

## CHAPTER 14

# HEATING AND COOLING EQUIPMENT AND APPLIANCES

### SECTION M1401

#### GENERAL

**M1401.1 Installation.** Heating and cooling *equipment* and *appliances* shall be installed in accordance with the manufacturer's installation instructions and the requirements of this code.

**M1401.2 Access.** Heating and cooling *equipment* and *appliances* shall be located with respect to building construction and other *equipment* and *appliances* to permit maintenance, servicing and replacement. Clearances shall be maintained to permit cleaning of heating and cooling surfaces; replacement of filters, blowers, motors, controls and vent connections; lubrication of moving parts; and adjustments.

**Exception:** Access shall not be required for ducts, piping, or other components approved for concealment.

**M1401.3 Sizing.** Heating and cooling *equipment* and *appliances* shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

**M1401.4 Exterior installations.** *Equipment* and *appliances* installed outdoors shall be *listed* and *labeled* for outdoor installation. Supports and foundations shall prevent excessive vibration, settlement or movement of the *equipment*. Supports and foundations shall be in accordance with Section M1305.1.4.1.

**M1401.5 Flood hazard.** In flood hazard areas as established by Table R301.2(1), heating and cooling *equipment* and *appliances* shall be located or installed in accordance with Section R322.1.6.

### SECTION M1402 CENTRAL FURNACES

**M1402.1 General.** Oil-fired central furnaces shall conform to ANSI/UL 727. Electric furnaces shall conform to UL 1995.

**M1402.2 Clearances.** Clearances shall be provided in accordance with the *listing* and the manufacturer's installation instructions.

**M1402.3 Combustion air.** *Combustion air* shall be supplied in accordance with Chapter 17. *Combustion air* openings shall be unobstructed for a distance of not less than 6 inches (152 mm) in front of the openings.

### SECTION M1403 HEAT PUMP EQUIPMENT

**M1403.1 Heat pumps.** The minimum unobstructed total area of the outside and return air ducts or openings to a heat pump

shall be not less than 6 square inches per 1,000 Btu/h (13 208 mm<sup>2</sup>/kW) output rating or as indicated by the conditions of the listing of the heat pump. Electric heat pumps shall conform to UL 1995.

**M1403.2 Foundations and supports.** Supports and foundations for the outdoor unit of a heat pump shall be raised at least 3 inches (76 mm) above the ground to permit free drainage of defrost water, and shall conform to the manufacturer's installation instructions.

### SECTION M1404 REFRIGERATION COOLING EQUIPMENT

**M1404.1 Compliance.** Refrigeration cooling *equipment* shall comply with Section M1411.

### SECTION M1405 BASEBOARD CONVECTORS

**M1405.1 General.** Electric baseboard convectors shall be installed in accordance with the manufacturer's installation instructions and Chapters 34 through 43 of this code. Electric baseboard heaters shall be listed and labeled in accordance with UL 1042.

### SECTION M1406 RADIANT HEATING SYSTEMS

**M1406.1 General.** Electric radiant heating systems shall be installed in accordance with the manufacturer's installation instructions and Chapters 34 through 43 of this code and shall be listed for the application.

**M1406.2 Clearances.** Clearances for radiant heating panels or elements to any wiring, outlet boxes and junction boxes used for installing electrical devices or mounting luminaires shall comply with Chapters 34 through 43 of this code.

**M1406.3 Installation of radiant panels.** Radiant panels installed on wood framing shall conform to the following requirements:

1. Heating panels shall be installed parallel to framing members and secured to the surface of framing members or mounted between framing members.
2. Mechanical fasteners shall penetrate only the unheated portions provided for this purpose. Panels shall not be fastened at any point closer than  $\frac{1}{4}$  inch (6.4 mm) to an element. Other methods of attachment of the panels shall be in accordance with the panel manufacturer's instructions.
3. Unless *listed* and *labeled* for field cutting, heating panels shall be installed as complete units.

