



## RESIDENTIAL FURNACE

### 1. PERMIT INFORMATION:

- The installation of new or replacement of existing furnace equipment and/or duct work requires a Mechanical Permit. The new furnace must be installed in the same location as the current furnace. Otherwise plans must be submitted in person at the Permit Center, Building & Safety Department, 455 E. Calaveras Blvd.
- Refer to the separate handouts for replacement of existing or installation of new air conditioning for additional information.
- A separate permit is required if new or modifications to the existing electrical is required.
- A Building Permit may be issued only to a State of California Licensed Contractor or the Homeowner.
- If the work is performed by the Homeowner personally or by his/her workers, and an inspection indicates the work cannot be completed satisfactorily, then a licensed contractor must perform the work.
- If the Homeowner hires workers, State Law requires the Homeowner to obtain Worker's Compensation Insurance. Proof of this insurance is required prior to inspection.

### 2. INSTALLATION REQUIREMENTS:

- Building Codes:** All work must comply with the 2010 California Building Code, 2010 California Residential Code (CRC), 2010 California Mechanical Code (CMC), 2010 California Electrical Code (CEC), 2010 California Energy Code based upon 2008 Building Energy Efficiency Standards (CEnc) and 2011 Milpitas Municipal Code (MMC).
- General:**
  - Appliances shall comply with applicable nationally recognized standards as evidenced by the listing and label of an approved agency or be approved by the Authority Having Jurisdiction. A list of accepted standards is included in Chapter 17. (CMC 302.1)
  - Appliances shall be installed in accordance with their listing and the manufacturer's instructions [CMC 902.0(A)].
  - Installer shall leave the manufacturer's installation and operating instructions attached to the appliance (CMC 303.1).
  - Appliances shall be securely fastened in place. Supports shall be designed and constructed to sustain vertical and horizontal loads per the Building Code (CMC 303.4).
  - Equipment and appliances shall be accessible for inspection, service, repair and replacement without removing permanent construction. Not less than 30 inches in depth, width and height of working space shall be provided for servicing. (CMC 304.0)
  - Air filters shall be installed in a heating, cooling, or makeup air system. Such filters shall comply with the standard, Air Filter Units, Test Performance of, that is referenced in Chapter 17 (CMC 311.2).
  - Appliances installed on combustible floors must be listed for said installation. (CMC 904.3).
  - Appliances installed in garages and other areas subject to damage shall be guarded with protective barriers or by being elevated or located out of the normal path of vehicles (CMC 307.1).

- Appliances installed in a garage that generates a glow, spark or flame capable of igniting flammable vapors shall be installed with the pilots and burners or heating elements and switches at least 18 inches above the floor level, unless installed in a separate, approved compartment having access only from outside the garage (CMC 307.1).
- For buildings located in flood hazard areas, heating, ventilating, air-conditioning, and other energy-utilizing equipment and appliances shall be elevated at or above the design flood elevation, or shall be designed and installed to prevent water from entering or accumulating within the components and to resist loads and stresses including the effects of buoyancy (CMC 307.2).
- Air exhaust and intake openings shall be located at or above the design flood elevation (CMC 307.2.2).
- Outside or return air shall not be taken from any of the following locations: (CMC 311.3)
  - Closer than 10 feet from an appliance vent outlet, a plumbing drainage vent, or the discharge outlet of an exhaust fan, unless the outlet is 3 feet above the outside air inlet.
  - Where it is less than 10 feet above the surface of any abutting public way, driveway, sidewalk, street, alley or driveway.
  - From an area, the volume of which is less than 50 percent of the entire volume served by such system, provided the balance of the required return air is taken from a room or hall having not less than 3 doors leading to other rooms served by the furnace.
  - A closet, bathroom, toilet room, or kitchen.
  - From rooms or spaces containing fuel burning appliance therein. Where such room or space serves as source of return air. Exceptions:
    - This shall not apply to fireplaces, fireplace appliance, residential cooking appliance, direct vent appliance, enclosed furnaces, and clothes dryers installed within the room or space.
    - This shall not apply to a gravity type or listed vented wall heating or cooling air system.
    - This shall not apply to a blower-type heating or cooling air system complying with the following:
      - Where the return air is taken from a room or space having a volume exceeding one cubic foot for each 10 Btu per hour fuel input rating of all fuel burning appliances therein.
      - Not less than 75 percent of the supply air is discharged back into the same room or space.
      - Return air inlets shall not be located within 10 feet from any appliance firebox or draft diverter in the same enclosed room or confined space.
- Return air from one dwelling unit shall not discharge into another dwelling unit (CMC 311.4).
- Appliances on roofs shall be installed in accordance with CMC 303.8 and 304.1.
- Appliances installed under-floor shall be in accordance with CMC 904.3.1 and 904.11).
- Appliances installed in attics shall be installed in accordance with CMC Section 904.11. Also refer to the separate handout "*Furnace Attic Installation*".
- Wall furnaces shall be installed in accordance with CMC Section 928.0.
- Floor furnaces shall be installed in accordance with CMC Section 912.0.

