made substantially air tight. Slip joints shall have a lap of at least one (1) inch, and be individually fastened. Tape used for sealing joints shall be no more combustible than approved flameproof fabric. All joints shall be s and drive cleat or snap lock.
- (8) Duct and Riser Supports. All ducts and risers shall be securely supported by metal hangers, straps, lugs or brackets. No nails shall be driven through the duct or riser walls and no unnecessary holes shall be cut therein.
- (9) Riser Installation. All risers shall be tightly fitted and supported in a proper manner so as not to obstruct the flow of air, but to retain the full capacity throughout. Warm air baseboard risers shall extend through the finished floor at least three-eighths (3/8) inch and shall be securely fastened into baseboard section.
- (10) Removal of Firestopping for Ducts. Where the installation of ducts in walls, floor or partitions require the removal of any fire-stopping, the spaces around the duct at such points where fire-stopping was removed shall be tightly filled or sealed with incombustible materials.
- (11) Insulation of Warm Air Ducts for Gravity and Forced Air. Ducts located in cold attic spaces, garages with rooms above or adjacent to it, or other equivalent cold spaces, shall be insulated with at least one (1) inch thickness of insulation, and an inspection shall be made of the insulation before the work is concealed.
- (12) Insulation of Warm Air Ducts for Gravity and Forced Air. Ducts located in cold spaces, garages with rooms above or adjacent to it, or other equivalent cold spaces, shall be insulated with at least one (1) inch thickness of insulation and an inspection shall be made of the insulation before the work is concealed.
- (13) Volume Dampers - Forced Air Systems. Volume dampers of locking type shall be placed in each forced warm air run. Where warm air runs are concealed, the dampers will not be required but volume control dampers will be required in each branch duct and a damper shall be installed in each register or baseboard section. Outside air intake ducts shall be equipped with volume dampers.

30.10 RETURN AIR DUCT CONSTRUCTION.

- (1) Materials, Return Air Ducts. All return air ducts, except as required by Section 30.10(8) may be constructed of metal or one (1) inch (nominal) wood boards, or other suitable material, provided that no material more flammable than one (1) inch wood boards shall be used.
- (2) Return Air Ducts Within Two (2) Feet of Furnace. Portions of return air ducts within two (2) feet horizontal distance of the outer jacket shall be constructed of incombustible material.
- (3)
 - (a) Return Air Ducts in Floors, Walls, Partitions. Where return air ducts are installed in walls, floors or partitions, their installation shall comply with the provisions of Section 30.10(8) regarding firestopping.
 - (b) Insulation of Return Air Ducts Located in or Adjacent to Cold Spaces. Where return air ducts are located in or adjacent to cold spaces, they shall be insulated with at least one (1) inch thickness of insulation and an inspection shall be made of the insulation before the work is concealed.
(Sec. 30.10(3) Am. by Ord. 6278, 6-15-78)
- (4) Joist Spaces Used as Return Air Ducts. Where spaces between joists in floors are used as ducts, the portions of such spaces so used shall be cut off from all remaining unused portions by tight fitting stops of sheet metal or of wood not less than a two (2) inch thickness.
- (5) Combustible Return Air Duct Space Linings. The interior of combustible ducts shall be lined with incombustible material at points where there might be danger from incandescent particles dropped through the register or heater, such as directly under floor registers and the bottom of vertical ducts or directly under a heater having a bottom return.
- (6) One Grille to Each Stack. No vertical stud space shall have openings to receive return air from more than one (1) level, except where high sidewall returns for air conditioning are required, then a low sidewall or baseboard return air grille with a damper shall be installed.
- (7) Underfloor Return Air Plenums. Return air shall be conducted to the heater through continuous ducts, except that underfloor spaces may be used as ducts for return of air from rooms directly above, provided such spaces are not over two (2) feet in height to bottom of floor joists and are cleaned of all combustible material and are tightly and substantially enclosed.
- (8) Bridging and Panning in Return Air Joist Spaces. Whenever the space between joists is used to convey return air overhead, all bridging shall be removed and a dustproof bottom shall be constructed. If more area is required, two (2) or more spaces may be used or a pan may be constructed to extend below the joist to obtain the required area.
- (9) Gravity Return Air Grille Height Above Floor. Where a vertical gravity return air face is used, the open work or face must extend to within at least one (1) inch of the floor line and not more than fourteen (14) inches high.

30.11 AIR FILTERS.

- (1) Requirements. All forced warm air heating systems installed in residences shall have air filters.
- (2) Fire Resistance. Air filters shall be a type that will not burn freely or emit large volumes of smoke or other objectionable products of combustion when attacked by flames.
- (3) Coating Flash Point. Liquid adhesive coatings used on filters shall have a flash point of three hundred twenty-five (325) degrees Fahrenheit, Cleveland open cut tester, or higher.

30.12 DESIGN OF A GRAVITY WARM AIR SYSTEM. For one (1) and two (2) family structures with a BTU requirements NOT in excess of one hundred fifty thousand (150,000) BTU per hour, the furnace shall be selected and installed according to Manual 5 of the N.W.A.H.A.C. Association as listed in Appendix No. 1.

30.13 DESIGN OF A FORCED WARM AIR SYSTEM.

- (1) For one (1) and two (2) family structures with a BTU requirement NOT in excess of one hundred twenty thousand (120,000) BTU per hour, the furnace shall be selected and installed according to Manual 7 of the N.W.A.H.A.C. Association as listed in Appendix No. 1.
- (2) For one (1) and two (2) family structures having a BTU requirement in excess of one hundred twenty (120,000) BTU per hour, the furnace shall be selected and installed according to Manual 9 of the N.W.A.H.A.C. Association as listed in Appendix No. 1.
- (3) In the design of warm air perimeter heating systems, the furnace shall be selected and installed according to Manual 4 of the N.W.A.H.A.C. Association as listed in Appendix No. 1.
- (4) In the design of a small pipe, warm air, perimeter system, the furnace shall be selected and installed according to Manual 10 of the N.W.A.H.A.C. Association as listed in Appendix No. 1.
- (5) Design of a Warm Air Ceiling Panel System.
 - (a) Selection and Installation of Furnace. The furnace shall be selected and installed according to Manual 7-A of the N.W.A.H.A.C. Association as listed in Appendix No. 1.
 - (b) Use.
 1. Temperature Limit. Heating panels shall be used only with automatically fired, gas or oil burning, forced warm air systems equipped with temperature limit controls that cannot be set above two hundred (200) degrees Fahrenheit.
 2. Combination Systems. Heating panels may be used with forced warm air systems equipped with heat exchangers utilizing steam which cannot exceed fifteen (15) pounds gauge pressure or hot water which cannot exceed a temperature of two hundred (200) degrees Fahrenheit.
 - (c) Construction.
 1. Panel Construction. Where warm air supply is from a warm air furnace, heating panels shall be enclosed on all sides with material which is wholly incombustible or which possesses a flame spread classification of not over twenty (20), as determined in accordance with the Method for Fire Hazard Classification of Building Materials, NFPA No. 255, ASTM E84-50T, Underwriters' Laboratories, Inc. Standard.

This enclosing material shall be securely attached to the building structure; joints and seams shall be substantially air tight. Braces and hangers inside the chamber shall be incombustible.
 2. Combination System Panel. Where warm air supply is from a steam or hot water heat exchanger, heating panels shall either comply with Section 30.13(5)(c) or shall be enclosed on all sides with material not more flammable than one (1) inch wood boards.

This enclosing material shall be securely attached to the building structure; joints and seams shall be substantially air tight. No single vertical heating panel shall serve more than one (1) story.

30.14 STEAM AND HOT WATER HEATING SYSTEMS.

- (1) Definitions. For the purpose of Section 30.14, the following definitions shall govern as to the meaning of the several terms and expressions therein defined, wherever said terms and expressions are employed in this Code.
- (a) A gravity system is one in which the condensate is returned to the boiler by gravity due to the static head of water in the return mains. The elevation of the boiler water line must consequently be sufficiently below the lowest heating units and steam main and dry return mains to permit the return to condensate by gravity. The water line difference must be sufficient to overcome the maximum pressure drop in the system and when radiator and drip traps are used as in two-pipe vapor systems, the operating pressure of the boiler. This applies only to closed circuit systems where the condensation is returned to the boiler. If the condensation is wasted, no water line difference is required.
- (b) A mechanical return system is one in which the condensate flows to a receiver and is then forced into the boiler against the boiler pressure. The lowest parts of the supply side of the system must be kept sufficiently above the water line of the receiver to insure adequate drainage of water from the system, but the relative elevation of the boiler line is unimportant in such cases except that the discharge head on the mechanical return device becomes greater as the height of the boiler water line above the pump increases.
- There are three (3) general types of mechanical returns in common use, namely:
1. The mechanical return trap,
 2. The condensation return pump, and
 3. The vacuum return pump.
- (c) Service Mains.
1. Supply service mains shall be defined as those pipes through which the steam flows from the boiler or pressure reducing valve and to which the radiator supply branches are connected.
 2. Return service mains shall be defined as those pipes which carry condensate to the boiler or mechanical return device, and to which the radiator return branches are connected.
- (d) Down-feed or overhead systems shall be defined as those in which the supply mains are above the level of the radiation which they serve.
- (e) Up-feed systems shall be defined as those in which the supply mains are below the level of the radiation which they serve.
- (f) One-pipe systems shall be defined as those in which the steam supply to the radiation and the return of condensation flow are in opposition to each other.
- (g) Two-Pipe systems shall be defined as those in which one pipe is used for the supply of steam to the radiator and another for the return of condensation.
- (h) Dry returns shall be defined as those returns through which both water and air are being passed.
- (i) Wet returns shall be defined as those returns through which water only is being passed.
- (j) Vacuum returns shall be defined as those returns through which both water and air are being passed and upon which a vacuum is maintained at all times through the medium of a vacuum producer.
- (k) Equivalent length of run shall be defined as the actual distance in feet from source of steam supply, boiler or pressure reducing valve, to the farthest radiator in system, and then back along return line to boiler or mechanical return device, plus resistance of all fittings and valves as expressed in terms of straight pipe.

- (l) Transmission mains shall be defined as those pipes which though not actually a part of the heating system proper, are connected to the service mains of the system and act as sources of supply to same.
- (m) Gravity Hot Water Systems. Gravity hot water heating systems shall be defined as those in which the water is circulated through the radiation and connecting piping by virtue of the difference in density of the water in the flow and return risers.
- (n) Forced Hot Water Systems. Forced hot water heating systems shall be defined as those in which the water is circulated through the radiation and connection piping principally by means of a pump.
- (o) Open Gravity Systems. Open gravity hot water heating systems shall be defined as those in which expansion tanks are used, installed above the level of the highest radiator of the system which they serve and vented directly to the atmosphere.
- (p) Closed Gravity Systems. Closed gravity hot water heating systems shall be defined as those in which some device enables the system to be operated at a pressure in excess of the pressure corresponding to the static head of the system.
- (q) Supply or Flow Mains. The supply or flow mains of a hot water heating system shall be defined as those pipes through which the water flows from the boiler and to which the radiator supply branches are connected.
- (r) Return Mains. The return mains of a hot water heating system shall be defined as those pipes through which the water flows on its return to the boiler and to which the radiator return branches are connected.
- (2) Steam. Minimum Requirements for Determining Amount of Direct Steam Radiation to be Installed.
 - (a) The amount of equivalent direct radiation to be installed in a given room where unenclosed radiators are to be employed shall be determined by dividing the heat loss of the room in BTU per hour by two hundred forty (240).
 - (b) Convectors and Baseboard Used on Steam. All convectors used with steam as the heating medium shall be piped as a two-pipe system unless the convector is specifically designed for use on a one-pipe system. All baseboard radiation shall be piped as a two-pipe system and shall be installed according to the manufacturer's recommendations.
 - (c) Enclosed Radiators. If cast iron direct radiators are to be recessed or enclosed in a cabinet, proper allowance shall be made for capacity loss or gain incurred by this type of installation.
 - (d) Selection of convectors and baseboard ratings used in selecting convectors and baseboards shall be those as published by the Mechanical Contractor's Association of America, or any other nationally recognized rating authority.

- (3) Hot Water. Minimum Requirements for Determining Amount of Direct Hot Water Radiation to be Installed.
- (a) The amount of equivalent direction radiation to be installed in a given room where unenclosed radiators are to be employed shall be determined by dividing the heat loss of the room in BTU per hour by the BTU heat emission of the radiation at the design average water temperature as given by the manufacturer of the radiation.
- (b) Design Water Temperature.
1. Gravity Hot Water. Gravity hot water systems shall be designed on the basis of one hundred seventy (170) degrees average water temperature. Only radiation designed for gravity hot water shall be used.
 2. Forced Hot Water. The average water temperature to be used in designing forced hot water systems shall not be higher than one hundred eighty (180) degrees average hot water temperature.
- (4) Minimum Capacity and Installation Requirements for Low Pressure System and Hot Water Boilers; Ratings for Such Boilers, How Determined; High Pressure Source of Steam Supply. The manner of installation of all low pressure steam and hot water boilers hereafter installed for use in connection with heating systems, the minimum required capacities thereof and the ratings to be assigned thereto shall conform to the following provisions.
- (a) Boiler Foundation.
1. Each steam or hot water boiler hereafter installed in any basement for use in connection with space heating plants shall be supported on a level concrete foundation.
Where installed on any floor above the basement, each such boiler shall rest upon concrete or other fireproof floor, construction having no wooden or other combustible finish.
Provided, however, that where any such boiler is to be installed on any floor above the basement in any building constructed prior to the passage of this ordinance, the method of supporting such boiler, both as to fireproofing and construction, shall be subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development.
 2. Boiler Capacity to be Installed. All boilers not rated by a recognized testing laboratory shall have a net rating equal to sixty percent (60%) of fuel input.
Note: The Building Inspection Division of the Department of Planning and Community and Economic Development accepts net ratings as listed by Mechanical Contractor's Association of America, Inc., Steel Boiler Institute, Inc., Institute of Boiler and Radiator Manufacturers, and American Gas Association.
 3. It shall be unlawful for any person, firm, corporation, or their agent, to sell or install any boiler for use in the City of Madison that has not been rated by any of the above-mentioned organizations until the boiler has been approved by the Building Inspection Division of the Department of Planning and Community and Economic Development. The application for approval shall include name of boiler, manufacturer's name, complete literature giving all physical dimensions and manufacturer's recommended net load.

(Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)

- (b) Steam Supply, Where Taken From High Pressure Boilers. In every case where steam supply for a low pressure heating plant is taken from a high pressure boiler or boilers from which steam may or may not be furnished for other purposes, the capacity of such boiler or boilers shall be adequate to meet the demand to be placed upon them under peak load conditions, and a proper reducing valve or valves, with bypasses, capable of maintaining a reduced pressure of not to exceed fifteen (15) pounds per square inch on the heating system shall be installed between said high pressure boiler or boilers and the heating system. A relief valve of proper capacity set at not to exceed fifteen (15) pounds per square inch shall be installed on the low pressure side.
- (5) Minimum Requirements for Pipe Sizes of Low Pressure Steam Vapor and Vacuum Heating Systems.
- (a) Pipe sizes of all low pressure steam, vapor and vacuum heating systems shall be as hereinafter provided for in this section of this code.
- (b) Service Main Design. All supply and return mains in heating systems shall be designed for a low initial pressure and a reasonable small pressure drop. The total pressure drop shall never exceed one-half (1/2) of the initial pressure when condensate is flowing in the same direction as the steam. Where condensate must flow counter to the steam, the governing factor is the velocity permissible without interfering with condensate flow.
- Capacity Tables as shown in the American Society of Heating, Refrigeration and Air Conditioning Engineers' Guide, as listed in Appendix No. 1, shall be used when designing steam supply and return mains. It shall be noted that these tables show the capacity of pipe per one hundred (100) feet of equivalent length of run. In using these tables allowance shall be made for fittings and length of run.
- All steam supply and return mains shall be pitched not less than one-fourth (1/4) inches in ten (10) feet.
- (c) Steam Riser and Runout Design. The size of all risers and runouts shall be taken from the tables in the American Society of Heating, Refrigeration and Air Conditioning Engineers' Guide, or Part 3, Pipe Sizes and Design of Heating, Piping and Air Conditioning of the Contractors' National Association as per Appendix No. 1. Radiator runouts over eight (8) feet long shall be increased one pipe size. Pitch of horizontal runouts to risers and radiators shall be not less than one-half (1/2) inch in ten (10) feet. Supply mains, branches to risers or risers, shall be dripped where necessary. Where necessary, supply main, supply riser, or branches to supply riser should be dripped separately into a wet return.
- (6) Piping and Piping Connections and Equipment for Low Pressure Steam, Vapor and Vacuum Heating Systems and Hot Water Systems.
- (a) Piping and piping connections and equipment hereafter installed for all steam and hot water heating plant installations, or portions of such installations, shall conform to the following requirements:
1. Pipe. All pipe used shall be not less in weight and strength than that known to the trade as "Standard Wrought Pipe". Provided, however, that brass pipe and copper tubing may be so used where desired, the weight of all such pipe and tubing to be subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development.
- The weight of all such pipe and tubing to be Type M or heavier for aboveground and Type L or heavier for underground. No pipe or tubing shall be so used that is not in sound condition.
- (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)

2. Reaming. All pipe, after cutting shall be reamed to full internal diameter.
3. Fittings and Joints. Piping may be joined together by welding or by the use of fittings. Such welds shall be made in a neat workmanlike manner and shall be as strong as base metal. Fittings shall be of cast or malleable iron or of brass, and of standard weight, and clean-cut threads and free from blow-holes or other defects.
4. Expansion and Contraction, Allowance For. In all piping systems which are subject to expansion and contraction, provision shall be made for adequate anchorage and protection against damage to piping from such expansion and contraction. All risers shall be so anchored and safeguarded that the difference in length, when hot, from the length when cold, shall not disarrange the necessary provisions for drainage of the branches or distort, damage or displace radiators.
5. Piping to be Securely Supported. Piping installed under ceilings shall be securely supported by substantial metal hangers, so spaced that there will be no sag in piping between points of suspension, and where run on walls shall be securely supported by metal brackets or pipe supports similarly spaced. Supports shall be so arranged that there will be no undue strain on the threads of any pipe or fittings.
6. Drips. All points at which accumulations of water or condensation are liable to occur in steam supply pipes shall be properly dripped, the method of such dripping to be subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development.

No steam main shall be dripped into a dry return which carries radiator or unit heater condensate without either sealing or trapping such drip. The seal shall be of adequate depth to compensate for pressures involved.
(Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
7. Radiator and Boiler Connections. Supply and return connections to radiators and boilers shall be in accordance with the following provisions.
8. Radiator Connection. In two-pipe steam systems, the return connection for each radiator shall be made at the bottom of the radiator by means of either an eccentric bushing turned down or a water-leg section and the supply connection shall be made at the opposite end of the radiator either at top or bottom.
9. Boiler Connections. Steam boiler outlets shall not be bushed. Steam boilers with multiple outlets shall have at least two (2) of these outlets connected to a header the area of which shall be at least equal to the combined areas of the steam supply mains connected to it. All steam boilers used in connection with systems having gravity returns shall be provided with a Hartford return connection. Equalizer shall be taken from the bottom of the horizontal header. No return lines shall be connected together above the waterline of the boiler.

Note. Steam boilers with multiple outlets may use one (1) outlet if the area of the outlet is equal to or greater than the steam main and is recommended by the boiler manufacturer.

- (b) Condensation Pumps, Vacuum Pumps, Boiler Feed Pumps and Combination Thereof, Etc. Capacity and Installation Requirements. The following provisions shall govern the capacities and manner of installation of all condensation pumps, vacuum pumps, boiler feed pumps and combinations thereof, traps, etc. hereafter installed in connection with steam heating plants.

Capacities. In all cases where condensation pumps or vacuum pumps or boiler feed water pumps, or any combination of such devices, or traps, etc., are used in connection with steam heating plants, the capacity of each such device or combination of devices shall be subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development.

Pipe connections shall be independently supported in such manner as to prevent undue stresses in pumps or traps, due either to weight or expansion.

All equipment shall be installed in accordance with the manufacturer's recommendations, subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development.

(Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)

- (c) Sizes of Mains, Risers and Radiator Connections for Hot Water Systems.

1. Sizes of mains, risers, and radiator connections shall be selected from capacity tables as shown in the American Society of Refrigeration and Air Conditioning Engineers' Guide as listed in Appendix No. 1. Piping systems shall include an expansion tank of proper size.

2. Forced Hot Water System. Sizes of mains, risers and radiator connections shall be selected according to the method and data given in the American Society of Refrigeration and Air Conditioning Engineers' Guide as listed in Appendix No. 1.

The amount of water required in gallons per minute shall be determined by the following formula:

G.P.M. equals Total BTU per hour divided by the Temperature drop times sixty (60) times eight (8).

Where sixty (60) equals Minutes Per Hour and eight (8) equals Pounds Per Gallon of Water.

A maximum temperature drop of twenty (20) degrees shall be used in determining G.P.M. requirements for forced hot water system.

3. Selection of Pumps. Pumps shall be selected from manufacturer's pump capacity charts. The minimum allowable head pressure shall be two and one-half (2 1/2) feet.

4. Size of Pipe to be Installed. Having determined the equivalent length of pipe in the longest circuit and the total gallons per minute for the entire system, the sizes of pipe to be used for mains and risers shall be selected from the American Society of Refrigeration and Air Conditioning Engineers' Guide, as listed in Appendix No. 1. The friction loss per foot of pipe shall be between one hundred (100) and five hundred (500) mil-inches.

- (7) Piping and Piping Connections and Equipment for Hot Water Heating Systems. Piping and piping connections and equipment hereafter installed for all hot water heating plant installations or portions of such installation, shall conform to the following requirements:
- (a) Pipe, reaming, fittings and joints, expansion and contraction and piping supports for hot water heating systems shall conform to Section 30.13(4)(a)1, 2, 3, 4, and 5.
 - (b) Pitch. All piping shall be pitched either up or down so that all gases which are liberated from the water can move freely to a vented section of the system. Whenever practicable, the pipe line shall be the same direction as the water when a pipe system cannot be installed without creating air pockets, that is, sections in the system from which liberated gases cannot escape, such sections shall be provided with air relief valves which may be operated manually when necessary.
 - (c) Drainage. All piping shall be arranged so that the entire system can be drained, either to permit alterations or repairs, or to prevent freezing if the system is not to be operated during a cold period.
 - (d) Friction Head to be Equalized. The piping system shall be installed so that each circuit has its correct friction head. This shall be accomplished by making the pipe line as short as possible and providing as few fittings as possible where it is necessary to minimize the friction, and by increasing the length of pipe and number of fittings where necessary to increase the friction. Where the correct balance cannot be obtained by use of pipe and fittings, balancing cocks or orifices shall be used.

Whenever two (2) or more heating circuits are connected to the same source of supply, balancing cocks shall be installed in each branch circuit.

- (e) Expansion Tanks and Relief Valves. Expansion tanks and relief valves shall be installed in accordance with the following provisions:
 - 1. Expansion Tanks for Open Systems. Each open hot water system shall be provided with an expansion tank which meets the following minimum requirements:

The minimum contents of an open tank should be six-hundredths (.06) of the volume of the water in the system, including that in the boiler, heat transmitters, pipes, etc. They shall be located at least three (3) feet above the highest radiator. Provisions must be made to prevent freezing of the water in the tank as well as in the pipe leading to the tank.

In gravity circulation systems, the pipe to the open expansion tank shall be connected to the supply riser from the boiler, so that air liberated from water in the boiler will enter the expansion tank.

In forced circulation systems, the pipe of an open expansion tank should be connected on the suction side of the circulating pump.

2. Closed Expansion Tanks. Minimum contents of a closed expansion tank must be such that, the expansion of the water due to the increase in temperature, will be cushioned against a reservoir of compressed air above the water level in the expansion tank. Manufacturers' ratings of expansion tanks, or method for selecting expansion tanks as given in Section V of Bell & Gosset Co. Engineering Manual--1954 Edition, may be used in selecting the expansion tank.
3. Relief Valves. All boilers shall have an A.S.M.E. approved pressure relief valve rated at the full gross rating of the boiler output. There shall be no valves between the boiler and the relief valve. The discharge from the relief valve and the discharge from the low water cutoff shall be piped full size to within eighteen (18) inches of the floor.

When water feed valves are used, a minimum size of one-half (1/2) inch shall be used and a valved bypass shall be installed. Valves shall be installed upstream and downstream from the feed valve.

(R. & Recr. by Ord. 4438, 1-7-74)

(8) Minimum Requirements for the Design and Installation of Hot Water and Radiant Panel Heating Systems.

- (a) Hot Water Radiant Panel Heating System. All hot water radiant panel heating systems shall be designed according to standards set forth in American Society of Refrigeration and Air Conditioning Engineers' Guide or Part VI, Panel Heating Contractors - National Association Mechanical Contractors Association of America as listed in Appendix No. 1.
- (b) Panel Surface Temperature. The maximum surface temperature for floor panels shall be eighty-five (85) degrees and for ceiling panels one hundred twenty (120) degrees.

Screw threads will not be permitted in coils or grids embedded in concrete slabs or in plaster. Ferrous fabrication shall be all welded except in equipment room above floor or in boxes or covered recesses in slabs where flow adjusting cocks are installed.

- (c) Piping or Tubing Located in Concrete Slabs. Where nonferrous pipe or tubing is used in concrete slabs or in plaster, solder sweat fittings shall be used throughout and no ferrous to nonferrous connections shall be embedded in concrete, in plaster or concealed in the construction, nor shall nonferrous pipe or tubing come in contact with steel reinforcing in slabs. Threaded pipe and fittings may be used in equipment room above floor or in accessible recess boxes where adjusting flow cocks are installed in slabs.

A balancing cock or valve shall be installed in each individual coil branch, either on the supply side or on the return side.

(9) Requirements for Concealed Piping for Hot Water and Steam Systems. Concealed or embedded pipe or tubing shall be tested before being covered to a hydrostatic or compressed air pressure of not less than one hundred (100) pounds gauge for a period of not less than four (4) hours.

30.15 OIL BURNER INSTALLATIONS FOR DRAFT BURNERS. The construction, arrangement and manner of installation of all oil burners and oil burner equipment hereafter installed for use in connection with heating systems, and the alteration and repair hereafter of all oil burners and oil burner equipment used or to be used in connection with heating systems, shall conform to the following provisions:

- (1) Oil Burners and Oil Burner Equipment Defined. For the purpose of this ordinance, the term “oil burner” shall mean any device for use in connection with a system designed to burn fuel oil having a flash point of one hundred (100) degrees Fahrenheit, or higher, as determined by the Tag Closed Tester in accordance with the method of test adopted by the American Society for Testing Materials (A.S.T.M. Designation D56-21), and having a fuel tank or container with a capacity of more than ten (10) gallons connected thereto. The term “oil burner equipment” shall include oil burners, as above defined, and all tanks, piping, pumps, control devices and accessories, connected to the burners.
- (2) Approval of Oil Burner.
 - (a) It shall be unlawful for any person, firm, corporation or their agents, to install any oil burner which has not been approved by the National Board of Fire Underwriters’ Laboratory or any other nationally recognized inspection board or laboratory. Any burner which does not meet the above requirements shall not be installed until a certificate of approval has been issued.
 - (b) Application for approval shall give the following information: Name of burner, name and address of manufacturer, fuel recommended for burner, past history of company and burner, furnish detailed drawings and specification sheets.
- (3) Installation of Oil Burners.
 - (a) All oil burners shall be installed according to the recommendations of the manufacturer. Combustion chambers shall be of proper size and design to meet requirements of firing rate of boiler or furnace.
 - (b) Where oil burners are installed in furnaces, originally designed for solid fuel, the ash door of the furnace shall be removed or bottom ventilation otherwise provided to prevent the re-accumulation of vapors in the ash pit, unless the burner is of a type which mechanically purges the ash pit.
 - (c) Rooms in which oil burners are located shall be provided with adequate ventilation to assure continuous, complete combustion of the oil.
- (4) Gravity Feed to Burners. Gravity feed shall be used only with burners arranged to prevent abnormal discharge of oil at the burner by automatic means specifically approved for the burner with which it is used.

30.16 OIL TANKS AND PIPING.

- (1) Gravity supply tanks shall not exceed two hundred seventy-five (275) gallons individual capacity. Each tank shall be valved independently.

Where oil is supplied to the burner by gravity and a constant level device is not incorporated in the burner assembly or in an auxiliary tank used in connection with an automatic pump, an approved constant level device shall be installed in the oil feed line at the gravity tank or as close thereto as practicable. The vent openings of such constant level device shall be connected by piping or tubing to outside the building unless the constant level device is provided with an approved anti-flooding device. Vent pipes or tubing of constant level devices shall not be connected to tanks or tank vents.

- (2) Pressure tank feed shall be used only with burners arranged to prevent abnormal discharge of oil at the burner by automatic means specifically approved for the burner with which it is used.

Pressure tanks shall not exceed a capacity of sixty (60) gallons and shall not be operated at pressure exceeding fifty (50) pounds per square inch. They shall be equipped with a reliable pressure gauge and with an automatic relief valve piped to discharge outside of buildings.

- (3) Installation of Underground Tanks. All underground tanks shall comply with ILHR 8 Wisconsin Flammable and Combustible Liquids Code. Tank owners must also comply with the U.S. Environmental Protection Agency, Regulations for Underground Storage Tanks Systems. (R. & Re-Cr. by Ord. 10,255, Adopted 5-7-91)

- (4) Installation of Tanks Inside Buildings. Oil supply tanks larger than sixty (60) gallons capacity shall not be located in buildings above the lowest story, cellar or basement.

Unenclosed inside storage tanks and auxiliary tanks shall not be located within five (5) feet, horizontally, of any fire or flame.

Inside storage and auxiliary tanks shall be securely supported by substantial incombustible supports to prevent settling or sliding.

Oil supply tanks located inside buildings shall not exceed two hundred seventy-five (275) gallons individual capacity or five hundred fifty (550) gallons aggregate capacity.

Tanks exceeding two hundred seventy-five (275) gallons individual capacity or one thousand one hundred (1,100) gallons aggregate capacity in an individual building or in a section of a building separated by fire walls shall be installed in an enclosure constructed as follows:

The walls of the enclosure shall be constructed of reinforced concrete at least six (6) inches thick or of brick at least eight (8) inches thick. Such enclosures shall be installed only on concrete or other fire-resistive floors and shall be bonded to the floors. Enclosures shall have tops of reinforced concrete at least five (5) inches thick or equivalent fire-resistive construction, except that where floor or roof construction above the enclosure is concrete or other fire-resistive construction, the walls may be extended to and bonded to the underside of the construction above, in lieu of the provision of a separate top. Any openings to such enclosures shall be provided with fire doors or other approved closures and six (6) inch, noncombustible liquid-tight sills or ramps.

- (5) Construction of Tanks. Underground tanks and tanks inside buildings shall be constructed of steel or wrought iron of a minimum gauge (U.S. Standard) in accordance with the following table, except that for tanks of one hundred eighty-one (181) to two hundred seventy-five (275) gallons capacity, installed in buildings, and without masonry enclosure, the minimum gauge shall be No. 14.