**M1406.4 Installation in concrete or masonry.** Radiant heating systems installed in concrete or masonry shall conform to the following requirements:

1. Radiant heating systems shall be identified as being suitable for the installation, and shall be secured in place as specified in the manufacturer's installation instructions.
2. Radiant heating panels or radiant heating panel sets shall not be installed where they bridge expansion joints unless protected from expansion and contraction.

**M1406.5 Finish surfaces.** Finish materials installed over radiant heating panels or systems shall be installed in accordance with the manufacturer's installation instructions. Surfaces shall be secured so that nails or other fastenings do not pierce the radiant heating elements.

### SECTION M1407 DUCT HEATERS

**M1407.1 General.** Electric duct heaters shall be installed in accordance with the manufacturer's instructions and Chapters 34 through 43 of this code. Electric duct heaters shall comply with UL 1996.

**M1407.2 Installation.** Electric duct heaters shall be installed so that they will not create a fire hazard. Class 1 ducts, duct coverings and linings shall be interrupted at each heater to provide the clearances specified in the manufacturer's installation instructions. Such interruptions are not required for duct heaters *listed* and *labeled* for zero clearance to combustible materials. Insulation installed in the immediate area of each heater shall be classified for the maximum temperature produced on the duct surface.

**M1407.3 Installation with heat pumps and air conditioners.** Duct heaters located within 4 feet (1219 mm) of a heat pump or air conditioner shall be *listed* and *labeled* for such installations. The heat pump or air conditioner shall additionally be *listed* and *labeled* for such duct heater installations.

**M1407.4 Access.** Duct heaters shall be accessible for servicing, and clearance shall be maintained to permit adjustment, servicing and replacement of controls and heating elements.

**M1407.5 Fan interlock.** The fan circuit shall be provided with an interlock to prevent heater operation when the fan is not operating.

### SECTION M1408 VENTED FLOOR FURNACES

**M1408.1 General.** Oil-fired vented floor furnaces shall comply with UL 729 and shall be installed in accordance with their *listing*, the manufacturer's instructions and the requirements of this code.

**M1408.2 Clearances.** Vented floor furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions.

**M1408.3 Location.** Location of floor furnaces shall conform to the following requirements:

1. Floor registers of floor furnaces shall be installed not less than 6 inches (152 mm) from a wall.

2. Wall registers of floor furnaces shall be installed not less than 6 inches (152 mm) from the adjoining wall at inside corners.
3. The furnace register shall be located not less than 12 inches (305 mm) from doors in any position, draperies or similar combustible objects.
4. The furnace register shall be located at least 5 feet (1524 mm) below any projecting combustible materials.
5. The floor furnace burner assembly shall not project into an occupied under-floor area.
6. The floor furnace shall not be installed in concrete floor construction built on grade.
7. The floor furnace shall not be installed where a door can swing within 12 inches (305 mm) of the grille opening.

**M1408.4 Access.** An opening in the foundation not less than 18 inches by 24 inches (457 mm by 610 mm), or a trap door not less than 22 inches by 30 inches (559 mm by 762 mm) shall be provided for access to a floor furnace. The opening and passageway shall be large enough to allow replacement of any part of the *equipment*.

**M1408.5 Installation.** Floor furnace installations shall conform to the following requirements:

1. Thermostats controlling floor furnaces shall be located in the room in which the register of the floor furnace is located.
2. Floor furnaces shall be supported independently of the furnace floor register.
3. Floor furnaces shall be installed not closer than 6 inches (152 mm) to the ground. Clearance may be reduced to 2 inches (51 mm), provided that the lower 6 inches (152 mm) of the furnace is sealed to prevent water entry.
4. Where excavation is required for a floor furnace installation, the excavation shall extend 30 inches (762 mm) beyond the control side of the floor furnace and 12 inches (305 mm) beyond the remaining sides. Excavations shall slope outward from the perimeter of the base of the excavation to the surrounding *grade* at an angle not exceeding 45 degrees (0.79 rad) from horizontal.
5. Floor furnaces shall not be supported from the ground.