**□ Location:**

- A furnace may be installed in a bedroom or bathroom if: [CMC 904.1(1)]
  - Installed in a closet located in the bedroom or bathroom, provided the closet is equipped with a listed, gasketed door assembly, a listed, self-closing device, threshold and bottom door seal. All combustion air must be obtained from the outdoors. The closet shall be for the exclusive use of the furnace.
  - The furnace is of the direct-vent type.

❑ **Clearances: (CMC 904.2)**

- Listed central heating furnaces installed in rooms that are large in comparison with the size of the appliance (a room or space having a volume at least 12 times the total volume of the furnace) shall be installed with clearances per the terms of their listings and the manufacturer's instructions.
  - Where the room size in comparison with the size of the appliance is to be calculated, the total volume of the appliance is determined from exterior dimensions and is to include fan compartments and burner vestibules. Where the actual ceiling height of a room is great than 8 feet, the volume of the room is figured on the basis of a ceiling height of 8 feet. [CMC 9020(C)]
- Central heating furnaces installed in rooms that are NOT large (such as alcoves and closets) in comparison with the size of the appliance shall be listed for such installations. Listed clearances shall not be reduced by protection methods, regardless of whether the enclosure is of combustible or noncombustible material.
- Unlisted central heating furnaces installed in rooms that are large in comparison with the size of the appliance shall be installed with clearances not less than those specified in CMC Table 9-1.
- Central heating furnaces (listed and unlisted) installed in rooms that are large in comparison with the size of the appliance shall be permitted to be installed with reduced clearances to combustible material provided the combustible material or appliance is protected as described in CMC Table 3-3.
- Listed central heating furnaces shall have the clearance from supply ducts within 3 feet of the furnace plenum be not less than that specified from the furnace plenum. No clearance is necessary beyond this distance.
- Unlisted central heating furnaces with temperature limit controls that cannot be set higher than 250°F shall have the clearance from supply duct within 6 feet of the furnace plenum be not less than 6 inches. No clearance is necessary beyond this distance. Without temperature limit controls, the clearances from the supply ducts shall be not less than 18 inches from the furnace plenum for the first 3 feet, then 6 inches for the next 3 feet and 1 inch beyond 6 feet.

❑ **Condensate drains:**

- Condensate drains shall be discharged to an approved plumbing fixture or disposal area. If discharged into the drainage system, equipment shall drain by means of an indirect waste pipe. The waste pipe shall have a slope of not less than 1/8 inch per foot or 1 percent slope and shall be of approved corrosion-resistant material not smaller than the outlet size as required in either CMC Section 309.3 or 309.4. Condensate shall not drain over a public way. (CMC 309.1)
- When a cooling coil or unit is located in an attic or furred space where damage may result from condensate overflow, an additional watertight pan of corrosion-resistant metal shall be installed beneath the cooling coil or unit top to catch the overflow condensate due to a clogged primary condensate drain, or one pan with a standing overflow and a separate secondary drain may be provided in lieu of the secondary drain pan. The additional pan or the standing overflow shall be provided with a drain pipe, minimum 3/4 inch, discharging at a point that can be readily observed. (CMC 309.2)
- Condensate waste pipes shall be sized in accordance with equipment capacity as follows assuming a 1/8 inch per foot or 1 percent slope: (CMC 309.3)
  - Up to 20 tons of refrigeration            3/4 inches
  - 21 – 40 tons of refrigeration            1 inch
  - 41 – 90 tons of refrigeration            1 1/4 inches
  - 91 – 125 tons of refrigeration            1 1/2 inches
  - 126-250 tons of refrigeration            2 inches
- Condensate drain lines from condensing appliances shall be sized according to the manufacturer's recommendations (CMC 309.4).

