

CHAPTER 28

MECHANICAL SYSTEMS

780 CMR 2801.0

2801.1 Scope: The provisions of 780 CMR 28 shall control the construction, inspection and maintenance of all mechanical equipment and systems with respect to structural strength, fire safety and operation.

Note: Also see 780 CMR 9, 12 and 13.

2801.2 Mechanical code: All mechanical equipment and systems shall be constructed, installed and maintained in accordance with the BOCA National Mechanical Code listed in *Appendix A*.

2801.2.1 Heating, Pumping, Process Piping and Refrigeration Systems: Heating, pumping, process piping and refrigeration systems shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts (Installing Contractor). Engineered designs and specifications prepared by Registered Professional Engineers shall identify systems requiring compliance with appropriate sections of M.G.L. c. 146 and 528 CMR. Shop drawings and design layout prepared by licensed installing contractors shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing the heating, pumping, process piping and refrigeration systems. (See Installing Contractor Definition 780 CMR 202.0).

2801.2.2 Location of Air Intakes and Outlets:

2801.2.2.1 Location of Outdoor Air Intakes:

Outdoor air intakes shall be located such that the distance measured from the closest point of the intake opening to the object, or point, listed in Table 2801.2.2.1 exceeds the minimum separation distance listed in Table 2801.2.2.1.

Exception: Shorter separation distances are acceptable if it can be shown that an equivalent rate of introduction of outdoor air contaminants will be attained using an alternative design, and if approved by the authority having jurisdiction.

Table 2801.2.2.1

AIR INTAKE MINIMUM SEPARATION DISTANCE

| Object | Minimum Distance, ft |
|--|----------------------|
| Property line | 3 |
| Garage entry, loading area, or drive-in queue (Note 1) | 25 |
| Driveway or street | 10 |

| | |
|------------------------------|------|
| Limited access highway | 25 |
| Mantles or ledges (Note 2) | 3 |
| Landscaped grade (Note 3, 4) | 6 |
| Roof or grade (Note 4) | 0.75 |
| Cooling towers (Note 5) | 15 |

Note 1: These areas are likely locations where vehicles will be paused and idling, such as while paying parking fees or waiting for traffic in the case of the garage entry, while loading or unloading materials in case of the loading area, or waiting in line for drive-in restaurant or bank service in the case of the drive-in queue.

Larger separation distances may be needed if the intake is located directly above the likely location of idling vehicles.

Note 2: Applies to mantles or ledges that are sloped less than 45 degrees from the horizontal and that are more than six in. wide.

Note 3: Landscaped grade is soil, lawn, shrubs, or any plant life within 1.5 ft horizontally of intake.

Note 4: Intake must be at least eight in. above the average maximum snow depth at the intake.

Note 5: Applies to closest wetted surface of tower, such as intake or basin. See Section 5.5 for separation distance from tower discharge.

2801.2.2.2 Exhaust outlets and air intakes:

Exhaust air and vent outlets shall be located no closer to outdoor air intakes than the minimum separation distance determined in accordance with Equation 2801.2.2.2:

Equation 2801.2.2.2

$$S = 0.09 \times Q^{0.5} (D^{0.5} - V/400)$$

Where:

Q = Exhaust air volume, cfm. The value used in Equation 2801.2.2.2 shall not be less than 150 cfm nor exceed 3000 cfm regardless of actual volume.

For gravity vents such as plumbing vents, use an exhaust rate of 150 cfm. For flue vents from fuel burning appliances, assume a value of 250 cfm per million Btu/hr of combustion input (or obtain actual rates from the combustion appliance manufacturer).

D = Dilution factor:

1. Dilution factor shall be five for exhaust air outlets from spaces without unusual sources of contaminants.
2. Dilution factor shall be ten for exhaust air outlets with mild contaminants including copy rooms, printer rooms, dining area and break rooms, cafeterias, laundry rooms, locker rooms and residential kitchens and bathrooms.

THE MASSACHUSETTS STATE BUILDING CODE

3. Dilution factor shall be 15 for plumbing vents and exhaust air outlets from spaces with significant contaminant intensity including public toilets or toilets in health care facilities,

4. Dilution factor shall be 25 for air with noxious or toxic fumes or gases including spray paint booths, garages, tunnels, kitchen grease hoods, laboratory fume hoods, chemical stor-age, refrigerating machinery rooms, soiled laundry storage and natural gas and propane burning appliance vents.

5. Dilution factor shall be 50 for air with a high concentration of dangerous particles including vents from fuel burning appliances other than natural gas or propane burning appli-ances, uncleaned fume hood exhaust, evapora-tive condenser and cooling tower outlets.