### SECTION M1409 VENTED WALL FURNACES

**M1409.1 General.** Oil-fired vented wall furnaces shall comply with UL 730 and shall be installed in accordance with their *listing*, the manufacturer's instructions and the requirements of this code.

**M1409.2 Location.** The location of vented wall furnaces shall conform to the following requirements:

1. Vented wall furnaces shall be located where they will not cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

- Vented wall furnaces shall not be located where a door can swing within 12 inches (305 mm) of the furnace air inlet or outlet measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this clearance.

**M1409.3 Installation.** Vented wall furnace installations shall conform to the following requirements:

- Required wall thicknesses shall be in accordance with the manufacturer's installation instructions.
- Ducts shall not be attached to a wall furnace. Casing extensions or boots shall be installed only when listed as part of a *listed* and *labeled* appliance.
- A manual shut off valve shall be installed ahead of all controls.

**M1409.4 Access.** Vented wall furnaces shall be provided with access for cleaning of heating surfaces; removal of burners; replacement of sections, motors, controls, filters and other working parts; and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that must be removed for normal servicing operations shall not be attached to the building construction.

## SECTION M1410 VENTED ROOM HEATERS

**M1410.1 General.** Vented room heaters shall be tested in accordance with ASTM E 1509, UL 896 for oil-fired or UL 1482 for solid fuel-fired and installed in accordance with their *listing*, the manufacturer's installation instructions and the requirements of this code.

**M1410.2 Floor mounting.** Room heaters shall be installed on noncombustible floors or *approved* assemblies constructed of noncombustible materials that extend at least 18 inches (457 mm) beyond the *appliance* on all sides.

### Exceptions:

- Listed* room heaters shall be installed on noncombustible floors, assemblies constructed of noncombustible materials or *listed* floor protectors with materials and dimensions in accordance with the *appliance* manufacturer's instructions.
- Room heaters *listed* for installation on combustible floors without floor protection shall be installed in accordance with the *appliance* manufacturer's instructions.

## SECTION M1411 HEATING AND COOLING EQUIPMENT

**M1411.1 Approved refrigerants.** Refrigerants used in direct refrigerating systems shall conform to the applicable provisions of ANSI/ASHRAE 34.

**M1411.2 Refrigeration coils in warm-air furnaces.** Where a cooling coil is located in the supply plenum of a warm-air furnace, the furnace blower shall be rated at not less than 0.5-inch water column (124 Pa) static pressure unless the furnace is *listed* and *labeled* for use with a cooling coil. Cooling coils

shall not be located upstream from heat exchangers unless *listed* and *labeled* for such use. Conversion of existing furnaces for use with cooling coils shall be permitted provided the furnace will operate within the temperature rise specified for the furnace.

**M1411.3 Condensate disposal.** Condensate from all cooling coils or evaporators shall be conveyed from the drain pan outlet to an *approved* place of disposal. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than  $\frac{1}{8}$  unit vertical in 12 units horizontal (1-percent slope). Condensate shall not discharge into a street, alley or other areas where it would cause a nuisance.

**M1411.3.1 Auxiliary and secondary drain systems.** In addition to the requirements of Section M1411.3, a secondary drain or auxiliary drain pan shall be required for each cooling or evaporator coil where damage to any building components will occur as a result of overflow from the *equipment* drain pan or stoppage in the condensate drain piping. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than  $\frac{1}{8}$  unit vertical in 12 units horizontal (1-percent slope). Drain piping shall be a minimum of  $\frac{3}{4}$ -inch (19 mm) nominal pipe size. One of the following methods shall be used:

- An auxiliary drain pan with a separate drain shall be installed under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1.5 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Galvanized sheet steel pans shall have a minimum thickness of not less than 0.0236-inch (0.6010 mm) (No. 24 Gage). Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).
- A separate overflow drain line shall be connected to the drain pan installed with the *equipment*. This overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
- An auxiliary drain pan without a separate drain line shall be installed under the coils on which condensation will occur. This pan shall be equipped with a water level detection device conforming to UL 508 that will shut off the *equipment* served prior to overflow of the pan. The pan shall be equipped with a fitting to allow for drainage. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.
- A water level detection device conforming to UL 508 shall be installed that will shut off the *equipment* served in the event that the primary drain is blocked. The device shall be installed in the primary

drain line, the overflow drain line or the *equipment*-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

**M1411.3.1.1 Water-level monitoring devices.** On down-flow units and all other coils that have no secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the equipment served in the event that the primary drain becomes restricted. Devices shall not be installed in the drain line.

**M1411.3.2 Drain pipe materials and sizes.** Components of the condensate disposal system shall be cast iron, galvanized steel, copper, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing. All components shall be selected for the pressure and temperature rating of the installation. Joints and connections shall be made in accordance with the materials specified in Chapter 30. Condensate waste and drain line size shall be not less than  $\frac{3}{4}$ -inch (19 mm) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an *approved* method.

**M1411.3.3 Appliances, equipment and insulation in pans.** Where *appliances*, *equipment* or insulation are subject to water damage when auxiliary drain pans fill, those portions of the *appliances*, *equipment* and insulation shall be installed above the flood level rim of the pan. Supports located inside of the pan to support the *appliance* or *equipment* shall be water resistant and *approved*.

**M1411.4 Auxiliary drain pan.** Category IV condensing *appliances* shall have an auxiliary drain pan where damage to any building component will occur as a result of stoppage in the condensate drainage system. These pans shall be installed in accordance with the applicable provisions of Section M1411.3.

**Exception:** Fuel-fired *appliances* that automatically shut down operation in the event of a stoppage in the condensate drainage system.

**M1411.5 Insulation of refrigerant piping.** Piping and fittings for refrigerant vapor (suction) lines shall be insulated with insulation having a thermal resistivity of at least R-4 and having external surface permeance not exceeding 0.05 perm [2.87 ng/(s · m<sup>2</sup> · Pa)] when tested in accordance with ASTM E 96.

**M1411.6 Locking access port caps.** Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

## SECTION M1412 ABSORPTION COOLING EQUIPMENT

**M1412.1 Approval of equipment.** Absorption systems shall be installed in accordance with the manufacturer's installation instructions. Absorption equipment shall comply with UL 1995.

**M1412.2 Condensate disposal.** Condensate from the cooling coil shall be disposed of as provided in Section M1411.3.

**M1412.3 Insulation of piping.** Refrigerant piping, brine piping and fittings within a building shall be insulated to prevent condensation from forming on piping.

**M1412.4 Pressure-relief protection.** Absorption systems shall be protected by a pressure-relief device. Discharge from the pressure-relief device shall be located where it will not create a hazard to persons or property.

## SECTION M1413 EVAPORATIVE COOLING EQUIPMENT

**M1413.1 General.** Evaporative cooling equipment and appliances shall comply with UL 1995 and shall be installed:

1. According to the manufacturer's instructions.
2. On level platforms in accordance with Section M1305.1.4.1.
3. So that openings in exterior walls are flashed in accordance with Section R703.8.
4. So as to protect the potable water supply in accordance with Section P2902.
5. So that air intake opening locations are in accordance with Section R303.5.1.

## SECTION M1414 FIREPLACE STOVES

**M1414.1 General.** Fireplace stoves shall be *listed*, *labeled* and installed in accordance with the terms of the listing. Fireplace stoves shall be tested in accordance with UL 737.

**M1414.2 Hearth extensions.** Hearth extensions for fireplace stoves shall be installed in accordance with the *listing* of the fireplace stove. The supporting structure for a hearth extension for a fireplace stove shall be at the same level as the supporting structure for the fireplace unit. The hearth extension shall be readily distinguishable from the surrounding floor area.

## SECTION M1415 MASONRY HEATERS

**M1415.1 General.** Masonry heaters shall be constructed in accordance with Section R1002.