❑ **Electrical:**

- A readily accessible approved disconnect must be installed on the electric supply adjacent to and in sight from the furnace (CMC 308.0) (CEC 440.14).
- A 15 or 20 amp receptacle outlet must be installed at an accessible location for the servicing of the heating and air-conditioning equipment. The receptacle shall be located on the same level and within 25 feet of the equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means. (CMC 308.0) (CEC 210.63)
- Central heat equipment shall be supplied by an individual branch circuit (CEC 422.12).

❑ **Ducts:**

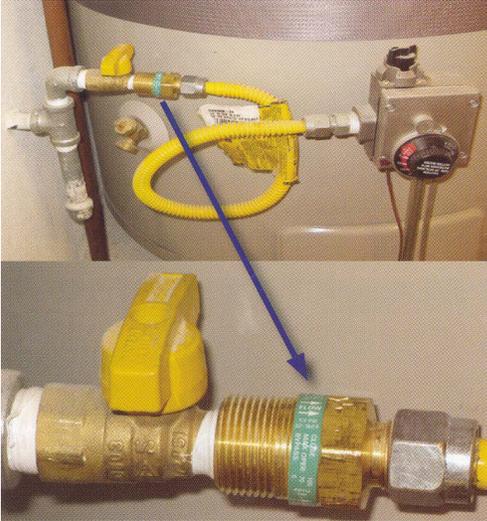
- Duct systems shall be sized in accordance with Air Conditioning Contractors of America (ACCA) Manual D-2002. Duct sizing calculations are not required for existing duct systems. (CMC 601.2).
- Supply air, return air, and outside air shall be conducted through duct systems constructed of metal as set forth in ANSI/SMACNA 006-2006 or other approved duct constructions standard (CMC 602.1).
- Factory made air ducts shall be approved for the use intended or shall conform to the requirements of the referenced standard for air ducts in Chapter 17. Each portion of a factory made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with the referenced standard and its class designation. These ducts shall be listed and shall be installed in accordance with the terms of their listing. Flexible air connectors are not permitted. (CMC 602.3)
- Joints of duct systems shall be made substantially air-tight by means of tapes, mastics, gasketing, or other means. Crimp joints for round ducts shall have a contact lap of at least 1 ½ inches and shall be mechanically fastened by means of at least 3 sheet metal screws equally spaced around the joint. (CMC 602.4)
- Joints and seams for sheet metal shall be in accordance with ANSI/SMACNA 006-2006 (CMC 602.4).
- Joints and seams and all reinforcements for factory-made air ducts and plenums shall meet with the conditions of prior approval in accordance with the installation instructions that shall accompany the product. Closure systems for rigid air ducts and plenums shall be listed in accordance with UL 181A. Closure systems for flexible air ducts shall be listed in accordance with UL 181B. (CMC 602.4)
- Air ducts installed under a floor in a crawl space shall not prevent access to any area of the crawl space and where it is required to move under ducts a minimum vertical clearance of 18 inches shall be provided (CMC 604.1).
- Ducts shall be securely fastened in place at each change of direction and as set forth in the ANSI/SMACNA 006-2006. Riser ducts shall be held in place by means of metal straps or angles and channels to secure the riser to the structure. (CMC 604.2)
- Metal ducts shall be installed with at least 4 inches separation from earth. Metal ducts when installed in or under a concrete slab shall be encased in at least 2 inches of concrete. (CMC 604.2)
- Supports for rectangular ducts, when suspended from above, shall be installed on two opposite sides of each duct and shall be riveted, bolted, or metal screwed to each side of the duct at not more than the intervals specified in ANSI/SMACNA 006-2006 (CMC 604.2).
- Supports for round ducts, when suspended from above, shall be supported at intervals specified in ANSI/SMACNA 006-2006 and shall comply with the following: (CMC 604.2)
  - Ducts shall be equipped with tight-fitting circular bands extending around the entire perimeter of the duct.
  - Circular bands shall be not less than 1 inch wide nor less than equivalent to the gauge of the duct material, except ducts 10 inches and less in diameter may be supported by No. 18 gauge galvanized steel wire.
  - Each circular band shall be provided with a suitable means of connecting to the suspending support.
  - Ducts shall be braced and guyed to prevent lateral or horizontal swing.
- Factory made air ducts shall be installed with at least 4 inches of separation from earth (CMC 604.3).

- Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by approved barriers (CMC 604.4).
- Installers shall provide the manufacturers field fabrication and installation instructions. In the absence of specific supporting materials and spacing, approved factory made air ducts may be installed as set forth in ANSI/SMACNA 006-2006. (CMC 604.5)
- In flood hazard areas, ducts shall be located above the design flood elevation or shall be designed and constructed to prevent water from entering (CMC 604.6).
- Supply air and return air ducts and plenums shall be insulated to a minimum installed level of R-6 (CEnC 150(m)1).
- For the purpose of determining installed R-value of duct wrap, the installed thickness of insulation must be assumed to be 75 percent of the nominal thickness due to compression (CEnC 150(m)5).
- Metal ducts and inner core of flexible ducts shall be mechanically fastened (CEnC 150(m)1).
- Openings shall be sealed with mastic, tape, or other duct-closure system that meets the applicable requirements of UL181, UL181A or UL181B or aerosol sealant that meets the requirements of UL723. If mastic or tape is used to seal openings greater than ¼ inch, the combination of mastic and either mesh or tape shall be used. (CEnC 150(m)1)
- Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board, or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. (CEnC 150(m)1)
- Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts (CEnC 150(m)1).
- Duct systems shall comply with UL181 for ducts and closure systems, including collars, connections, and splices, and be labeled as complying with UL181 (CEnC 150(m)2 & 3).
- All pressure sensitive tapes, mastics, aerosol sealants, heat activated tapes, sealants, mastics or other closure systems shall comply with UL181 and UL181A and UL181B. Mastic sealants and mesh shall be nontoxic and water resistant. Sealants shall be rated for exterior used and tested in accordance with ASTM C731 and D2202, and if for exterior application ASTM C732. Aerosol sealants shall meet the requirements of UL723. (CEnC 150(m)2 & 3).
- Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands or it has on its backing “CEC approved” (CEnC 150(m)2 & 3).
- Draw bands must be either stainless steel worm-drive hose clamps or UV resistant nylon duct ties. Draw bands must have a minimum tensile strength rating of 150 pounds and be tightened as recommended by the manufacturer with an adjustable tensioning tool. (CEnC 150(m)E).

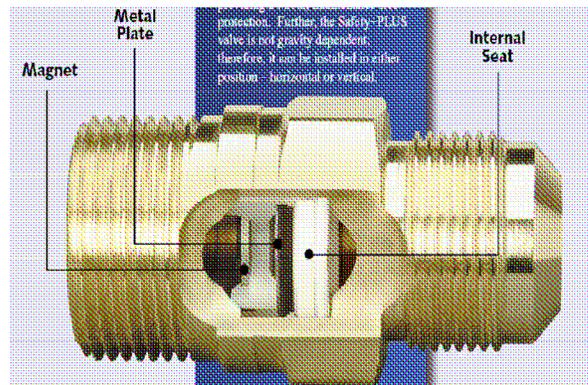
**☐ Gas piping and shut-off vales:**

- A separate plumbing permit is required if a new gas line is required to supply the new furnace. New gas piping must be installed back to the meter or calculations must be provided to show the existing piping is adequately sized.
- It is the responsibility of the installer to verify that the new or existing gas supply is correctly sized before installation. Refer to the separate handout “*Natural Gas Piping*” for additional information.
- Gas connectors must comply with CMC Section 1313.0. Listed flexible gas connectors in compliance with CSA Z21.24, *Standard for Connectors for Gas Appliances* may be used if installed in accordance with their listing. Connectors must be located completely in the same room as the appliance.