V = Exhaust air discharge velocity, fpm. V shall have a positive value when the exhaust is directed away from the object, and shall have a negative value when the exhaust is directed towards the object. V shall be set to 0 in Equation 2801.2.2.2 for vents from gravity (atmospheric) fuel fired appliances, plumbing vents, and other non-powered exhausts, or if the exhaust discharge is covered by a cap or other device that dissipates the exhaust air stream. For hot gas exhausts such as combustion products, an effective additional 500 fpm upward velocity shall be added to the actual discharge velocity.

2801.2.2.3 Exhaust outlets and windows: Exhaust air and vent outlets shall be located no closer to operable windows than one-half the minimum separation distance determined in accordance with Equation 2801.2.2.2.

For exhaust air with a dilution factor greater than ten the horizontal distance between outlets and operable windows shall be at least the minimum separation distance determined in accordance with Equation 2801.2.2.2.

2801.2.2.4 Exhaust outlets and property lines: Exhaust air outlets shall be located at least ten feet from property lines for air with a dilution factor greater than ten, in accordance with Equation 2801.2.2.2.

Exception: exhausts located ten ft. or more above grade where the property line abuts a street or public way.

780 CMR 2802.0 CONSTRUCTION DOCUMENTS

2802.1 General: The *construction documents* for the installation, repair, extension or removal of any mechanical equipment or system shall be submitted in accordance with 780 CMR 110.0 and a building

commercial kitchens, laboratories, dry-cleaning establishments and indoor swimming pools.

permit shall be secured prior to the commencement of any work.

2802.2 Matter covered: The *construction documents* shall show in sufficient detail all applicable features and clearances of the appliances and systems, including: size and type of apparatus; construction of flue, stack or chimney; stack connections; type of fuel; method of operation; and the method of compliance with all regulations for the class and type of equipment installed.

2802.3 Details: An application for a building permit for mechanical systems shall be accompanied by *construction documents* complying with the provisions of the mechanical code listed in *Appendix A* before a permit shall be issued for the mechanical equipment or system. The *construction documents* shall be drawn to a scale of not less than $\frac{1}{4}$ inch to the foot (1:100). and shall show the location and arrangement of all equipment and distribution elements including safeties and pressure-controlling devices.

Note: Also see 780 CMR 2803.1.

780 CMR 2803.0 FEES

2803.1 General: Fees for mechanical work, shall be included in the building permit application (see 780 CMR 114.0).

780 CMR 2804.0 INSPECTIONS AND TESTS

2804.1 Inspection: All mechanical equipment and systems requiring a permit shall be inspected in accordance with the BOCA National Mechanical Code listed in *Appendix A* and shall not be placed in operation until having been tested and approved.

2804.2 Concealment: It shall be unlawful for owners, contractors or workers to lath over or in any way conceal any piping, outlet boxes or other parts of the mechanical equipment or system requiring a permit until an inspection has been made thereof and due notice has been given that the work has been approved.

2804.3 Defects and repairs: Upon inspection or reinspection of a mechanical system, any defects or deficiencies which require repair to insure safe operation shall be rectified before the system is placed in service.

2804.4 Power to deem unsafe: A system or any part thereof that is found to be unsafe to life or property,

shall be deemed unsafe and shall not be restored to service until such system has been made safe and approved.

780 CMR 2805.0 PLENUMS

2805.1 General: The term "plenum" shall mean an enclosed portion of the building structure which forms part of an air distribution system and is designed to allow the movement of air. Supply, return, exhaust, relief and *ventilation* air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, or *attic* spaces and mechanical equipment rooms. The location of supply and return air plenums shall also comply with 780 CMR 1005.7. Plenums shall be limited to one *fire area*. Fuel-fired equipment shall not be installed within a plenum. In buildings of Type I or 2 construction, all plenums shall be noncombustible and shall comply with 780 CMR 2805.2. In build-

ings of Type 3, 4 or 5 construction, noncombustible plenums in accordance with 780 CMR 2805.2, combustible plenums in accordance with 780 CMR 2805.3, and stud and joist space plenums in accordance with 780 CMR 2805.4, shall be permitted.

2805.2 Noncombustible plenums: Plenums shall be constructed with noncombustible material. Combustible material shall not be exposed within a plenum except as permitted in 780 CMR 2805.2.1 through 2805.2.6.

2805.2.1 Pipe: Pipe shall be noncombustible except that plastic fire *sprinkler* piping in wet pipe systems shall be permitted where the piping has a peak optical density not greater than 0.50, an average optical density not greater than 0.15 and a flame spread not greater than 5.0 feet (1524 mm) when tested in accordance with UL 1887 listed in *Appendix A*. Piping shall bear the *label* of an *approved agency*.