Capacity Gals.	Minimum Thickness	Vent Size	Minimum Distance to Lines of Adjoining Property or Nearest Building
1 to 300	14 Gauge	1-1/4"	1 Foot
301 to 560	14 Gauge	1-1/4"	1 Foot
561 to 1,100	14 Gauge	1-1/4"	1 Foot

Joints shall be riveted and caulked, brazed, welded or made tight by some equally satisfactory process. Tanks shall be tight and sufficiently strong to bear without injury, the most severe strains to which they may be subjected in practice. Shells of tanks shall be properly reinforced where connections are made. All connections to underground tanks, outside tanks aboveground, and tanks inside buildings shall be made through the top of the tank above the liquid level, except that tanks of not over two hundred seventy-five (275) gallons capacity may have one bottom connection for gravity feed and one opening for an approved key stem gate valve to facilitate cleaning or for a scavenging line to be run to the outside and capped oil tight when not in use.

Pressure tanks shall be designed for at least six (6) times the maximum working pressure.

Tanks shall be thoroughly coated on the outside with tar, asphaltum, or other suitable rust-resisting paint. Where placed in corrosive soil, special protection may be required.

Note. Tanks labeled by Underwriters' Laboratories have been tested and examined for compliance with these regulations and detailed standards covering their design and construction. The construction and installation of all tanks having a capacity of five thousand (5,000) gallons and larger shall be submitted to the Department of Commerce for approval (Comm. 10.10). This information shall be forwarded to the Fire Prevention Bureau.

For fuel oil heavier than thirty-five (35) degrees A.P.I., tanks may be made of concrete, in accordance with the regulations of the National Board of Fire Underwriters for the Construction of Concrete Fuel Oil Storage Tanks as recommended by the National Fire Protection Association. (Am. by Ord. 12,322, Adopted 2-2-99)

- (6) Tank Vents. Storage tanks shall be equipped with an open vent or an approved automatically operated vent, arranged to discharge to the open air. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than one and one-fourth (1 1/4) inches pipe size. See table under Section 30.16(5).

Vent pipes shall be arranged to drain to the tank. The lower end of the vent pipe shall not extend through the top into the tank for a distance of more than one (1) inch.

Vent pipes shall terminate outside of buildings at a point not less than two (2) feet distant from any window or other building opening and not less than twenty-four (24) inches above the ground. Outer ends of vent pipes shall be provided with a weatherproof hood with screen. Vent pipes of tanks containing heaters shall be extended to such a height that oil vapors discharging from the vent will be readily diffused without danger of ignition. Provided, however, that combination fill and vent fittings approved by the Building Inspector may be used if located not less than two (2) feet distant from any window or other building opening and less than twenty-four (24) inches above the ground.

Vent pipes shall not be cross-connected with fill pipes or return lines from burners.

Fill and vent pipes shall not be run through windows or coal chutes unless such openings are totally enclosed with masonry to prevent oil from entering building during filling operations.

- (7) Tank Fill and Overflow Pipes. Underground tanks and storage tanks inside the buildings shall be filled only through fill pipes terminating outside of buildings at a point at least two (2) feet from any building opening at the same or lower level. Fill terminals shall be closed tight, when not in use by a metal cover designed to prevent tampering. The fill pipe shall be located below the vent pipe.

Auxiliary tanks shall be filled by pumping from storage tanks.

Auxiliary tanks other than vacuum tanks shall be equipped with an overflow pipe draining to the storage tank, at least one (1) size larger than the supply pipe.

Overflow pipes of auxiliary gravity tanks shall have no valves or obstructions. Overflow pipes of auxiliary pressure tanks shall be provided with interconnected valves or other means for automatically venting the tank during filling.

- (8) Oil Gauging. All tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with an approved method of determining the oil level.

Test wells shall not be installed inside buildings and where permitted for outside services, shall be closed tight when not in use by a metal cover designed to prevent tampering.

Gauging devices such as liquid level indicators or signals shall be installed so that oil or vapor will not be discharged into the building from the fuel supply system.

No glass gauge or any gauge, the breaking of which will permit oil to escape from the tank, shall be used.

- (9) Oil Pumps. Oil pumps shall be of an approved type, secure against leaks, and shall be rigidly fastened in place.
Automatic pumps not an integral part of the burner, shall be arranged to stop automatically in case of total breakage of the supply line to the burner.
In isolated locations, where fire protection equipment is dependent upon a heating plant fired by an oil burner, oil pumps supplying the burner shall be installed in duplicate.
- (10) Piping. All piping shall be standard full weight wrought iron, steel or brass pipe with standard fittings or approved brass or copper tubing with approved fittings, except that an approved flexible metal hose may be used for reducing the effects of jarring and vibration or where rigid connections are impracticable. No sweat joints shall be used on any oil lines including vent and fill pipe.
- (11) Oil Lines. Domestic and Commercial Fuels. Any oil line for burners using a catalytic or universal fuel oil of No. 3 grade or lighter, drawing from an outside tank may use three-eighths (3/8) or one-fourth (1/4) O.D. copper tubing or equal on runs of forty (40) feet or less. For fuel lines longer than forty (40) feet, one-half (1/2) inch O.D. copper shall be used.
Oil lines to an outside underground tank shall consist of one (1) suction line and one (1) return line.
Oil supply lines to burners shall be provided with approved filter. Where pumping from a tank on multiple burner installations, each burner must have its own suction line but may be connected to a common return line.
All oil lines shall be carefully protected against mechanical injury in a manner satisfactory to the Director of the Building Inspection Division.
(Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
- (12) Valves. Readily accessible shut-off valves of approved type shall be installed in oil supply line near each burner and close to gravity and pressure supply tanks. Shut-off valves of approved type shall be installed on the discharge and suction side of oil pumps which pump directly to the burner but which are not a part of the burner unit.
Where a shut-off valve is installed in the discharge line of an oil pump, an approved pressure relief valve shall be connected into the discharge line between the pump and the shut-off valve and arranged to return surplus oil to the storage tank or to bypass it around the pump.
- (13) Gas Pilots on Oil Burner. Line supplying gas pilots for oil burning appliances shall be accessible and not less than one-half (1/2) inch standard wrought iron or steel pipe size and shall not be exposed to extreme temperature.

30.17 STOKER INSTALLATION. The arrangement, equipment and manner of installation of all stokers hereafter installed for use in connection with heating plants, in or for buildings in the City of Madison, and the alterations hereafter of such stoker installations, shall conform to the following provisions.

- (1) **Stoker Defined.** The term “stoker” shall, for the purposes of this Code, be taken to mean a mechanical device for feeding solid fuel into the combustion chamber of a boiler or furnace used in connection with a heating plant, whether automatically or manually controlled.
- (2) **Maximum Peak Load.** The maximum peak load requirements of the plant must be determined in BTU per hour. The selection of the stoker should be based on the use of the lowest BTU value coal generally available and used at the point of consumption.
- (3) **Heat Release.** Heat release is the quantity of heat expressed in BTU per hour released in a combustion chamber for each cubic foot of furnace volume, computed with the following formula:

Heat Release equals Pounds of coal burned per hour times BTU per pound of coal divided by Furnace Volume in cubic feet.

- (4) **Combustion Volume.** The combustion volume of the firing device shall be at least one (1) cubic foot for each sixty thousand (60,000) BTU of heat release for coal with twelve thousand (12,000) BTU. Use the following factors for coal of other than twelve thousand (12,000) BTU.

BTU/Pound	Factor	BTU/Pound	Factor
9,000	.75	11,500	.96
9,500	.79	12,500	1.04
10,000	.83	13,000	1.08
10,500	.87	13,500	1.12
11,000	.92	14,000	1.17

- (5) **Setting Height.** The following formula shall be used in determining setting height for stokers:
 - For burning rates up to one hundred (100) pounds coal per hour--
H equals 0.1125B plus 15.75
 - For burning rates from one hundred (100) to twelve hundred (1,200) pounds of coal per hour--
H equals 0.03B plus 24.

Where H equals minimum setting height, inches, measured from dead plates to crown sheet for steel boilers. For cast iron boilers, height may be 7/8 H.
B equals Burning Rate coal per hour, pounds.
- (6) **Ash Storage Space.** Ash storage space (hearth area) shall be determined as follows:
 - All stokers up to and including fifty (50) pounds per hour coal feed rate should have minimum depth of three (3) inches of flat hearth on all sides of the retort.
- (7) **Grates for Stokers Over Two Hundred (200) Pounds. Per Hour Capacity.**
 - All stokers of two hundred (200) pounds per hour coal feed capacity and over should be installed with dead plates or dump grates. Under no circumstances shall they be installed with refractory hearths immediately adjacent to the tuyeres.
- (8) **Clinker Removal Door Spacing.** All stokers must be so installed that the maximum distance from the bottom of the lowest clinker removal door to the top of the hearth will not exceed eighteen (18) inches.

- (9) Pit Set Stoker. Where a stoker is pitted to a greater depth than eighteen (18) inches below the original floor of an installation, the pit shall be made large enough so that a minimum clearance from the furthest extending part of the stoker on each side and the side wall of the pit will be eighteen (18) inches.
- (10) Hopper Clearance. In the case of a hopper model stoker, the minimum distance between the furthest rear part of the stoker and the nearest wall or obstruction shall be twenty-four (24) inches.
- (11) Automatic Draft Control. On all stokers, some means of automatic draft control shall be installed.
- (12) Controls. (Refer to Control Section 30.25)

30.18 MINIMUM REQUIREMENTS FOR THE INSTALLATION OF GAS-FIRED HEATING EQUIPMENT AND PIPING. In addition to the requirements contained in the manuals and pamphlets listed in Appendix No. 1, which shall be classed as minimum standards of this code, the installation of gas heating equipment shall conform to the requirements set forth in the following subsections of this section and Section 30.07.

- (1) Scope. The provisions of this code, unless otherwise indicated herein, shall apply only to utilization pressure (not in excess of one-half (1/2) pound per square inch) gas pumping systems extending from the gas meter outlet connection to the inlet connections of appliances. They are intended to cover the design fabrication, installation and test of gas piping systems for fuel gases such as natural gas, liquefied petroleum gas, liquefied petroleum air, gas or mixtures thereof. They are not intended to cover systems or portions of systems supplying equipment engineered, designed and installed for specific manufacturing, production processing, large power generating application, melting and treating furnaces, production ovens and similar applications.

Exception. Gas piping and control equipment requirements for systems using gas pressures in excess of one-half (1/2) pound per square inch.

The use of gas in excess of one-half (1/2) pound per square inch may be used if the following requirements are met:

1. Generally, the valving arrangement shall conform to the American Standards Association (ASA-Z 21.33 - 1950). The Board will recognize as approved valving, arrangements and designs approved by any other nationally recognized approved agency.
2. A safety relief valve shall be placed downstream from a gas pressure regulator where gas is supplied at pressures in excess of one-half (1/2) pound per square inch. The discharge from the relief valve shall be piped to a safe location outside the building. (Valve setting not to exceed four (4) pounds.)
3. Provide a suitable pressure gauge in the gas line located downstream from the pressure regulator.
4. Where a gas supply pressure is higher than that at which the burners are designed to operate, a gas pressure regulator shall be provided to reduce pressure to satisfy design conditions.
5. Where the gas supply pressure is in excess of one-half (1/2) pound per square inch, the piping system shall be identified indicating the maximum line pressure. It is recommended that the legend "Gas _____ P.S.I." be applied on gas piping near and downstream from pressure regulator at intervals of fifty (50) feet in every room or area which is less than fifty (50) feet.
6. Submit two (2) copies of drawings (schematic is acceptable) and specifications to the Building Inspection Division of the Department of Planning and Community and Economic Development for review and approval. (Am. by ORD-08-00109, 10-7-08)

(Am. by Ord. 8081, 7-29-83)

- (2) Work on Gas Piping Containing Unmeasured Gas. Disconnecting inlet of gas meter, changing meter location or making connection to gas service pipe, shall be done only by gas company employees or others authorized by gas company to do such work. A pipefitter shall connect or disconnect the building piping from outlet meter connection when necessary. No person, unless in employ of gas company or having permission from gas company shall turn on or reconnect gas service in or on any premises where and when gas service is not at the time being rendered.
- It shall further be unlawful to turn on or supply gas on or at any premises unless at least one (1) gas appliance is connected to the gas piping system and all outlets are properly and securely connected to appliances or capped or plugged with screw joint fittings.
- (3) Authority to Disconnect. The Building Inspection Division of the Department of Planning and Community and Economic Development or the gas utility is hereby authorized to disconnect or have disconnected, any gas space heating equipment or gas piping, which shall be found not to conform to the requirements of this code, or which may be found defective and in such condition as to endanger life or property. Where such disconnection has been made, a notice shall be attached to such equipment or gas piping which shall state that the same has been disconnected, together with a reason therefore and such notice shall not be removed nor shall the equipment or gas be reconnected until authorized by the Building Inspection Division of the Department of Planning and Community and Economic Development to do so. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
- (4) General Precautions.
- (a) Installation of Gas Piping. Installation of gas piping shall be performed with the gas turned off to eliminate hazards from leakage of gas. Connection of new piping system to existing system shall be done, if practical, with gas turned off.
 - (b) Burner and Pilot Valves. Before turning off the gas at the meter, except in cases of emergency, all burner and pilot valves on the premises supplied with gas through the meter, shall be turned off and the meter test hand observed for a sufficient length of time to ascertain that there is no gas passing through the meter. When there is more than one meter on the premises, precaution shall be exercised to assure that the proper heater is turned off.
 - (c) Checking for Gas Leakage. No matches, candles, flame or other source of ignition shall be employed to check for gas leakage from meters, piping or appliances. Check for gas leakage with a soap and water solution.
 - (d) Artificial Illumination. Artificial illumination used in connection with a search for gas leakage shall be restricted to electric hand flashlights, fixed electric lights controlled only by explosion-proof safety switches or switches remote from the area of the leakage, or approved safety lamps.
 - (e) Smoking Not Permitted. When connecting or disconnecting pipe which contains gas, smoking shall not be permitted.
 - (f) Electrical Circuits Grounded to Gas Piping. Except for appliance controls requiring a ground electrical system including low voltage, circuits shall not be grounded to gas piping.

(5) Piping to Meter Location.

- (a) Piping Extended to Meter Location. Gas building piping shall be extended to the meter location specified by the gas company. The meter location and gas piping connections shall be such that the meter connections are easily accessible in order that the meter may be read or changed.
- (b) Piping Marked. Piping from multiple meter installations, (four (4) or more meters) shall be plainly marked near outlet connection with a permanent tag by the installer so that the piping systems supplied through them can be readily identified.
- (c) Meters Supplied by Single Service Pipe. Unless otherwise approved in writing by gas company, all meters supplied by a single service pipe shall be at the same location.
- (d) Piping Systems not Interconnected. Unless otherwise approved, where two (2) or more meters are installed on the same premises but supply separate consumers, the piping systems shall not be interconnected on the outlet side of the meters.
- (e) Pipe Capacity Table 1.