- An approved Excess Flow Gas Shut-off Device (non-motion sensitive) shall be installed at the gas fuel appliance outlet when replacing any existing or installing any new gas fuel appliance. The Excess Flow Device shall be installed between the shutoff valve and the connector (see diagram page 8 *not the photo below*). (MMC II-170-2.00)



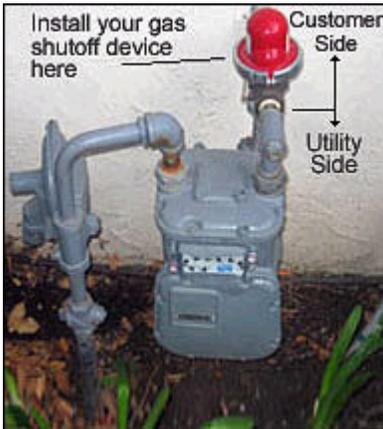
- Close up view of an excess flow device:



- An approved Seismic Gas Shut-off Device (motion sensitive) *or* an approved Excess Flow Gas Shut-off Device (non-motion sensitive) shall be installed downstream of the gas utility meter (after PG&E service tee), but upstream of any appliances, when providing alteration or addition to the existing gas fuel line. (MMC II-170-2.00)

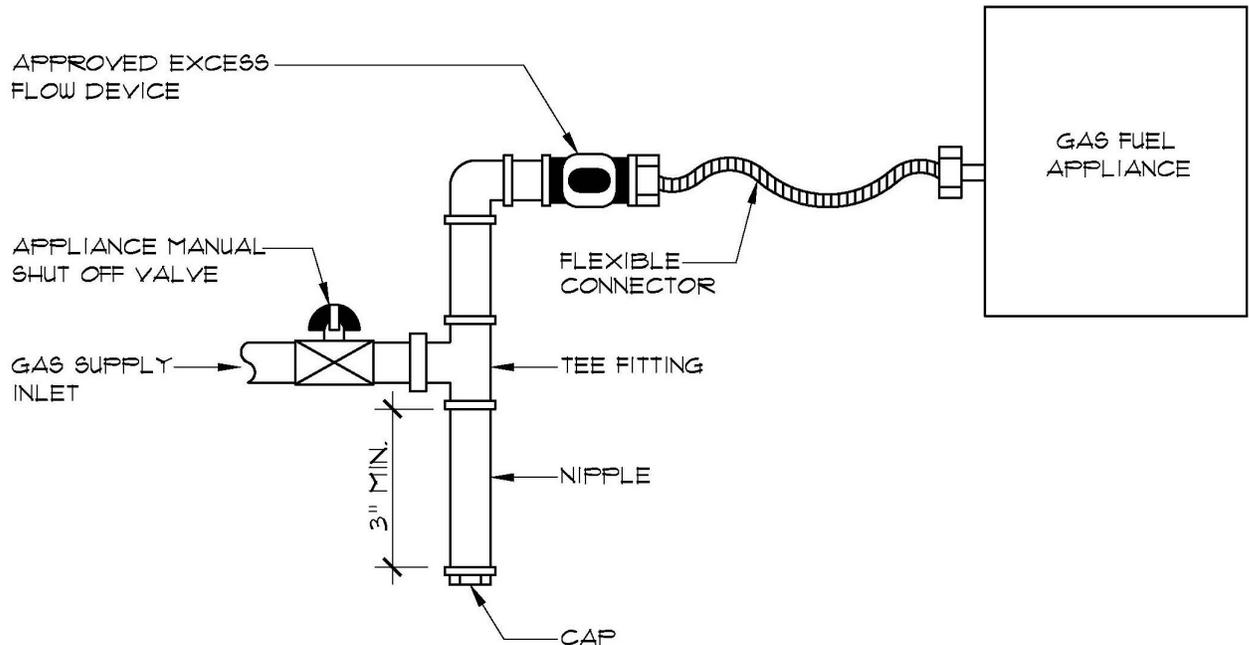


"California Valve"