2805.2.2 Ceiling and thermal material: Thermal and acoustical materials and pipe insulation shall have a flame spread of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E84 listed in *Appendix A*.

2805.2.3 Ducts: Rigid or flexible ducts and connectors shall conform to the mechanical code listed in *Appendix A*.

2805.2.4 Duct coverings: Duct coverings, linings, tape and connectors shall conform to the BOCA National Mechanical Code listed in *Appendix A*.

2805.2.5 Wire: Wire shall be low-voltage or power-limited wire or cable. Wire shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15 and a flame spread of not greater than five feet (1524 mm) when tested in accordance with UL 910 listed in *Appendix A*. Wire shall bear the *label* of an *approved agency* and shall be marked in accordance with 527 CMR 12.00 listed in *Appendix A*.

2805.2.6 Combustible pneumatic tubing: Combustible pneumatic tubing shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15 and a flame spread of not greater than five feet (1524 mm) when tested in accordance with UL 1820 listed in *Appendix A*, and shall bear the *label* of an *approved agency*.

2805.3 Combustible plenums: The plenum shall be constructed with approved material. Combustible material, pipe or wire exposed within the plenum shall be permitted.

2805.3.1 Size: Combustible plenums shall be *draftstopped* every 3,000 square feet (279 m²) in area.

Exception: Plenums shall be limited to one *fire area* without *draftstopping* in buildings equipped throughout with an *automatic sprinkler* system in accordance with 780 CMR 906.2.1.

2805.4 Stud and joist spaces: The space between studs or joists shall not be utilized as a plenum for supply air. The space between studs or joists utilized as a plenum for return air shall not be part of a required fireresistance rated assembly. Air shall be removed from one floor level only. All connections shall be *firestopped* and *draftstopped*.

780 CMR 2806.0 DRYING ROOMS

2806.1 General: A drying room or dry kiln installed within a building shall be constructed entirely of approved noncombustible materials or assemblies of such materials with the required fireresistance rating based on the fire hazard of the contents and the process, as required in 780 CMR 4.

2806.2 Piping clearance: All overhead heating pipes shall have a clearance of not less than two inches (51 mm) from combustible contents of the dryer.

2806.3 Insulation: Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of air space, or the metal walls shall be lined with ¼-inch insulating mill board or other approved equivalent insulation.

2806.4 Fire protection: Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in 780 CMR 4, shall be protected by an approved *automatic fire suppression system* conforming to the provisions of 780 CMR 9.

780 CMR 2807.0 WASTE- AND LINEN-HANDLING SYSTEMS

2807.1 General: Waste (refuse) and linen (laundry) systems shall be installed in accordance with 780 CMR 2807.0 and the provisions of Chapters 3 and 4 of NFiPA 82 listed in *Appendix A*.

Exception: Systems serving and contained within a single *dwelling unit*.

2807.2 Waste and linen chute enclosures: A *shaft* containing a refuse or linen chute shall not be used

THE MASSACHUSETTS STATE BUILDING CODE

for any other purpose and shall be enclosed in accordance with 780 CMR 710.0. All openings into the *shaft*, including those from access rooms and termination rooms, shall be protected with approved

NON-TEXT PAGE

fireresistance rated assemblies. Such opening protectives shall be self-closing or automatic-closing upon detection of smoke, except that a heat-activated device for closing the opening protective between the *shaft* and the termination room is permitted.

2807.3 Waste and linen chute access rooms: Access openings for waste and linen chutes shall be located in rooms or compartments which are completely enclosed by *fire separation assemblies* having a fireresistance rating of not less than one hour; and openings into the access rooms shall be protected by *fire doors* that comply with 780 CMR 716.0. Access openings to waste and linen chutes shall not be located in *exit access corridors* or *exit enclosures*.

2807.4 Termination room: Waste and linen chutes shall discharge into an enclosed room that is completely separated from the remainder of the building by *fire separation assemblies* having a fireresistance rating of not less than one hour; and openings into the termination room shall be protected by *fire doors* that comply with 780 CMR 716.0. Waste chutes shall not terminate in an incinerator room.

2807.5 Incinerator room: Where located within a building, incinerators shall be enclosed within a room that is separated from the remainder of the building by *fire separation assemblies* having a fireresistance rating of not less than two hours; and openings into the incinerator room shall be protected by *fire doors* that comply with 780 CMR 716.0.

2807.6 Automatic fire suppression: An approved *automatic fire suppression system* shall be installed at the top and at alternate floor levels in a waste or linen chute and in the termination and incinerator rooms.