CAPACITY--CUBIC FEET PER HOUR WITH A 67 S.P. 970 BTU SP. GR. GAS AND PRESSURE DROP OF 0.3 INCH WATER COLUMN							
Length of Pipe in Ft	Nominal Diameter of Pipe in Inches						
	3/4	1	1-1/4	1-1/2	2	3	4
15	158	319	694	1130	2300	6000	12900
30	111	223	495	790	1640	4350	9000
45	92	184	403	650	1360	3600	7300
60	80	160	352	565	1200	3200	6300
75	71	144	317	500	1040	2775	5550
90	65	131	287	455	925	2500	5100
105	60	123	264	415	850	2250	4700
120		111	250	390	795	2125	4450
150		101	224	350	720	1925	4050
180		93	208	325	670	1800	3700
210			190	295	610	1650	3400
240			176	280	570	1550	3200
270			165	265	535	1450	3000
300			158	250	500	1375	2750
450			130	210	415	1150	2300
600			110	180	360	950	1975

- (6) Size of Piping to Gas Appliances.
- (a) Piping shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand without undue loss of pressure between the meter and the appliance or appliances. The minimum gas pipe shall be not less than three-fourths (3/4) inch. This does not apply to water heaters, space heaters, and unit heaters with inputs of less than fifty thousand (50,000) input.
- The size of the gas pipe to be used depends upon the following factors:
1. Allowable loss in pressure to be provided for.
 2. Maximum gas consumption to be provided for.
 3. Length of pipe and number of fittings.
 4. Specific gravity of the gas.
 5. Diversity factor.
- (b) Pressure Loss. The pressure loss in any gas piping system from the gas meter to any appliance for the maximum demand shall not exceed 0.3 inch water column. The minimum size of piping required to comply with 0.3 inch pressure loss limitation shall be determined by procedure given in Subsection (c) below or by standard engineering methods including use of gas flow computers.
- (c) Size of Piping. To determine the size of any section of gas pipe in a system, proceed as follows:
1. Measure the length of pipe from the gas meter to the most remote outlet in the building on that piping system. Where separate or individual fuel lines are extended from meter to one or more appliances, such as individual gas line to heating plant, each separate fuel line from meter shall be considered as separate piping system.
 2. In Table No. 1, select the horizontal line showing that distance, or the next longer distance if the table does not give the exact length.
 3. Use this horizontal line so selected to locate all gas demand figures for this particular system of gas piping.
 4. Starting at the most remote outlet, find in the horizontal line just selected, the gas demand for that outlet. If the exact figure of demand is not shown, choose the next larger figure in the same horizontal line.
 5. Above this demand figure in the first line at the top of Table No. 1 will be found the correct size of pipe required to serve such an outlet.
 6. Proceed in a similar manner for each outlet and each section of pipe. For each section of pipe, determine the total gas demand supplied by that section and use the length indicated by Section 30.18(5)(e) above, which length is at all times taken as total distance from meter to most remote outlet.
 7. The hourly volume of gas required at each outlet shall be taken as not less than the maximum hourly rating specified by the manufacturer of the appliance or appliances to be connected to each such outlet. Where the manufacturer's rating of an appliance is given in British Thermal Units (BTU) per hour, this rating shall be divided by nine hundred seventy (970) to obtain the corresponding gas demand in cubic feet per hour for natural gas. Where BTU rating of gas appliances to be installed has not been definitely specified, estimate of approximate requirements may be based on current typical appliances.
- (d) Extensions to Existing Piping. Extensions to existing piping shall conform to Section 30.18(6)(a). Existing piping, if extended, shall be converted to the proper size of pipe where necessary. In no case shall extensions be made to existing pipe which is smaller than permitted by Section 30.18(6)(a).

- (7) Materials for Pipe and Fittings. All piping systems shall be installed according to NFPA 54 - National Fuel Gas Code (1987). (R. & Re-Cr. by Ord. 10,255, Adopted 5-7-91)
- (8) Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- (9) Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- (10) Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- (11) Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- (12) Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)
- (13) Reserved for Future Use. (R. by Ord. 10,255, Adopted 5-7-91)

30.19 MINIMUM REQUIREMENT FOR GAS-FIRED EQUIPMENT AND INSTALLATION OF GAS-FIRED EQUIPMENT.

- (1) All gas design space heating equipment to be installed in the City of Madison shall conform with regulations governing the minimum standards of construction and performance of gas space heating equipment as shall be determined by the American Gas Association, or any other nationally recognized testing agency adequately equipped and competent to perform such services, and shall be evidenced by attachment of its seal or label to such gas space heating equipment. This agency shall be one which maintains a program of National Inspection of Production Models of all types of gas space heating equipment.
- (2) On all gas-fired space heating units which are not approved as a complete design unit, the gas-firing equipment shall be considered as a conversion unit and shall conform to the requirements for the installation of gas conversion burners.

30.20 INSTALLATION REQUIREMENTS FOR GAS CONVERSION BURNERS.

- (1) Preparation of Existing Heating Appliance. Thoroughly clean the ash pit, flue passage and combustion chamber of the furnace or boiler, removing all adhering tars, scale or dirt.
- (2) Reconditioning the Existing Heating Appliance.
 - (a) If cracks or fractures, especially above the grate level are found in any of the castings after they have been cleaned, the casting shall be replaced. Cracks or fractures in other materials shall be repaired or the parts replaced and the appliance made gas tight as shown by smoke bomb test or equivalent.
 - (b) All joints between sections shall be properly cemented and the ash pit tightly grouted to the floor. Openings for grate shaker bars, cracks around door frames, and cracks such as under clinker doors, shall be tightly sealed with furnace cement.
 - (c) Firing door catches shall be filed or otherwise altered so that the firing door will open easily to relieve pressure. Positive latches shall be removed from the appliance and replaced by either light sheet metal catches, a spring placed on the hinge pin to keep the door closed or an equivalent arrangement which will permit the door to open and relieve any excessive pressure which may occur in the furnace. Latches on firing doors shall hold such firing doors close to the frame without exposing or forming any cracks.
 - (d) Where revertible or diving flue type furnaces or boilers are converted to gas firing, it is required that small opening or passage, not less than one (1) inch pipe, be provided between the top of the highest point in the flue passage of the appliance and its vertical flue pipe. If there is a bypass, open the bypass slightly and lock it in position.

- (e) Where the burner is installed at approximately grate level and the furnace is lined with a refractory material, this material shall be removed down to the level of the burner except where the refractory material forms the only wall between the combustion chamber and the furnace front shield.
 - (f) When inshot type conversion burners are installed in dry base boilers or gravity warm air furnaces, the ash pit shall be lined for protection in accordance with the manufacturer's installation instructions, or as follows:
 - 1. With at least two (2) inches of insulating fire brick which covers the ash pit bottom.
 - 2. With at least two (2) inches of insulating fire brick along the sidewalls of the ash pit up to the level of the water back surface of a boiler or sufficiently high to protect the grate lugs of a furnace.
 - (g) Where inshot type conversion burners are installed, the floor area of a combustion chamber shall be in accordance with the burner manufacturer's instructions or recommendations; however, in the absence of such instructions, it shall be at least one and one-half (1-1/2) square inches per one thousand (1,000) BTU per hour input of the burner.
 - (h) The water column and gauge glass on a steam boiler shall be clean, with the water level plainly visible. The connections from gauge glass to boiler shall be free and unobstructed.
 - (i) The chimney shall be examined and thoroughly cleaned, if necessary, before installation is made.
 - (j) Every conversion burner, upon completion of its installation, shall not be left in operation unless the burner has been properly adjusted so that the products of combustion shall contain not more than (.04%) of carbon monoxide. Samples of the gas shall be taken from breeching at a point as near to the furnace or boiler as possible. In no case shall the samples be taken from a point between the draft hood or barometric draft control and the chimney, or through the relief openings of the draft hood or barometric draft control.
- (3) Installation of Burner and Controls.
- (a) The installation of gas conversion burners having inputs not exceeding four hundred thousand (400,000) BTU per hour shall be installed in accordance with the following provisions:

Every conversion gas burner installed in the City of Madison shall bear the symbol of a recognized testing agency certifying compliance with the American Standard Listing Requirements for Domestic Gas Conversion Burners. It shall consist of a factory assembled and factory inspected unit supplied with an automatic pilot, automatic gas control valve, including, when necessary, proper transformer to operate the gas valve, gas pressure regulator, (except on burners certified for use on liquefied petroleum gases), manual mainline shutoff calve, pilot shutoff valve, tubing or piping for pilot gas supply tubing for bleedline from diaphragm valves when employed.

Installation of burner shall be so planned that it and all its controls will be readily accessible for inspection, cleaning, adjustment and repairs.

- (b) Installing the Burner.
1. The burner shall be solidly supported on fireproof material, both front and rear, and shall be level in both directions. No portion of the combustion air door opening of the burner shall be closed off by the seal covering the ash pit opening. Care shall be exercised when installing the burner to avoid undue strain on, or distortion of, duct or other components which would impair the fit, alignment or mechanical functioning of parts, such as pilots, positions of orifices with respect to venturi, combustion air door, etc.
 2. For drilled port of multi-jet upshot type conversion burners installed in boilers, the burner ports shall be at least one (1) inch above grate level. For single port upshot burners, the above dimension shall apply to the bottom of the flame spreader.
 3. For drilled port of multi-jet upshot type conversion burners installed in warm air furnaces, the burner ports shall be set above the grate level but not more than one-third (1/3) the distance between the grate and the bottom level of the firing door. For single port upshot burners, the above dimension shall apply to the bottom of the flame spreader. If the level of the burner port is below the highest point of the return air connection to the furnace casing, provisions shall be made to assure against counter circulation.
 4. Burners shall be so placed with respect to the firebox dimensions as to uniformly distribute the heat over as much of the available heating surface as possible. Where the burner is appreciably shorter than the firebox, it shall be placed at the end of the firebox which will insure the longest flue travel. In some instances, it may be necessary to install air directing baffles to insure proper distribution of combustion air within the flame zone and to thereby prevent floating flame conditions on one side of the burner.
 5. Firing door (fuel door) type burners shall be installed in accordance with the burner manufacturer's instructions. The burner ports shall be located with respect to the side walls of the combustion chamber so as to provide the longest travel for the products of combustion and to avoid direct flame impingement.
 6. After the supply line has been connected to the burner, close the space between the ash pit opening and the air duct (and/or air door shield) in a permanent manner which will preclude entrance of combustion air except through the air duct. The use of sheet metal or hard asbestos board, neatly fitted, will facilitate servicing at a later date.
 7. All gas burners installed in the revertible flue type of equipment, exceeding a twelve (12) inch down draft, shall be provided with a complete shutoff type automatic pilot unless equipped with adequate bleeder connections.
- (c) Union for Connecting Burner to House Piping. A union shall be installed in the gas line downstream from the manual main shutoff valve.
- (d) Controls. (Refer to Section 30.25)

(4) Installation Requirements for Conversion Burners Having Inputs Exceeding 400,000 BTU Per Hour.(a) Approval of Gas Burner.

1. It shall be unlawful for any person, firm, corporation or their agents, to install any gas burner which has not been approved by the National Board of Fire Underwriters' Laboratory, or any other nationally recognized inspection board or laboratory. Any burner which does not meet the above requirements shall not be installed until a certificate of approval has been issued.
2. Application for approval shall give the following information:
 - a. Name of burner.
 - b. Name and address of manufacturer.
 - c. Past history of company and burner.
 - d. Furnish detailed drawings and specification sheets.
3. Every gas burner fired in excess of four hundred thousand (400,000) BTU per hour input shall be equipped with electronic combustion safeguard.

(b) Main Burner.

1. A burner shall be installed so that fuel and air will be completely mixed to assure efficient combustion within the combustion chamber, without injurious flame impingement on heating surfaces or refractories, vibration or pulsation, formation of soot, and without flame leaving any part of the burner throughout the entire range of operation. Burners shall be installed firmly in place to maintain correct alignment and shall be readily accessible for cleaning and inspection. All burner intake air louvers for manual operation shall be equipped with a mechanical locking device to prevent accidental closure, or if louvers are to be operated automatically, they shall be weighted to open in the event of linkage failure.
2. Load requirements of every job shall be satisfied by equipment within proper range of manufacturers' ratings.
3. The burner or burners and their component parts shall be installed according to the manufacturer's instructions and shall be properly and firmly secured in place to maintain correct alignment in normal use.
4. The burner or burners shall be so installed and adjusted that there will be no injurious flame impingement on walls or heating surfaces in a manner that will cause incomplete combustion or damage to boiler or furnace parts.
5. Means shall be provided to permit ready observation of the pilot, safety device and main burner while firing.

- (c) Manual Shutoff Valves.
1. Pilots shall be independently controlled by means of a manually operated pilot shutoff valve. In multiple installations, a manually operated pilot firing valve shall be provided for each pilot.
 2. On burners with inputs exceeding five million (5,000,000) BTU per hour, each burner unit, except those utilizing a zero governor inspirator mixer, shall be equipped with a manual firing valve downstream of all other valves and as close as practicable to the burner so that the flame can be observed during manipulation of this valve.
 3. On multiple burner installations, a manual shutoff valve shall be installed ahead of all other valves and controls for each burner.
 4. A manually operated shutoff valve of an approved type shall be installed in the main line to each burner. It shall be readily accessible and shall clearly indicate the "ON" and "OFF" positions with stops at the open and closed positions.
 5. On installations requiring inputs exceeding one million (1,000,000) BTU per hour, the main shutoff valve shall be of a pressure rating no less than the gas pressure in the street main.
- (d) Control Valves, Pressure Rating.
1. All safety and input control valves (automatic recycling or manual reset) shall be capable of withstanding the gas main pressure and shall be installed upstream of all other control valves.
 2. The gas supply pressure to the pilot or group of pilots shall be controlled independently of the burner supply.
- (e) Combustion Control. Uptake dampers shall be counterbalanced to open in the event of breakage or failure of their operating means. Counter-balancing arms, weights, etc. shall be so located or shielded as to prevent personal injury to the operator or damage to equipment in case of breakage.
1. For automatically lighted burners, automatically operated dampers, where used, shall be interlocked to prevent lighting of the main burner unless sufficient draft is available.
 2. All combustion control systems shall be so installed as to assure stable, safe and approved proper standards of combustion and efficiency with a minimum of seventy percent (70%) for the required range of operation.
 3. When air louvers, dampers or other air controls are automatically operated, such operation shall be in conjunction with gas input control valves, either by mechanical linkage or changes in furnace pressure and/or change in fuel flow to maintain proper fuel/air ratio over the entire required range of operation. The operating medium may be electrical, pneumatic or hydraulic. Arrangements shall be provided for shutting off the fuel supply in the event of failure of the control medium.
 4. An approved draft regulator having a minimum free area of three-fourths (3/4) of the area of the boiler or furnace breeching outlet may be used in lieu of a draft hood. Where barometric dampers are used they shall furnish positive and effective protection against back drafts. Barometric dampers shall be installed in accordance with the manufacturer's instructions.
- (f) Limiting Devices.
1. Automatically operated gas burners in connection with vapor, hot water, steam or warm air heating systems shall be equipped with approved devices to shut down the burner in the event of undue pressure in a steam boiler or overheating within a hot water boiler or warm air furnace. Each steam boiler shall be equipped with a low water cutoff.