780 CMR 2808.0 REFUSE VAULTS

2808.1 Refuse vault enclosures: A vault for receiving combustible refuse from an exhaust system shall be enclosed with *fire separation assemblies* having not less than a three-hour fireresistance rating.

2808.2 Openings to boiler rooms: The opening between a vault and a boiler room shall not exceed nine square feet (0.84 m²) in area and shall be located at least eight feet (2438 mm) from the firing door of the boiler, and the bottom of the opening shall not be less than six inches (152 mm) above the boiler room floor. All openings shall be equipped with *fire doors* having a fire protection rating of not less than 1½ hours and complying with 780 CMR 716.0.

2808.3 Location: Where located within a building, a refuse vault shall extend above the roof or shall be directly vented to the outer air with ducts that comply with the BOCA National Mechanical Code listed in *Appendix A*.

2808.4 Fire protection: A vault for combustible refuse which exceeds 360 cubic feet (10 m³) in volume shall be protected by an approved *automatic fire suppression system* that conforms to 780 CMR 9.

780 CMR 2809.0 MEDICAL GASES

2809.1 Nonflammable medical gases: Nonflammable medical gas systems shall be designed and installed in accordance with Chapter 4 of NFiPA 99 listed in *Appendix A*.

2809.2 Anesthetic systems: Inhalation anesthetic systems shall be designed and installed in accordance with Chapters 3 and 4 of NFiPA 99 listed in *Appendix A*.

780 CMR 2810.0 OXYGEN SYSTEMS

2810.1 General: Nonmedical oxygen systems shall be designed and installed in accordance with NFiPA 50 and NFiPA 51 listed in *Appendix A*.

780 CMR 2811.0 EXISTING BUILDINGS

2811.1 Unsafe orders: All existing mechanical equipment and systems shall be maintained and operated in accordance with the requirements of this code and the BOCA National Mechanical Code listed in *Appendix A*. Any such equipment which does not comply with the requirements, and the operation of which is deemed unsafe to the building occupants, shall be *altered* as ordered by the code official to secure adequate safety.

Note: Also see 780 CMR 3400.6.

780 CMR 2812.0 POWER VENTERS

2812.1 Power vented systems used for the venting of comfort heating and/or comfort cooling appliances: *Power venters are a portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure. Power venting of comfort heating and/or comfort cooling appliances may be accomplished via the use of power venting systems that are separately listed systems or are an integral part of the listed heating or cooling appliances. Such listed systems are equipment that have been tested for intended design conditions by established and recognized agencies regularly engaged in conducting tests or furnishing testing/listing services. Such listed*

equipment will typically bear a plate, label or other means of identification indicating the listing

agency, conditions of operation and other pertinent information.

2812.1.1 Regulations of the Specialized Codes impacting the acceptable design, installation, operation and maintenance of power vented equipment: The Specialized Codes (780 CMR 101.5) including 248 CMR: BOARD OF STATE EXAMINERS OF PLUMBERS AND GAS FITTERS, and 527 CMR: BOARD OF FIRE PREVENTION REGULATIONS, and not enforced by Building Officials but rather enforced by Plumbing/Gas Inspectors and Fire Service Personnel, respectively, have specific criteria imposed on power vented appliances beyond those regulations included herein.

accepted by the manufacturer as qualified to install). Power venters shall be selected to match the venting requirements of the equipment being vented in accordance with the manufacturers' requirements.

2812.2 Automatic safe shutoff: Power venters shall operate in such a manner and be electrically connected to the comfort heating and/or comfort cooling appliances in such a way as to prevent the operation of such appliances when the power venter is not in operation or is not providing sufficient draft for the appliance being vented.

2812.4 Termination: The vent system shall terminate so that proper clearances are maintained in accordance with the requirements of 248 CMR or 527 CMR when applicable or in accordance with the manufacturer's listed requirements when 248 CMR or 527 CMR are not applicable.

2812.3 Installation of power vented equipment: Power vented equipment shall be installed in accordance with the manufacturer's installation manual and instructions (typically, only personnel trained in the installation of such equipment are

2812.5 Other applications of power exhausters: For applications of power exhausters for other than the venting of comfort heating appliances and/or comfort cooling appliances, the requirements of the BOCA Mechanical Code, listed in Appendix A, shall apply, as well as any additional regulatory criteria set forth in any of the Specialized Codes.

2813.0 SOLID FUEL-FIRED APPLIANCES

2813.1 Solid fuel-fired appliances, general: For requirements addressing solid fuel-fired appliances see 780 CMR 3610.6.