2. On all installations, where operation of the burner is controlled by an aquastat or furnace stat, another aquastat or furnace stat shall be installed in the one hundred ten (110) volt line ahead of all other controls, as a high limit or safety control. The high limit on hot water heating systems shall be of the immersion type installed in the boiler. On all installations, where the operation of the burner is controlled by a pressure stat, this control shall be installed in the one hundred ten (110) volt line ahead of all other controls.
 3. Limiting devices shall not depend upon the closing of an electrical circuit to shut off the fuel supply.
 4. All limiting devices shall shut off fuel to all main burners.
 5. Shutoff valves shall not be installed in the piping between the boiler and pressure and/or water temperature limiting devices.
- (g) Flues and Flue Connections. The chimney or stack shall be preinspected and tested, if necessary, to determine whether or not it is in suitable condition. If not in suitable condition, as determined by the Building Inspection Division of the Department of Planning and Community and Economic Development, any defects shall be corrected subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
- (h) Combustion Chamber. Refractory combustion chambers to be used for inshot or horizontal type burners shall be constructed and sized to burner manufacturer's recommendations.
- (i) Installation Requirements for Dual Fuel Burning.
1. In addition to the requirements set forth in Sections 30.18, 30.19, and 30.20, inclusive, of this code, together with their subsections, gas burners installed in conjunction with other combustion equipment shall conform to the following requirements.
 2. Gas burners shall be of the inshot type and shall be installed to fire directly into the combustion chamber. Angle or corner installations will not be permitted without special permission of the Building Inspection Division of the Department of Planning and Community and Economic Development. (Am. by Ord. 8081, 7-29-83)
 3. The installer shall be responsible for the proper functioning of both the gas equipment and the existing combustion equipment.
 4. Proper protection of the gas and other combustion equipment shall be provided from the effects of each other. Such protection to be approved by the Building Inspection Division of the Department of Planning and Community and Economic Development. (Am. by Ord. 8081, 7-29-83)
 5. Controls may be common to both fuels or may be independent. Transfer from one fuel to the other shall be by a manual interlock system to prevent the gas and other fuel being used simultaneously.
 6. Where it is necessary that both fuels are to be used simultaneously, special approval must be obtained from the Building Inspection Division of the Department of Planning and Community and Economic Development. (Am. by Ord. 8081, 7-29-83)
 7. The installer shall file with the Building Inspection Division of the Department of Planning and Community and Economic Development, drawings showing electric wiring, gas piping of the gas burner and controls, method of mounting burner and operating instructions. (Am. by Ord. 8081, 7-29-83)
(Am. by ORD-08-00109, 10-7-08)

30.21 VENTING REQUIREMENTS.

- (1) General. The venting of all boilers, furnaces or appliances shall conform to the requirements as hereinafter set forth inclusive of this section, together with their subdivisions. Conditions not specifically mentioned in this section shall be governed by the current A.S.H.R.A.E. Guides or Section V of the standards of the National Fire Protection Association for the installation of gas appliances and gas piping. N.F.P.A. 54 as listed in Appendix No. 1.
- (2) Types of Chimneys or Vents Defined. For the purpose of this section, the following definitions shall govern as to the meaning of the several terms or expressions herein defined, whenever said terms and expressions are employed in this code.
 - (a) Chimneys.
 1. Factory Built Chimneys. Chimneys that are factory made, listed by a nationally recognized testing agency, for venting gas appliances, gas incinerators, and solid or liquid fuel burning appliances.
 2. Masonry Chimneys. Field constructed chimneys built in accordance with the City of Madison Building Code (Chapter 29).
 3. Metal Chimneys. Chimneys made of metal of adequate thickness properly galvanized or properly welded or riveted and built in accordance with nationally recognized codes or standards.
 - (b) Gas Vents.
 1. Type B Gas Vents. Factory made gas vents listed by a nationally recognized testing agency for venting listed or approved appliances equipped to burn only gas.
 2. Type B/W Gas Vents. Factory made gas vents listed by a nationally recognized testing agency for venting listed or approved gas-fired recessed heaters.
 3. Type C Gas Vents. Vents constructed of sheet copper not less than twenty-four (24) ounces per square foot or galvanized iron of not less than No. 20 U. S. Standard gauge or other approved noncombustible corrosion-resistant material.
 - (c) Chimney Liner. A vent pipe or flue liner inserted within a chimney for the purpose of flue products and preventing such condensation from contact with the interior of the chimney in which it is inserted.
 - (d) Chimney Flue. The flue gas conveying passageway in a chimney.
 - (e) Vent. A conduit or passageway, vertical or nearly so, for conveying vent gases to the outer air.
 - (f) Chimney Connector. (Use in place of smoke pipe or flue pipe.) The pipe which connects a solid or liquid fuel burning appliance to a chimney.
 - (g) Vent Connector. The pipe which connects a gas appliance to a gas vent or chimney.
 - (h) Draft Hood. A device built into an appliance, or made a part of the vent connector from an appliance which is designed to (1) assure the ready escape of the flue gases in the event of no draft, back draft, or stoppage beyond the draft hood; (2) prevent a back draft from entering the appliance; and (3) neutralize the effect of stack action of the chimney or gas vent upon the operation of the appliance.

- (3) Draft Hoods; Use of. (See Section 30.25)
- (4) Barometric Dampers. Barometric dampers shall be constructed and installed in accordance with the manufacturer's instructions.
- (5) Types of Chimneys or Vents, Use of. It shall be the duty of the owner of any building in which it is hereafter proposed to install any furnace, boiler or appliance to provide a properly constructed chimney or vent.
 - (a) Gas vents or chimney systems shall be engineered and constructed so as to develop a positive flow adequate to remove all flue gases to the outside atmosphere.
 - (b) Chimneys. Chimneys shall be used for venting the following types of appliances.
 1. Incinerators, except that metal pipe not less than No. 20 U.S. Standard gauge galvanized iron or other equivalent noncombustible, corrosion-resistant material may be used for venting incinerators installed in locations such as open sheds, breezeways or carports, provided the metal pipe is exposed and readily examinable for its full length and suitable clearance (eighteen inches from combustible) are maintained.
 2. Appliances which may be converted readily to the use of solid or liquid fuels.
 3. Combination gas-oil burning appliances.
 4. Appliances listed for use with chimneys only.
 - (c) Type B Gas Vents.
 1. Type B gas vents may be used to vent listed gas appliances except as provided in 30.21(5)(b) and (d) and 30.21(7)(a).
 2. For the purpose of this section, listed gas appliances shall refer to appliances which are shown in a list published by an approved, nationally recognized testing agency, qualified and equipped for experimental testing and maintaining an adequate periodic inspection of current production of listed models and whose listing states either that the appliance complies with nationally recognized safety requirements or has been tested and found safe for use in a specific manner. Listed gas appliances are considered to be equipped with draft hoods and to produce flue gas temperatures not in excess of five hundred fifty (550) degrees Fahrenheit at the outlet of the draft hood when operating at the manufacturer's normal input rating.
 3. Listed Type B vents shall be installed in accordance with their listings and the manufacturer's instructions.

4. Type B vents installed outside a building, or which pass through unheated portions of a building except that portion above the roof line, shall be equipped with a capped tee with provision for a condensate drain, so arranged that excessive condensation may be disposed of without damage to the foundation, floor, walls or footings.
 5. Any shape listed gas vent may be used provided its venting capacity is equal to the capacity of round pipe for which it is substituted and the minimum internal dimension of the gas vent is not less than two (2) inches.
 6. The gas vent or chimney should extend high enough above the building or other neighboring obstruction so that wind from any direction will not create a positive pressure in the vicinity of the gas vent or chimney termination. Gas vents shall extend at least two (2) feet above the highest point where they pass through a roof or a building and at least two (2) feet higher than any portion of a building with ten (10) feet except that gas vents need not comply with this provision when equipped with an approved device and proper and effective venting is accomplished. Gas vents or chimneys shall not terminate less than four (4) feet in vertical height above the highest connected appliance draft hood outlet or flue collar.
 7. Gas vents and factory built chimneys shall extend above the roof surface and through the flashing and shall terminate in a top or listed room assembly with a venting capacity not less than that of the gas vent or chimney. The top shall be of a design to prevent rain and debris from entering the gas vent or chimney.
 8. All portions of gas vents and chimneys shall be adequately supported for the weight and design of the materials employed. Listed gas vents and factory built chimneys shall be supported and spaced in accordance with their listings and the manufacturer's instructions.
 9. Size of Gas Vent or Chimney. The gas vent or chimney, when connected to a single appliance, shall be not less than the size of the draft hood outlet, or as provided in Section 30.21. When more than one (1) appliance is connected to a gas vent or chimney, the area of the passageway shall be not less than the area of the largest vent connector, plus fifty percent (50%) of the areas of additional vent connectors or as provided in Subsection (8) hereof.
- (d) Marking of Type B Vents. Gas vent systems shall be plainly and permanently identified by a label reading:
- “This gas vent is for appliances which burn gas only. Do not connect to incinerators or solid or liquid fuel burning appliances.”
- This label shall be attached to the wall or ceiling at a point near where the gas vent system enters the wall, ceiling or chimney.
- (e) Type BW Gas Vents.
1. Type BW gas vents shall be used with listed vented recessed heaters when installed with combustible two by four (2 x 4) wall construction.
 2. Listed Type BW gas vents shall be installed in accordance with their listings and the manufacturer's instructions.
 3. Type BW gas vents serving a vented recessed heater shall not terminate less than twelve (12) feet in vertical height above the bottom of the heater.

4. Type C Gas Vents.

- a. Type C gas vents shall be used only for runs directly from the space in which the appliance is located through the roof to the outer air. Such gas vents shall not originate in any unoccupied attic or concealed space, and shall not pass through any attic, inside wall, concealed space, or through any floor.
- b. When a Type C gas vent passes through a roof constructed of combustible material, it shall be guarded at the point of passage by a method described in 30.21(6)(n) or by a noncombustible nonventilating thimble not less than four (4) inches larger in diameter than the vent pipe and extending not less than eighteen (18) inches above and six (6) inches below the roof with annular space open at the bottom and closed only at the top.

(6) Vent Connectors.

- (a) Materials. Vent connectors used for gas appliances having draft hoods and for listed conversion burners having draft hoods, shall be constructed of materials having resistance to corrosion and heat not less than that of No. 24 U.S. Standard gauge galvanized steel except that Type B vent material may be used as the connector between the draft hood and the chimney.
- (b) Clearance. Vent connectors shall be located in such a manner that continued operation of the appliance will not raise the temperature of surrounding combustible construction more than ninety (90) degrees Fahrenheit above normal room temperature when measured with mercury thermometers or conventional bead type thermocouples. Minimum clearances of vent connectors to combustible material shall be in accordance with Table No. 1 of this section.
- (c) Avoid Unnecessary Bends. The vent connector shall be installed so as to avoid excessive turns or other construction features which create unnecessary resistance to flow of vent gases.
- (d) Joints. Vent connectors shall be firmly attached to draft hood outlets by sheet metal screws or other approved means. Vent connectors using listed Type B gas vent material shall be securely assembled, using the method shown in the listing and the manufacturer's instructions. Joints of other than listed Type B gas vent material shall be securely fastened by sheet metal screws or other approved materials.
- (e) Pitch. Vent connectors attached directly to side outlet draft hoods, such as on floor furnaces, shall be pitched upward from the appliance at least one-fourth (1/4) inch per foot. Vent connectors attached to top outlet draft hoods by means of a ninety (90) degree elbow may be horizontal or pitched upward from the appliance. No portion of any vent connector shall be run downward from the appliance nor shall there be any dips or sags.
- (f) Length. The horizontal run of the vent connector shall be as short as possible and the appliance shall be located as near to the gas vent or chimney as practicable. The maximum length of an uninsulated horizontal run of vent connector shall not exceed seventy-five percent (75%) of the height of the gas vent or chimney.

TABLE NO. 1
VENT CONNECTOR CLEARANCES FOR GAS APPLIANCES

Appliance	Minimum Distance from Combustible Material	
	Listed Type B Gas Vent Material	Vent Connectors of Other than Type B Material
Listed Boiler	1" or as listed*	6"
Listed Warm Air Furnace	1" or as listed*	6"
Listed Water Heater	1" or as listed*	6"
Listed Room Heater	1" or as listed*	6"
Listed Floor Furnace	1" or as listed*	6"
Listed Incinerator	Not Permitted	18"
Listed Conversion Burner (with draft hood)	6"	9"
Unlisted Appliances (having draft hoods)	6"	9"
Unlisted Appliances (without draft hoods)	Not Permitted	18"

*Where listing by national agency calls for greater distance, that distance shall apply.

The clearances from vent connectors to combustible materials may be reduced when combustible material is protected as specified in Table No. 2.

TABLE NO. 2

REDUCTION OF CLEARANCES WITH SPECIFIED FORMS OF PROTECTION

Type of protection applied to & covering all surfaces of combustible material w/in distance specified as required clearance w/no protection (See Figs. 7,8,9)	Where required clearance w/no protection from appliance, vent connector, or single wall metal pipe is:									
	36"		18"		12"		9"		6"	
	Allowable Clearances w/Specified Protection, inches									
	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear	Above	Sides and Rear
a) 3½" thick masonry wall w/out ventilated air space	--	24	--	12	--	9	--	5	--	5
b) ½" insulation board over 1" glass fiber or mineral wool batts	24	18	12	9	9	6	6	5	4	3
c) 0.024 (24 gauge) sheet metal over 1" glass fiber or mineral wool batts reinforced w/wire on rear face w/ventilated air space	18	12	9	6	6	4	5	3	3	3
d) 3½" thick masonry wall w/ventilated air space	--	12	--	6	--	6	--	6	--	6
e) 0.024 (24 gauge) sheet metal w/ventilated air space	18	12	9	6	6	4	5	3	3	2
f) ½" thick insulation board w/ventilated air space	18	12	9	6	6	4	5	3	3	3
g) 0.024 (24 gauge) sheet metal w/ventilated air space over 0.024 (24 gauge) sheet metal w/ventilated air space	18	12	9	6	6	4	5	3	3	3
h) 1" glass fiber or mineral wool batts sandwiched between two sheets 0.024 (24 gauge) sheet metal w/ventilated air space	18	12	9	6	6	4	5	3	3	3

NOTES APPLICABLE TO TABLE NO. 2

1. Reduction of clearances from combustible materials shall not interfere with combustion air, draft hood clearance and relief, and accessibility of servicing.
2. All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the appliance, disregarding any intervening protection applied to the combustible material.
3. Spacers and ties shall be of noncombustible material. No spacer or tie shall be used directly opposite appliance or connector.
4. With all clearance reduction systems using a ventilated air space, adequate provision for air circulation shall be provided as described. (See Figures 7 and 8.)
5. There shall be at least 1 inch between clearance reduction system and combustible walls and ceilings for reduction systems using ventilated air space.
6. If a wall protector is mounted on a single flat wall away from corners, adequate air circulation may be provided by leaving only the bottom and top edges or only the side and top edges open with at least 1 inch air gap.
7. Mineral wool batts (blanket or board) shall have a minimum density of 8 lb/ft³ and a minimum melting point of 1500°F.
8. Insulation material used as part of clearance reduction system shall have a thermal conductivity of 1.0 (Btu-in)/(sq ft-hr-F) or less.
9. There shall be at least 1 inch between the appliance and the protector. In no case shall the clearance between the appliance and the combustible surface be reduced below that allowed in the table.
10. All clearances and thicknesses are minimum; larger clearances and thicknesses are acceptable.

(Sec. 30.21(6)(f)Table 2 R. & Re-Cr. by Ord. 10,255, Adopted 5-7-91)

- (g) Support. Vent connectors shall be securely supported for the weight and design of the materials employed to maintain proper clearances to prevent physical damage and to prevent separation of the joints. Support shall be accomplished by means of metal hangers spaced not more than six (6) feet on centers. Wire hangers will not be permitted.
- (h) Provide Vertical Run. Vent connectors shall have the greatest possible rise consistent with head room available between the draft hood outlet and the start of the horizontal run.
- (i) Location. When the vent connector used for an appliance having a draft hood must be located in, or pass through a crawl space or other area difficult of access which may be cold, that portion of the vent connector shall be of listed Type B gas vent material or material having equivalent insulation qualities. Type C gas vent material used as a vent connector shall not pass through any floor or ceiling.

- (j) Chimney Connection. When an existing chimney wall is to be pierced for a chimney connection, approval shall be obtained from the Building Inspection Division of the Department of Planning and Community and Economic Development before the opening is cut. An inspection shall be made and approved before the connection is made to the opening. In entering a passageway in a masonry or metal chimney, the vent connector shall be installed above the extreme bottom to avoid stoppage. Means shall be employed which will prevent the vent connector from entering so far as to restrict the space between its end and the opposite wall of the chimney. A thimble or slip joint may be used to facilitate removal of the vent connector. The vent connector shall be firmly attached or inserted into the thimble or slip joint to prevent it from falling out. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
- (k) Fireplace. A vent connector shall not be connected to a chimney serving a fireplace unless the fireplace opening is permanently sealed.
- (l) Size, Height and Length of Interconnected Vent Connectors. Two (2) or more vent connectors may be joined through a gas vent manifold or to a gas vent provided that:
 1. Vent connectors carrying the gases of a single appliance shall have the greatest possible rise consistent with the head room available between the draft hood outlet and the points of its interconnection to manifold or to common vent.
 2. Size of vent connector shall be equal to or greater than the size shown in Table No. 3 of this section for the allowable heat input.
 3. When Table No. 3 indicates that a vent connector must have a larger size than the draft hood, the size increase shall be made at the draft hood outlet.

TABLE NO. 3

ALLOWABLE INPUT TO VENT CONNECTORS BEFORE INTERCONNECTION

Connector Size in Inches	Maximum Appliance Input -- In BTU Per Hour
3	30,000
4	55,000
5	80,000
6	125,000
7	180,000
8	245,000
9 and above	5,000 BTU per square inch of cross-sectional area.

- (m) Dampers. Manually operated dampers shall not be placed in the vent connector from any gas appliance except an incinerator. Fixed baffles ahead of draft hoods are not classified as dampers.
 - (n) Use of Thimbles.
 - 1. When passing through combustible walls or partitions, vent connectors built of listed Type B gas vent material shall be installed so that the clearances required by the listing are maintained.
 - 2. Vent connectors made of other than Type B vent material shall not pass through any combustible walls unless they are guarded at the point of passage by ventilated thimbles not smaller than the following:
 - For listed appliances, except incinerators - four (4) inches larger in diameter than the vent connector, unless there is a run of not less than six (6) feet of vent connector in the open, between the draft hood outlet and the thimble in which case the thimble may be two (2) inches larger in diameter than the vent connector.
 - For unlisted appliances having draft hoods - six (6) inches larger in diameter than the vent connector.
 - For incinerators and unlisted appliances - twelve (12) inches larger in diameter than the vent connector.
 - 3. In lieu of thimble protection, all combustible material in the wall shall be cut away from the vent connector a sufficient distance to provide the clearance required from such vent connector to combustible material. Any material used to close up such opening shall be noncombustible.
 - (o) Size. Vent connectors shall not be smaller than the size of the flue collar or the draft hood outlet. When the appliance has more than one (1) draft hood outlet and in the absence of the appliance manufacturer's specific instructions, the vent connector shall equal the combined area of the draft hood outlets for which it acts as a common connector to the gas vent chimney.
 - (7) Special Venting Arrangements.
 - (a) Appliances With Sealed Combustion Chamber. The provisions of draft hoods in Section 30.21 (1) through (6), do not apply to listed appliances having sealed combustion chambers and which are so constructed and installed that all air for combustion is derived from outside the space being heated and all flue gases are discharged to the outside atmosphere. Such appliances, having integral venting, shall be considered as being properly vented when they are installed in accordance with their listing and the manufacturer's instructions.
 - (b) Gas Vent and Chimney Exhausters. Forced venting and exhaust systems and power burners usually require special engineering and shall, in all cases, be subject to the approval of the Director of the Building Inspection Division. However, when used, the following regulations shall apply:
 - 1. When an exhauster is used with gas appliances requiring venting, provisions shall be made to prevent the flow of gas to the main burner in the event of failure of the exhaust system.
 - 2. A vent connector serving a gas appliance vented by natural draft shall not be connected into the discharge side of a power exhauster.
 - 3. Induced Draft. Where an induced draft or forced draft fan is used with gas, oil or solid fuel, it shall be equipped with a control that will not allow burner to start until proper draft has been established.
- (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)

- (8) Engineered Vent Systems. The size of chimneys, gas vents or vent connectors specified in this section shall not necessarily govern where standard engineering methods have been used to design the vent system.
- (9) Flues or Vents. This section applies only to natural draft venting. Forced venting or exhaust systems and power burners usually require special engineering and shall, in all cases, be subject to the approval of the Director of the Building Inspection Division. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
 - (a) Check Flue or Vent. Before connecting a flue or vent connector, the flue or vent shall be examined to ascertain that it is properly constructed, clear, and will freely conduct the products of combustion to the outer air.
 - (b) Size. For conversion burners not exceeding four hundred thousand (400,000) hourly BTU input, the internal cross-sectional area of the vent connector and the vent flue shall be such as to provide not less than one (1) square inch of flue area per six thousand five hundred (6,500) BTU combined input of all gas appliances connected to such flue pipe as set forth in Table No. 3. In no case shall this flue pipe be less than five (5) inches in diameter.

For conversion burners exceeding four hundred thousand (400,000) hourly BTU input, where the chimney or vertical flue is of such height as to provide a high draft intensity, the area of the chimney or vertical flue may be based on an input of greater than six thousand five hundred (6,500) BTU per square inch of cross-sectional area, subject to the approval of the Building Inspection Division of the Department of Planning and Community and Economic Development. (Am. by ORD-08-00109, 10-7-08)

TABLE NO. 4

**MINIMUM PERMISSIBLE FLUE SIZES
FOR GAS CONVERSION BURNER INSTALLATIONS**

Input Rating BTU Per Hour	Area of Flue Outlet - Sq. In.	Diameter of Flue Pipe - Inches
120,000	19.6	5
160,000	28.3	6
250,000	38.5	7
320,000	50.3	8
410,000	63.6	9

(Sec. 30.21(9) (Am. by Ord. 8081, 7-29-83)

- (10) Insufficient Draft or Down-Draft to be Provided Against. In the event conditions at the time of installation are such that the chimney or vertical flue has insufficient natural draft to properly carry away the products of combustion, provision shall be made to rectify existing conditions or provide mechanical means of maintaining constant up-drafting during appliance operation. The draft must be proved before the burner may be operated.

- (11) Smoke Pipes.
- (a) Required Weight of Metal Smoke Pipes Used With Solid and Liquid Fuels. For each and every steam or hot water boiler, warm air furnace or incinerators hereafter installed under the provisions of this code, the area of the breeching or smoke pipe shall not be less than the area of the smoke collar of the boiler or furnace to which it is connected, and each such breeching or smoke pipe shall be made of material equal in durability to galvanized iron of thicknesses (U.S. Standard Gauge), for the various breeching or smoke pipes, not less than the following:
- For areas from 13 to 113 square inches - No. 24 Gauge.
 - For areas from 114 to 177 square inches - No. 18 Gauge.
 - For areas from 178 to 314 square inches - No. 16 Gauge.
 - For areas from 315 to 616 square inches - No. 14 Gauge.
 - For areas from 617 to 1,017 square inches - No. 12 Gauge.
 - For areas from 1,018 to 2,827 square inches - No. 10 Gauge.
- (b) Smoke Pipes, How Installed. Each such breeching or vent connector or smoke pipe shall be lock seamed or riveted, with all joints lapped not less than one and one-half (1 1/2) inches or be rigidly secured, and shall have proper construction for making tight connection to chimney flue the full thickness of masonry, and shall not extend more than one-fourth (1/4) inch beyond liner.
- The smoke pipe shall extend full size of the chimney flue for not less than one and one-half (1 1/2) diameters nor more than two (2) diameters so that additional appliances may be properly vented into the manifold.
- Smoke pipes shall be supported by means of strap hangers spaced not less than six (6) feet on centers. Wire hangers will not be permitted.
- Each such breeching or smoke pipe shall be as short and direct to the chimney flue as possible, and shall be installed with a pitch upward of not less than one-fourth (1/4) inch per running foot.
- (c) Multiple Smoke Pipe Connections. Two (2) or more smoke pipes shall not be jointed for a single flue connection unless the smoke pipe and flue are of sufficient size to serve all the appliances so connected. The manifold for multiple smoke pipe connections shall be designed and installed so that the inlet connections enter so as not to cause opposed venting.
- (d) Clearances. No part of any smoke pipe shall be placed nearer to any combustible ceiling than one and one-half (1 1/2) times the diameter of the pipe; or nearer to any combustible wall than one (1) diameter of the pipe; but the above distances may be reduced by one-half (1/2) if the wall or ceiling is covered with one-fourth (1/4) inch asbestos paper and a metal shield so fastened so that an inch space exists between this shield and the combustible material.
- (12) Dampers. All smoke pipes on hand-fired coal equipment shall be provided with a check damper placed on the side of the smoke pipe or at the end of a tee. Where cast iron smoke pipe dampers are used, they must be placed between the check damper and the heating equipment and supported on both sides of pipe. The smoke pipe on all incinerators that are not fired by auxiliary fuel shall have a cast iron damper to control the draft.
- Automatically operated dampers shall be of approved type designed to maintain a safe damper opening at all times and arranged to prevent starting of the burner unless the damper is opened, at least twenty percent (20%) of the internal cross-section area.
- (13) Draft Regulators. A draft regulator or draft hood shall be provided for all fired appliances, unless the burner is listed for use without one. (Refer to Section 30.25.)

30.22 - 30.24 RESERVED FOR FUTURE USE.**30.25 CONTROL SYSTEMS FOR AUTOMATIC FIRING EQUIPMENT.**

- (1) General. All systems shall have one (1) operating control to control temperature for furnace or pressure for boilers. Each system shall have, in addition, one (1) high limit control. These controls shall be one hundred twenty (120) volts, one (1) side grounded and shall be wired into the ungrounded line (except where self-generating controls are used). In addition, all steam boilers shall have a low water cutoff and all hot water boilers over two hundred thousand (200,000) BTU input shall be equipped with a low water cutoff. The above-mentioned control shall be wired into the circuit ahead of all other controls or relays.

All motors of one-eighths (1/8) HP and larger used in conjunction with any heating, ventilating, or air conditioning equipment shall be on its own circuit. Each motor shall be protected by a proper Type S time delay fuse, except that fractional horse power motors for circulating pumps, unit ventilators, etc. may be grouped on a motor branch circuit. If the motors for the circulating pumps, unit ventilators, etc. are provided with integral thermal overload protection, external over-current protection will not be required.

All heating, ventilating, and air conditioning units shall have an electrical disconnect located within ten (10) feet and in sight of the unit.

- (2) Relief Valves. All boilers shall have an A.S.M.E. approved pressure relief valve rated at the full gross rating of the boiler input. There shall be no valves between the boiler and the relief valve. The discharge from the water relief valve and the discharge from the low water cutoffs shall be piped full size to within eighteen (18) inches of the floor.
- (3) Draft Controls. All automatically fired natural draft equipment shall have either barometric or mechanical draft control equipment installed in the boiler breeching. Gas-fired boilers or furnaces may use approved draft hoods, mechanical draft control or barometric draft regulators. Barometric draft regulators used on gas-fired equipment must be free-swinging with no stops within one hundred eighty (180) degrees from the pivot point. No barometric damper, draft hood or sensor for mechanical draft control shall be located in any space other than where the burner is drawing combustion air.
- (4) Stoker Controls. Stoker-fired steam boilers with zone valves shall have a reverse acting pressure control or aquastat to open one of the zone valves at a pressure or temperature below the setting of the high limit control. On water boilers, there shall be reverse acting submerged type aquastat to open the zone valve and/or start a circulating pump below the setting of the high limit control. On a furnace with zone control or fan system, there shall be a reverse acting airstat to open a zone damper and/or turn on the fan below the setting of the high limit control. All stokers shall be equipped with a timing device to operate the stoker a minimum of one (1) minute every thirty (30) minutes during the off period.

All bin feed type stokers shall have out-fire control.

- (5) Retrofit Controls and Devices. Controls or devices installed on all gas fired heating equipment shall be certified by American Gas Association (A.G.A.) or any other nationally recognized testing laboratory and be used for the certified purposes only.

The installation shall be performed by a licensed heating contractor, and it shall be the responsibility of the installing contractor to make the installation according to the manufacturer's instructions.

(Sec. 30.25(5) Am. by Ord. 6576, 3-21-79)

30.26 COMMERCIAL AND INDUSTRIAL BURNERS OVER TEN (10) GALLONS PER HOUR OR 1,500,000 BTU PER HOUR.

- (1) General. Flame safeguard equipment on all gas and/or oil burning equipment shall be two (2) wire, one hundred twenty (120) volt, one side grounded and approved for the equipment it is to be installed with.

On commercial gas or combination gas-oil burners, a hi-lo gas pressure switch shall be provided and wired so that the main fuel valve cannot open if the gas pressure is above or below the rating of the equipment.

On pressure type burners, forced draft burners or induced draft burners, an air flow switch shall be provided so that the main fuel valve cannot open unless all fans are running. Natural draft burners must have a prepurge period of a minimum of ninety (90) seconds after the burner motor starts and all dampers are wide open before opening the fuel valve.

Forced or induced draft burners must have a prepurge period of at least four (4) air changes after the motor starts and all dampers are wide open before opening the fuel valve. Oil burners shall be equipped with low fire start.

Gas burners shall be equipped with slow opening gas valves.

Where gas pressures exceed fourteen (14) inches W.C. piped to a burner, an applicable gas pressure regulator shall be installed at each burner. The automatic gas valve shall be slow opening motorized with positive shutoff in case of power failure.

- (2) Continuous Pilot Burning. Gas burners using continuous pilots shall be equipped with U.L. or A.C.A. approved safety pilot and automatic shutoff valve.
- (3) Location of Pilot Valves. The gas supply to the pilot or group of pilots on all burners shall be controlled independently of the main gas burner including independent manual shutoff valve.

30.27 RESERVED FOR FUTURE USE.

30.28 RESIDENTIAL AIR CONDITIONING.

- (1) Scope. This section is intended to insure safety of operation and the location of the components in conjunction with the heating and cooling or cooling systems of one (1) and two (2) family residences where central air conditioning is employed.
- (2) Central Air Conditioning Systems (Existing System). When air conditioning is added to an existing heating system, the air volume shall be maintained so the BTU room requirement will be satisfied during the heating cycle.
- (3) Controls. On all heating and cooling systems, the fan and limit switch shall be located between the heat exchanger and the cooling coil.
- (4) Wiring. All wiring shall comply with the City of Madison Electrical Code, Chapter 19, of the Madison General Ordinances.
- (5) Manufacturer's Name and Rating Plate. Manufacturer's name and rating plate shall be affixed to all units.
- (6) Location of Condensing Unit. A plot plan shall be submitted with application for a permit showing the location of the condensing unit. The condensing unit shall not be located in the required front or side yards.
- (7) Foundation for Condensing Unit. All units shall be placed on a level waterproof and fireproof base and on well-tamped earth.
- (8) Refrigerants. ARI Group 2 refrigerants shall not be used for residential air conditioning (ammonia, dichloroethylene, methyl or ethyl chloride, methyl formate and sulphur dioxide). Substitutes of refrigerants shall not be made.

- (9) Piping. Joints are to be made by braising or by mechanical joints. Joints to be made by soldering shall be made only with materials that melt at temperatures above four hundred (400) degrees Fahrenheit.
- Soft annealed copper tubing used for refrigerant piping erected on the premises shall not be used in sizes larger than one and three-eighths (1 3/8) inches Standard Size (1.375 outside diameter). Mechanical joints shall not be used on soft annealed copper tubing on sizes larger than seven-eighths (7/8) inch Standard Size (0.875 outside diameter). It shall conform to ASTM Specifications B280-62.
- (10) Installation of Piping. All pipe shall be strapped to the ceiling and free of kinks. The unused portion of precharge or factory furnished pipe shall be strapped to the ceiling in a workmanlike manner. All holes to the exterior shall be sealed tightly.
- (11) Location of Evaporator. The evaporator coil shall be located upstream of the heating equipment.
- (12) Condensate Drain. The condensate drain shall be installed according to City of Madison Plumbing Code, Chapter 18, of the Madison General Ordinances.

30.29 APPENDIX NO. 1.

- (1) Heating, Ventilating and Air Conditioning Code (Wisconsin Administrative Code, Chapter 64). (Am. by Ord. 5599, 9-13-76)
- (2) American Society of Heating, Refrigerating and Air Conditioning Engineers Guide and Data Book (ASHRAE) 1970 Systems; 1969 Equipment; 1968 Applications; and 1967 Fundamentals.
- (3) Manual J - Load Calculation, 2nd Edition.
- (4) Manual 4 - Warm Air Perimeter Heating, Ninth Edition - National Warm Air Heating and Air Conditioning Association.
- (5) Manual 5 - Code and Manual for Gravity Systems, Fifth Edition - National Warm Air Heating and Air Conditioning Association.
- (6) Manual 6 - Adjusting Winter Air Conditioning Systems for Maximum Comfort - Third Edition - National Warm Air Heating and Air Conditioning Association.
- (7) Manual 7A - The Design and Installation of Warm Air Ceiling Panel Systems. Third Edition 1950 - National Warm Air Heating and Air Conditioning Association.
- (8) Manual 8 - Application Guide for Residential Central Air Conditioning Systems (Winter and year-round) - Fifth Edition - National Warm Air Heating and Air Conditioning Association.
- (9) Manual 9 - Code and Manual for the Design and Installation of Warm Winter Air Conditioning Systems and Year-Round Air Conditioning Systems - Seventh Edition - National Warm Air Heating and Air Conditioning Association.
- (10) Manual 9-S - Perimeter Warm Air Heating and Ventilation of Industrial, Commercial and Public - First Edition - National Warm Air Heating and Air Conditioning Association.
- (11) Manual 10 - Four Inch Pipe Warm Air Perimeter Heating - Fourth Edition - National Warm Air Heating and Air Conditioning Association.
- (12) National Fire Code, Volume 1, Flammable Liquids and Gases, 1956.
- (13) NFPA No. 54 - Standards of the National Fire Protection Association for the Installation of Gas Piping and Gas Appliances, 1969.
- (14) American Standards for Installation of Gas Piping and Gas Appliances in Buildings Z-21.30, 1964.
- (15) American Standard Requirements for Installation for Domestic Gas Conversion Burners Z-21.8.

- (16) American Standard Requirements for Installation of Gas Equipment in Large Boilers Z-21.33.
- Part 1, Engineering Standards Heat Loss Calculations, 6th Edition, 1950. Heating, Piping and Air Conditioning Contractors National Association.
 - Part 2, Engineering Standards. Net Load Recommendations for Heating Boilers Book - Issue Heating, Piping and Air Conditioning Contractors National Association Mechanical Contractors Association of America.
 - Part 3, Engineering Standards - Pipe Sizes and Design, 4th Edition - Heating, Piping and Air Conditioning Contractors - National Association.
 - Part 4, Engineering Standards. Comfort Air Conditioning, 6th Edition - Heating, Piping and Air Conditioning Contractors - National Association.
 - Part 5, Engineering Standards, Graphical Symbols for Use on Drawings and Scheme for the Identification of Piping Systems, 5th Edition 1950, Heating, Piping and Air Conditioning Contractors - National Association.
 - Part 6, Engineering Standards. Panel Heating, 1st Edition - Heating, Piping and Air Conditioning Contractors - National Association Mechanical Contractors Association of America.
 - Part 7, Engineering Standards. Standard Procedure Specifications for Welding of Pipe, Fittings and Flanges, 5th Edition - Heating, Piping and Air Conditioning Contractors - National Association.
 - Part 8, Engineering Standards - Residential Air Conditioning - 1st Edition - Heating, Piping and Air Conditioning Contractors - National Association Mechanical Contractors Association of America.
- (17) Manual for Electric Comfort Heating (NEMA) National Electric Manufacturer's Association.

Note. All of the above, as amended to date, are used for reference purposes.

30.30 INCINERATORS.

- (1) Application. The provisions of this Code shall apply to all direct-fed incinerator installations as defined in the I.I.A. Incinerator Standards, dated November, 1968.* Further, this Code shall apply to all buildings where incinerators are required to be installed by Section and to any other incinerator installation of the direct-fed type. (Am. by Ord. 8081, 7-29-83; ORD-10-00083, 9-15-10)

*Available for review in Building Inspection Division of the Department of Planning and Community and Economic Development, Suite 100, Madison Municipal Building, Madison, Wisconsin, and may be ordered from I.I.A., 60 E. 42nd Street, New York, New York 10017. (Am. by ORD-08-00109, 10-7-08)

- (2) Standards - Adopted by Reference. The I. I. A. Incinerator Standards, dated November, 1968, is hereby adopted by reference as a standard for all direct-fed incinerators.
- (3) Out-of-Doors Burning. All out-of-doors burning shall comply with the requirements as set forth in Section 34.307. (Am. by ORD-10-00083, 9-15-10)
- (4) Definitions. Definitions and incinerator terminology shall be that as defined in I. I. A. Incinerator Standards, dated November, 1968.
- (5) Permit. There shall be a permit secured for each incinerator hereafter installed in the City of Madison.

Note: Incinerators burning 1,000 pounds per hour or more shall be required to obtain a permit from the Wisconsin Department of Natural Resources.

- (6) Permit Fee. A permit fee of ten dollars (\$10) will be paid by the installer for each incinerator installed and an additional fee of five dollars (\$5) per floor will be paid for a multi-floor charge chute incinerator installation.
- (7) Plan Approval. Plans for all job-assembled incinerators shall be submitted to the Building Inspection Division of the Department of Planning and Community and Economic Development for approval before a permit may be issued. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
- (8) Penalty. The penalty provisions of Section 30.01(14) shall apply. (Am. by ORD-10-00058, 6-11-10)
- (9) Incinerator Design and Capacity.
- (a) The incinerator shall be of a design and size large enough to incinerate the amount of trash or combustible waste accumulated daily by the occupancy.
 - (b) Incinerators shall be designed according to the type of waste to be incinerated.
 - (c) Incinerators shall be of a design and size approved by the Building Inspection Division of the Department of Planning and Community and Economic Development. Installations meeting the standards of "NFPA #82", "Incinerators, Rubbish Handling, 1972" or "Incinerator Standards of the Incinerator Institute of America" will be accepted. (Am. by Ord. 8081, 7-29-83; ORD-08-00109, 10-7-08)
- (10) Inspections. Inspections of all multi-floor charging chute incinerator installations shall be called for and made on each floor as soon as the charging chute opening is installed.

- (11) Chimneys and Flues.
- (a) Chimneys serving an incinerator shall be used for no other purpose and shall be constructed to comply with the Building Code (Chapter 29) requirements, except that incinerators used in a one or two-family residence may be manifolded into the breeching serving other appliances, providing the chimney and breeching are sized to handle the additional load.
 - (b) The chimney shall not be smaller than the outlet of the incinerator, but in no case less than eight by eight (8 x 8) inches or sixty-four (64) square inches. The flue serving the incinerator shall have its top equipped with a copper or equal basket of fourteen (14) gauge wire and having openings of no more than one-half (1/2) inch.
 - (c) All incinerator flue stacks under two hundred sixty (260) square inches shall have clay fire flue liners surrounded with four (4) inches of solid masonry. All flue stacks over two hundred sixty (260) square inches shall be constructed within the requirements of Section Ind. 52.10 of the Wisconsin Administrative Code.
- (12) Class II Incinerators Prohibited.
- (a) No incinerators defined in I. I. A. Incinerator Standards, dated November, 1968, as Class II incinerators, shall be used after the publication of this ordinance.
 - (b) All Class II incinerators shall be either removed or permanently sealed so that there will be no possibility of them being reactivated.

(Section 30.30 R. & Recr. by Ord. 4319, 9-20-73)

30.31 RESERVED FOR FUTURE USE. (R. by Ord. 10,255, Adopted 5-7-91)

Editor's Note: See ILHR 23.045(8), Supplemental solid-fuel burning units connected to a furnace for installation requirements.

30.32 RESERVED FOR FUTURE USE. (R. by Ord. 10,255, Adopted 5-7-91)

30.33 - 30.49 RESERVED FOR FUTURE USE.

30.50 AIR POLLUTION.

- (1) The office of Smoke and Emissions Control is herein created. The Heating Inspector shall be responsible for the enforcement of this ordinance. The Inspector shall work under the direction and be responsible to the Director of the Building Inspection Division. (Am. by ORD-08-00109, 10-7-08)
- (2) The Heating Inspector shall see that this section relating to smoke abatement is enforced.
- (3) Emission of Dense Smoke. The emission of dense smoke within the corporate limits of the City of Madison, and one (1) mile there from the smokestack or chimney of any building or premises, or from any open fire, or from any portable boiler, portable crane, derrick, hoist, tar or asphalt kettle or any other similar machine or contrivance, except for a period of or periods aggregating nine (9) minutes or less of a density of No. 2 smoke as defined by the Ringelmann Chart is prohibited and is hereby declared to be a nuisance and may be summarily abated by the Smoke and Heating Plant Inspector in charge or by anyone whom he may duly authorize for such purpose. Such abatement may be in addition to the fine hereinafter provided.
- (4) Grading the Smoke Density. For the purpose of grading the density of smoke, the Ringelmann Chart, as now published and used by the United States Bureau of Mines, which is hereby made a part of this ordinance by reference shall be the standard.
Smoke shall be considered dense when it is equal to or of greater density than No. 2 of said chart.
- (5) Soot, Noxious Gases, Flyash, Etc.
 - (a) No person or persons, firm or corporation, shall cause, permit or allow to escape into the open air, such quantities of flyash, soot, or smoke, which are equal to or greater in density than as defined by No. 2 of the Ringelmann Chart for a period of or periods aggregating six (6) minutes or more, in any sixty (60) minute period, or from the stack of any locomotive after it is in or ready for service for a period of or periods in excess of one (1) continuous minute in any sixty (60) minute period. Dust or flyash emission shall not be in excess of eighty-five-hundredths (0.85) lbs. per one thousand (1,000) lbs. of stack gases adjusted to twelve percent (12%) carbon dioxide (CO₂).
 - (b) No person, or person, firm or corporation, shall cause, permit or allow the escape into the open air of noxious gases, acids, dust or other material, except material identified in Section 30.50(5)(a), in such places or manner and quantity as to cause injury, detriment or nuisance to the public or to endanger the health or safety of the public or in such manner as to cause physical damage to property.
 - (c) Any person, or persons, firm, or corporation, violating any of the provisions of this section shall forfeit not more than two hundred dollars (\$200) for each offense. Each day during which the provisions of this section shall be violated shall be deemed a separate offense.
- (6) Any person violating any of the provisions of this section for which a penalty is not specifically provided shall be subject to a forfeiture of not more than two hundred dollars (\$200).

(Sec. 30.50 Am. by Ord. 10,255, Adopted 5-7-91)

HEATING, VENTILATING AND
AIR CONDITIONING CODE

HEATING, VENTILATING AND AIR CONDITIONING CODE INDEX

-A-

ADMINISTRATION OF CODE 30.01

ACTIVE SOLAR COLLECTOR SYSTEMS - See SOLAR

AIR CONDITIONING

Air Conditioner, unitary defined.....	30.02(2)
Defined.....	30.02(1)
Fees.....	30.01(10)
Penalties.....	30.01(12)
Residential air conditioning.....	30.28
Central air conditioning systems (existing).....	30.28(2)
Condensate drain.....	30.28(12)
Condensing unit	
Foundation.....	30.28(7)
Location.....	30.28(6)
Controls.....	30.28(3)
Evaporator, location.....	30.28(11)
Manufacturer's name and rating plate.....	30.28(5)
Piping.....	30.28(9)
Installation.....	30.28(10)
Refrigerants.....	30.28(8)
Wiring.....	30.28(4)

AIR FILTERS

Coating flash point.....	30.11(3)
Fire resistance.....	30.11(2)
Requirements.....	30.11(1)

AIR INFILTRATION Defined.....30.02(3)

AIR POLLUTION 30.50

Penalties.....	30.50(5)(c) and (8)
Smoke density, grading.....	30.50(4)
Smoke emission.....	30.50(3)
Smoke and Heating Plant Inspector.....	30.50
Duties.....	30.50(6)and(7)
Soot, noxious gases, flyash, etc.....	30.50(5)

APPENDIX NO. 1 30.29

-B-

BAROMETRIC DAMPERS30.21(4)

BATHROOM EXHAUST VENTILATION30.03(6)

BOARD, HEATING, VENTILATING AND AIR CONDITIONING - See LICENSING

BLOWER CAPACITY30.06(2)

BOILER

- Capacity and installation requirements30.14(4)
- Connections 30.14(6)(a)9.
- Defined.....30.02(4)
- High pressure boiler defined.....30.02(5)
- Hot water and low pressure steam boiler defined30.02(6)

BOND REQUIRED OF HEATING LICENSEES30.01(8)

BUILDING Defined30.02(7)

BURNER(S)

- Commercial and industrial, over 10 gallons per hour or 1,500,000 BTU per hour (gas or oil)..... 30.26
- Gas conversion burner installation requirements 30.20
- Oil burner installation 30.15

BURNING OUT-OF-DOORS30.30(3)

-C-

CABLES, RESISTANCE30.04(8)

CENTRAL HEATING EQUIPMENT

- Defined.....30.02(8)
- Replaces circulating space heaters under some conditions.....30.03(1)

CENTRAL HEATING, SYSTEMS, ELECTRIC30.04(10)

CHIMNEYS AND FLUES30.21, 30.30(11)

CIRCUIT LOAD LIMITATIONS 30.04(2)(a)1.

CLEARANCES

- Furnaces30.06(4)(f)
- Gas-fired unit heaters30.07(2)

CLEARANCES - Continued

Smoke pipes	30.21(11)(d)
Stoker, hopper clearance	30.17(10)
Vent connector clearances	30.21(6)(b)
 CLOSED GRAVITY SYSTEMS Defined	 30.14(1)(p)
COEFFICIENT OF HEAT TRANSMISSION Defined	30.02(9)
COMBUSTION AIR	30.03(5)
Kitchen and bathroom exhaust.....	30.03(6)
One and two-family residences.....	30.03(5)(a)
COMMERCIAL AND INDUSTRIAL BURNERS (OIL OR GAS).....	30.26
CONDEMNATION DUE TO POOR WORKMANSHIP.....	30.03(4)
CONDUCTION, THERMAL Defined	30.02(10)
CONVECTION	
Convection resistance and fan-forced units	30.04(7)
Defined.....	30.02(11)
CONVECTORS	30.14(2)(b)
Defined.....	30.02(12)
CONVERSION GAS BURNER INSTALLATION REQUIREMENTS	30.20
CONVERSION OIL BURNER Defined	30.02(13)
CONVERTER Defined.....	30.02(14)
-D-	
DEFINITIONS.....	30.02, 30.14(1)
DESIGN STANDARDS	30.01(9)(d)
DOWN-FEED OR OVERHEAD SYSTEMS Defined.....	30.14(1)(d)
DRAFT	
Controls.....	30.25(3)
Drafthoods	30.21(3)
Defined.....	30.21(2)(h)
Insufficient draft or down-draft	30.21(10)
Regulator defined.....	30.02(15)

DUCTS - See also RETURN AIR DUCTS

Clearances30.06(4)(f)5.
 Construction, return air 30.10
 Registers, intakes and ducts30.06(3)
 Warm air supply..... 30.09

DRY RETURNS Defined 30.14(1)(h)

-E-

ELECTRIC

Central heating systems30.04(10)
 Floor furnaces30.04(11)
 Heaters
 Permanently placed.....30.04(13)
 Portable 30.04(4)(d) and (12)
 Panel heating resistance, cable type.....30.04(8)
 Panel, prefabricated conductive materials30.04(9)
 Space heating
 Central heating systems30.04(10)
 Convection units30.04(7)
 Electric panel heating resistance, cable type, where installed30.04(8)
 Electric panel, prefabricated conductive materials30.04(9)
 Electric service capacity30.04(2)
 Load limitation on circuits 30.04(2)(a)1.
 Equipment requirements30.04(1)
 Fan-forced units30.04(7)
 Floor furnaces30.04(11)
 Heaters
 Portable 30.04(4)(d) and (12)
 Permanent30.04(13)
 Nameplate required.....30.04(3)
 Radiant glass heaters, wall type30.04(6)
 Requirements, installation
 General.....30.03(1) and (2), 30.04(4)
 Thermostat30.04(5)
 Resistance units.....30.04(7)

ELECTRICAL SERVICE CAPACITY.....30.04(2)

EMERGENCY WORK..... 30.01(9)(a)and(10)

EQUIVALENT LENGTH OF RUN Defined..... 30.14(1)(k)

EXHAUST VENTILATION FOR KITCHEN AND BATHROOM30.03(6)

-F-

FEES

Appeals to Board	29.18
Compliance Inspection.....	30.01(13)
Incinerator permit fee.....	30.30(6)
Licenses	30.01(4) and (5)
Renewal	30.01(7)
Oil or wood burning stoves.....	30.01(10)
Permit fee schedules	30.01(10)
Waiving for assisted housing.....	30.01(10)

FILL PIPES FOR TANKS.....	30.16(7)
---------------------------	----------

FIREPLACE	30.21(6)(k)
-----------------	-------------

FIRING EQUIPMENT, AUTOMATIC

Draft controls	30.25(3)
General controls	30.25(1)
Relief valves	30.25(2)
Stoker controls	30.25(4)

FITTINGS AND PIPES - See PIPES AND PIPING

FLYASH.....	30.50(5)
-------------	----------

FORCED HOT WATER SYSTEMS Defined.....	30.14(1)(n)
---------------------------------------	-------------

FORCED WARM AIR SYSTEM

Design	
Ceiling panel system.....	30.13(5)
One and two-family structures.....	30.13(1) and (2)
Perimeter heating systems	30.13(3)
Small pipe	30.13(4)
Ducts, registers and intakes.....	30.06(3)

FURNACE(S)

Assembling	30.08
Clearances	30.06(4)(f)
Floor.....	30.04(11), 30.06(4)(c)
Location and mounting	30.06(4)
Pipeless	30.06(4)(b)
Room defined.....	30.02(16)
Setting of.....	30.08
Size selection	30.06(1)

-G-

GAS

Appliances

- Reconditioning.....30.20(2)
- Size of piping to30.18(6)
- Vent connectors30.21(6)

Conversion burner, installation requirements 30.20

- Installation, burners and controls30.20(3)
- Inputs exceeding 400,000 BTU30.20(4)
- Preparation and reconditioning 30.20(1) and (2)

Disconnecting30.18(3)

Exceptions, gas piping and control30.18(1)

Gas-fired equipment, requirements and installation 30.19

Gas-fired heating equipment and piping..... 30.18

Gas-fired unit heaters 30.07

- Class A-2 licensee may install 30.01(3)(b)3.

Leakage30.18(4)

Materials and fittings30.18(7)

Meters30.18(5)

Noxious.....30.50(5)

Pipe capacity table 30.18(5)(e)

Piping

- Containing unmeasured gas30.18(2)
- To meter location30.18(5)
- Size to gas appliances30.18(6)

Precautions, general30.18(4)

Vents 30.21(2)(b) and (5)

GAS-FIRED UNIT HEATERS

- Clearances30.07(2)
- Ductwork30.07(4)
- Negative pressure.....30.07(3)
- Support.....30.07(1)

GENERAL CONDITIONS..... 30.03

GRAVITY HOT WATER SYSTEMS Defined 30.14(1)(m)

GRAVITY SYSTEM Defined..... 30.14(1)(a)

GRAVITY WARM AIR SYSTEM

- Design 30.12
- Ducts, registers and intakes.....30.06(3)

-H-

HEATERS

Electric

- Permanently placed.....30.04(13)
- Portable 30.04(4)(d) and (12)

Recessed.....30.06(4)(d)

HEATING INSTALLATIONS

Air filters	30.11
Air pollution.....	30.50
Boilers	30.14(4)
Commercial and industrial burners	30.26
Conversion burners	30.20
Definitions	30.02
Electric space heating	30.04
Fees	30.01(4) and (10)
Firing equipment, automatic	30.25
Forced warm air system	30.13
Furnaces	30.08
Gas-fired heating equipment.....	30.18, 30.19
Unit heaters	30.07
Gravity warm air system.....	30.06(3), 30.12
Hot water and steam systems.....	30.14
Incinerators	30.30
Inspection.....	30.01(11)
Oil burner installations.....	30.15
Oil tanks and piping	30.16
Penalties	30.01(12)
Permits	30.01(9)
Piping and equipment, hot water heating systems	30.14(7)
Piping and oil tanks.....	30.16
Requirements, general.....	30.04(4)
Return air duct, construction.....	30.10
Space heating, electric	30.04
Steam and hot water systems	30.14
Stoker installations.....	30.17
Venting requirements.....	30.21
Violations.....	30.01(11)(b), (c) and (12)
Warm air	30.06
Supply ducts.....	30.09

HOT WATER SYSTEMS - See STEAM AND HOT WATER SYSTEMS

-I-

INCINERATORS	30.30
Burning out-of-doors	30.30(3)
Chimneys and flues.....	30.30(11)
Class II incinerators prohibited.....	30.30(12)
Definitions	30.30(4)
Design and capacity	30.30(9)
Building Inspection Division Director approves plans	30.30(7)
Penalty	30.30(8)
Permit.....	30.30(5)
Fee.....	30.30(6)

INDUSTRIAL AND COMMERCIAL BURNERS (GAS OR OIL)..... 30.26

INSPECTIONS

- Access to premises by Inspector 30.01(2)(b)
- Contractor to notify Heating Inspector when ready 30.01(11)(a)
- Incinerators30.30(10)
- Stop work order issued for violation of code 30.01(11)(b)
- Work not to be covered without inspection 30.01(11)(a)

INSPECTOR - HEATING, VENTILATING AND AIR CONDITIONING

- Access to premises 30.01(2)(b)
- Contractor to notify when ready for inspection 30.01(11)(a)
- Responsible to Building Inspection Division Director 30.01(2)(a)
- Stop work order issued by..... 30.01(11)(b)

INSPECTOR - SMOKE AND HEATING PLANT INSPECTOR - See SMOKE AND HEATING PLANT INSPECTOR

INTAKES, DUCTS AND REGISTERS30.06(3)

-K-

KITCHEN EXHAUST VENTILATION.....30.03(6)

-L-

LICENSING BOARD OF EXAMINERS APPEALS -

- See BOARD OF BUILDING CODE, FIRE CODE, CONVEYANCE CODE AND LICENSING APPEALS 29.18

LICENSES

Application.....	30.01(5)
Director of Building Inspection Division grants.....	30.01(5)(c)
Bond required of licensees.....	30.01(8)
Class A-1	
Fee.....	30.01(4)(b) and (5)(b)
Installation, repairing or altering warm air space heating equipment.....	30.01(3)(b)2.
Class A-2	
Fee.....	30.01(4)(c) and (5)(b)
Installation, altering or repairing steam or hot water equipment.....	30.01(3)(b)3.
Class A-3	
Fee.....	30.01(4)(d) and (5)(b)
Installation, repairing or altering electrical space heating equipment.....	30.01(3)(b)4.
Class A-4	
Fee.....	30.01(4)(e) and (5)(b)
Installation, alteration, repair of active solar heating equipment.....	30.01(3)(b)5.
Class B	
Fee.....	30.01(4)(a) and (5)(b)
Installation of gas, oil or coal conversion automatic equipment and controls.....	30.01(3)(b)1.
Examinations.....	30.01(5)
Failure.....	30.01(5)(c)
Fees.....	30.01(5)(b)
Inactive status.....	30.01(5)(d)
Prohibitions.....	30.01(6)
Renewal; fee.....	30.01(7)
Temporary licenses not to be issued.....	30.01(7)

-M-

MAINS, RETURN Defined.....	30.14(1)(r)
MAYOR APPOINTS MEMBERS OF BOARD.....	30.01(3)(a)
MECHANICAL RETURN SYSTEM Defined.....	30.14(1)(b)
MINIMUM STANDARDS.....	30.03(3)

-N-

NAMEPLATE REQUIRED ON ELECTRICAL HEATING EQUIPMENT.....	30.04(3)
---	----------

-O-

OIL BURNER

Defined.....	30.15(1)
Installation.....	30.15

OIL TANKS AND PIPING

Construction of tanks30.16(5)
 Fill and overflow pipes30.16(7)
 Gas pilots on oil burners30.16(13)
 Gravity supply tanks30.16(1)
 Oil gauging30.16(8)
 Oil lines.....30.16(11)
 Oil pumps.....30.16(9)
 Overflow and fill pipes30.16(7)
 Piping.....30.16(10)
 Pressure tank feed30.16(2)
 Storage tanks inside buildings30.16(4)
 Underground tank installation.....30.16(3)
 Valves30.16(12)
 Vents30.16(6)

ONE-PIPE SYSTEM

Hot water defined.....30.02(17)
 Steam defined.....30.02(18)
 Steam and hot water defined.....30.14(1)(f)

OPEN GRAVITY SYSTEMS Defined 30.14(1)(o)

OVERHEAD OR DOWN-FEED SYSTEMS Defined..... 30.14(1)(d)

-P-

PANEL HEATING SYSTEMS Defined30.02(19)

PENALTIES

Air pollution.....30.50(5)(c) and (8)
 Failure to obtain permit.....30.01(10)
 Heating, ventilating and air conditioning.....30.01(14)
 Incinerators30.30(8)

PERMITS, PLANS, SPECIFICATIONS AND DATA.....30.01(9)

Fee schedule; penalty30.01(10)
 Incinerators30.30(5)

PILOT(S)

Continuous pilot burning30.26(2)
 Location of pilot valves30.26(3)

PIPES AND PIPING

Air conditioning	30.28(9) and (10)
Fill and overflow pipes for tanks	30.16(7)
Gas appliances, piping to	30.18(6)
Gas-fired heating equipment	30.18
Hot water systems, pipe connections and equipment	30.14(7)
Materials for pipes and fittings	30.18(7)
Oil tanks and piping	30.16
Overflow and fill pipes	30.16(7)
Smoke pipes	30.21(11)
Steam pipes	30.14(5) and (6)
Vent pipes	30.16(6)

POLLUTION - See AIR POLLUTION

-R-

RADIANT GLASS HEATERS, WALL TYPE	30.04(6)
--	----------

RADIANT HEATING Defined	30.02(20)
-------------------------------	-----------

RADIANT PANEL HEATING SYSTEMS, DESIGN AND INSTALLATION REQUIREMENTS	30.14(8)
--	----------

RADIATION

Defined	30.02(21)
Direct radiation with unenclosed radiators, how determined	30.14(2)(a) and (3)(a)

RADIATOR

Defined	30.02(22)
Enclosed	30.14(2)(c)

REGISTER

Defined	30.02(23)
Ducts, intakes and registers	30.06(3)

RESISTANCE CABLE	30.04(8)
------------------------	----------

RETURN AIR DUCT CONSTRUCTION	30.06(3), 30.10
------------------------------------	-----------------

Bridging and panning	30.10(8)
Distance from furnace	30.10(2)
Floors, walls and partitions	30.10(3)(a)
Grilles	30.10(6)
Height above floor	30.10(9)
Insulation in or adjacent to cold spaces	30.10(3)(b)
Joist spaces used as return air ducts	30.10(4)
Linings	30.10(5)
Materials	30.10(1)
Underfloor plenums	30.10(7)

RETURN MAINS defined.....30.14(1)(r)

RETURN SERVICE MAINS defined 30.14(1)(c)2.

ROOFTOP WARM AIR UNIT SIZE.....30.06(1)

-S-

SERVICE MAINS Defined 30.14(1)(c)

SIGNS ON VEHICLES30.01(12)

SMOKE - See AIR POLLUTION

SMOKE AND HEATING PLANT INSPECTOR - See also AIR POLLUTION

 Duties 30.50(6) and (7)

 Responsible to Building Inspection Division Director30.50(1)

SMOKE PIPES30.21(11)

SOLAR - ACTIVE SOLAR COLLECTOR SYSTEMS

Air Systems

 Duct insulation and piping30.05(11)

 Ducting and penetration30.05(9)

 Storage30.05(15)

Collectors

 Mounting.....30.05(3)

Heat transfer fluids.....30.05(12)

Liquid Systems

 Pipe insulation.....30.05(10)

 Piping and penetration30.05(8)

 Storage tanks.....30.05(14)

Monitoring and manuals30.05(16)

Orientation guidelines30.05(1)

Site-built and nonstandard systems.....30.05(17)

SOOT30.50(5)

SPACE HEATING 30.03(1) and (2), 30.04

SQUARE FOOT OF HEATING SURFACE Defined.....30.02(24)

STEAM AND HOT WATER SYSTEMS	30.14
Definitions	30.14(1)
Hot water	
Concealed piping	30.14(9)
Piping connections and equipment	30.14(6) and (7)
Radiant panel heating systems	30.14(8)
Radiation, minimum requirements.....	30.14(3)
Low pressure steam and hot water boilers	30.14(4)
Low pressure steam vapor and vacuum heating systems	
Pipe sizes, minimum requirements	30.14(5)
Piping connections and equipment	30.14(6)
Steam	
Concealed piping	30.14(9)
Heating systems defined	30.02(15)
Pipes.....	30.14(5) and (6)
Radiation, minimum requirements.....	30.14(2)
Trap defined.....	30.02(26)
STEAM HEATING SYSTEM Defined.....	30.02(25)
STOKER	
Controls.....	30.25(4)
Defined.....	30.17(1)
Installations	30.17
Ash storage space.....	30.17(6)
Clinker removal door spacings	30.17(8)
Combustion volume	30.17(4)
Draft control, automatic	30.17(11)
Grates for stoker over 200 lbs.....	30.17(7)
Heat release	30.17(3)
Hopper clearance	30.17(10)
Peak load.....	30.17(2)
Pit set stoker.....	30.17(9)
Setting height	30.17(5)
STOP WORK NOTICE	30.01(11)(b)
SUPPLY OR FLOW MAINS defined.....	30.14(1)(q)
SUPPLY SERVICE MAINS Defined	30.14(1)(c)1.
-T-	
THERMOSTAT	
Defined.....	30.02(27)
Requirements	30.04(5)
THERMOSTATIC TRAP Defined.....	30.02(28)

TRANSMISSION MAINS Defined 30.14(1)(l)

TWO-PIPE SYSTEM (STEAM OR WATER) Defined 30.02(29), 30.14(1)(g)

-U-

UNDERGROUND GAS PIPING 30.02(30)

UNDERGROUND TANKS - See OIL TANKS AND PIPING

UNIT HEATER Defined 30.02(30)

UP-FEED SYSTEMS Defined 30.14(1)(e)

-V-

VACUUM HEATING SYSTEM (STEAM) Defined 30.02(31)

VACUUM RETURNS Defined 30.14(1)(j)

VALVES

Relief 30.25(2)

VAPOR HEATING SYSTEM (STEAM) Defined 30.02(31)

VENTILATION

Air from inside buildings 30.03(5)(a)2.c.

Defined 30.02(33)

VENTING REQUIREMENTS

Barometric dampers 30.21(4)

Chimney and vent defined 30.21(2)

Chimney types 30.21(5)

Clearances for appliances 30.21(6)

Connectors 30.21(6)

Dampers 30.21(12)

Definitions 30.21(2)

Draft or down-draft, insufficient 30.21(10)

Drafthoods 30.21(3)

Draft regulations 30.21(13)

Engineered vent systems 30.21(8)

Fireplace 30.21(6)(k)

Flues or vents 30.21(9)

Gas vents 30.21(2)(b) and (5)

Requirements, general 30.21(1)

Smoke pipes 30.21(11)

Special arrangements 30.21(7)

Tanks, vent pipes for 30.16(6)

VENT VALVES

Steam defined30.02(34)
Water defined.....30.02(35)

VIOLATIONS 30.01(11)(b) and (c) and (12)

-W-

WARM AIR - See also FORCED WARM AIR SYSTEM,
See also GRAVITY WARM AIR SYSTEM

Blower capacity30.06(2)
Ducts, registers, intakes30.06(3)
Furnaces30.06(4)
 Size30.06(1)
Rooftop unit size30.06(1)
Supply ducts
 Concrete slab, ducts in30.09(2)
 Cross bracing30.09(4)
 Firestopping, removal of ducts30.09(10)
 Insulation 30.09(11) and (12)
 Linings30.09(6)
 Masonry, ducts not to come in contact with30.09(5)
 Materials30.09(1)
 Riser installation30.09(9)
 Supports30.09(8)
 Vibration isolation30.09(3)
 Volume dampers30.09(13)

WET RETURNS Defined..... 30.02(36), 30.14(1)(i)

WISCONSIN ADMINISTRATIVE CODE

Adopted by reference.....30.01(1)(c) and (d)