- Automatic Gas Shut-off Devices shall be installed by a contractor licensed in the appropriate classification by the State of California and in accordance with the manufacturer's instructions.
- Seismic Gas Shut-off Devices (motion sensitive) must be mounted rigidly to the exterior of the building or structure containing the fuel gas piping. This requirement need not apply if the Building and Safety Department determines that the Seismic Gas Shut-off Device (motion sensitive) has been tested and listed for an alternate method of installation.
- Both Seismic Gas Shut-off Devices (motion sensitive) and Excess Flow Gas Shut-off Devices (non-motion sensitive) must be certified by the Office of State Architect and be listed by an approved listing and testing agency such as IAS, IAPMO, UL or the Office of State Architect.
- Both Seismic Gas Shut-off Devices (motion sensitive) and Excess Flow Gas Shut-off Devices (non-motion sensitive) must have a thirty (30) year warranty which warrants that the valve or device is free from defects and will continue to operate properly for thirty (30) years from the date of installation.
- Where Automatic Gas Shut-off Devices are installed voluntarily or as required by code, they shall be maintained for the life of the building or structure or be replaced with a valve or device complying with the requirements of this section.

- Where a sediment trap is not incorporated as a part of the gas appliance, a sediment trap shall be installed as close to the inlet of the appliance as practical at the time of equipment installation. The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated below, or other device recognized as an effective sediment trap. Trap shall be installed after shutoff valve to allow for draining. Sediment traps are not required on illuminating appliances, ranges, clothes dryers, decorative vented appliances for installation in vented fireplaces, gas fireplaces, and outdoor grills. (CMC 1312.6.3)



☐ Combustion air:

- Most furnaces vent by gravity, their flue gases are lighter than the air in the environment in which the combustion occurs so they naturally rise up in a vent that is open to the atmosphere at the top. The open draft hood on the top of the furnace allows additional air to dilute the flue gases. Insufficient combustion air is hazardous. If there is not sufficient oxygen to fully burn the fuel at the correct temperature, deadly carbon monoxide will also be a product of combustion. If the air pressure in the water heater space is lower than that in the vent, products of combustion might “spill” out of the draft hood and enter the interior environment.
- Air for combustion, ventilation, and dilution of flue gases for gas utilization equipment installed in buildings shall be obtained by application of one of the methods below. Gas utilization equipment of other than natural draft (direct-vent) and Category I vented appliances shall be provided with combustion, ventilation, and dilution air in accordance with the equipment manufacturer’s instructions. Where infiltration does not provide the necessary air, outdoor air shall be introduced in accordance with methods below. (CMC 701.1.1).
- Makeup air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements (CMC 701.1.4).
- Combustion air must be provided per CMC Section 701.0. When the appliance is located in a large room or space (e.g. garage) the combustion air may come from that area. When located in a closet, combustion air must be provided by one or more openings between the closet and a large room or space, directly to the outside, to an area that communicates directly with the outside, or a combination of these. The following are minimum opening requirements:

Indoor air:

- All air from indoors by infiltration (appliance in same room) – the room must have a minimum 50 cubic feet per 1,000 Btu/hour of all appliances. Indoor rooms must have sufficient infiltration from the outdoors to continuously replenish the indoor air. The rate of infiltration is dependent on the number and size of gaps and cracks around openings in the building. Buildings of Unusually Tight Construction (less than 40% air changes per hour) require calculations of the infiltration rate (CMC 701.2)
- Openings used to connect indoor spaces on the same story – each opening shall have a free area of not less than 1 square inch/1,000 Btu/hour of the total input rating of all gas appliances in the space, but not less than 100 square inches. One opening shall commence within 12 inches of the top, and one opening shall commence within 12 inches of the bottom of the enclosure. The minimum dimension of the air openings shall not be less than 3 inches. [CMC 701.3.1(1)]
- Openings used to connect indoor spaces on different stories – the volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or more openings in doors or floors having a total free area of not less than 2 square inches/1,000 Btu/hour of the total input rating of all gas appliances in the space [CMC 701.3.1(2)]
- Combustion, ventilation and dilution air shall not be obtained only from a bedroom or bathroom unless the bedroom or bathroom has the required volume in accordance with CMC Section 701.2 [CMC 902.0(B)].
- Outdoor air – Outdoor combustion air shall be provided through opening(s) to the outdoors in accordance with the following. The minimum dimension of the air opening(s) shall not be less than 3 inches. (CMC 701.4)
  - Two permanent openings, one within 12 inches of the top and one within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors as follows:
    - Where directly communicating with the outdoors or where communicating through vertical ducts, each opening shall have a free area of not less than 1 square inch/4,000 Btu/hour of total input rating of all appliances in the enclosure.
    - Where communicating with the outdoors through horizontal ducts, each opening shall have a free area of not less than 1 square inch/2,000 Btu/hour of total input rating of all appliances in the enclosure.
  - One permanent opening, commencing within twelve inches of the top of the enclosure. The appliance shall have clearances of not less than 1 inch from the sides and back and 6 inches from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of:
    - 1 square inch/3,000 Btu/hour of total input rating of all appliances in the enclosure, and not less than the sum of the areas of all vent connectors in the space.

- Combination of indoor and outdoor combustion air shall be in accordance with the following: (CMC 701.5)
  - Indoor openings shall comply with the requirements for indoor air above.
  - Outdoor openings shall comply with the requirements for outdoor air above.
  - The outdoor openings size shall be calculated as follows:
    - The ratio of interior spaces shall be the available volume of communicating spaces divided by the required volume.
    - The outdoor size reduction factor shall be one (1) minus the ratio of interior spaces.
    - The minimum size of outdoor openings shall be the full size of outdoor openings calculated in accordance with the requirements for outdoor air above (one or two openings), multiplied by the reduction factor. The dimension of air openings shall not be less than 3 inches.
- Mechanical air supply – where combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 cubic feet/min per 1,000 Btu/hour for all appliances located in the space (CMC 701.7).
  - Where exhaust fans are installed, additional air shall be provided to replace the exhausted air.
  - Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation.
  - Where combustion air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air.
- Louvers, grilles and screens: (CMC 701.9)
  - The required size of openings shall be based on the net free area of each opening. Where the free area through a louver or grille is known, it shall be used. Where the design and free area are not known, it shall be assumed that wood louvers will have a 25 percent free area and metal louvers and grilles will have a 75 percent free area. Non-motorized louvers and grilles shall be fixed in the open position.
  - Screens shall be not less than ¼ inch mesh.
  - Motorized louvers shall be interlocked with the appliance.
- Combustion air ducts: (CMC 701.10)
  - Ducts shall be of galvanized steel or a material having equivalent corrosion resistance, strength, and rigidity. Within dwelling units, unobstructed stud and joist spaces shall be prohibited from conveying combustion air, provided that not more than one fireblock is removed.
  - Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances.
  - Ducts shall serve a single space.

- Ducts shall not service both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
- Ducts shall not be screened where terminating in an attic space.
- Intakes for combustion air ducts located exterior to the building shall have the lowest side of the combustion air intake openings located at least 12 inches vertically from the adjoining finished grade level.
- Horizontal upper combustion air ducts shall not slope downward toward the source of combustion air.

Vents shall be as follows:

- A venting system shall be designed and constructed to develop a positive flow adequate to remove flue or vent gases to the outside atmosphere (CMC 802.3.1). The venting system shall satisfy the draft requirements of the appliance in accordance with the terms of its listing and the manufacturer's instructions (CMC 802.3.2). Refer to Table 8-15 for capacity of existing asbestos cement vent pipe.
- Type B gas vent is a vent for venting listed gas appliances with draft hoods and other Category I appliances listed for use with Type B gas vents (CPC 502.9).
- Type L gas vent is a vent for venting appliances listed for use with type L vents and appliances listed for use with Type B gas vents (CPC 502.10).
- Single-wall metal pipe shall not be used as a vent in dwellings and residential occupancies (CMC 802.7.4.1).
- For sizing an individual gas vent for a single, draft-hood-equipped appliance, the effective area of the vent connector and the gas vent shall be at least the area of the appliance draft hood outlet but no larger than seven times the draft hood outlet area [CPC 510.6.3.1(3)]. Vents for two draft-hood-equipped appliances shall be the size of the larger draft hood outlet area plus 50 percent of the smaller draft hood outlet area [CMC 802.6.3.1(4)].
- Type B or L vents shall extend in a generally vertical direction with offsets not exceeding 45 degrees, except that a vent system having not more than one 60 degree offset shall be permitted. Any angle greater than 45 degrees from the vertical is considered horizontal. The total horizontal distance of a vent plus the horizontal vent connector serving draft-hood-equipped appliances shall not exceed 75 percent of the vertical height of the vent. (CMC 802.6.1.1)
- Type B and L vents shall terminate at least 5 feet in vertical height above the highest connected appliance draft hood or flue collar (CMC 802.6.2.1).
- Type B-W gas vent shall terminate at least 12 feet in vertical height above the bottom of the wall furnace (CMC 802.6.2.2).
- Screws, rivets and other fasteners shall not penetrate the inner wall of double wall vents (CPC 510.6.1.2).
- The vent passing through a roof shall extend through the entire roof flashing, roof jack, or roof thimble and be terminated with a listed termination cap (CMC 802.6.1).
- A vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as permitted in CMC 802.2.5 and 802.3.4 (CMC 802.6.2.3).

- The vent shall terminate a minimum 12" (more if roof slope exceeds 6:12) above the roof (measured from the high side of the roof where the vent passes through to the lowest discharge opening) or 2 feet above a vertical wall or similar obstruction within 8 feet. (CMC 802.6.2)
  - A vent shall terminate at least 3 feet above a force air inlet located within 10 feet (CMC 802.6.2.6).
  - Direct vent appliances shall terminate in accordance with CMC 802.8.3.
  - Mechanical draft systems shall be installed in accordance with CMC 802.3.4.
  - Vents serving gas appliances located on more than one floor shall be sized and installed in accordance with CMC Section 802.6.4.
  - Vents must be supported and spaced in accordance with their listing and the manufacturer's instructions (CMC 802.6.5)
- Vent connectors shall be installed as follows:
- A vent connector shall be used to connect the water heater to the vent, unless the vent connects directly to the heater (CMC 802.10.1).
  - Vent connectors for listed gas appliances with draft hoods that are not installed in attics, crawl spaces, or other unconditioned areas shall be: (CMC 802.10.2.4)
    - Type B or L vent material.
    - Galvanized sheet steel at least 0.018 inches thick.
    - Aluminum (1100 or 3003 alloy or equivalent) sheet at least 0.027 inches thick.
    - Stainless steel sheet at least 0.012 inches thick.
    - Smooth interior wall metal pipe having resistance to heat and corrosion equal to or exceeding that of the galvanized, aluminum or stainless material listed above.
    - Listed vent connector.
  - Listed single-wall vent connectors may be used but must be located in the same room as the heater (CMC 802.7.4.3).
  - Single wall metal pipe shall not originate in any unoccupied attic or concealed space (CMC 802.7.4.3).
  - A vent connector shall not pass through any ceiling, floor, or fire-resistance-rated wall. A single-wall metal pipe shall not pass through any interior wall. A vent connector made of Type B material and serving a heater with a draft-hood may pass through walls if clearance to combustibles is maintained. (CMC 802.10.14)
  - Where two or more openings are provided into one vent, the openings shall either be at different levels, or the connectors shall be attached to the vertical portion of the vent at an angle of 45 degrees or less relative to the vertical. Where two or more connectors enter a common vent, the smaller connector shall enter at the highest level possible consistent with the available headroom or clearance to combustible material. Vent connectors serving natural draft venting appliances shall not be connected to a vent serving other appliances operating under positive static pressure. (CMC 802.10.4)
  - The minimum clearances from single wall metal connectors and combustibles shall be 6". The clearances from Type B connectors shall be per its listing. (CMC 802.10.5)
  - Connectors shall be installed so as to avoid turns or bends (CMC 802.10.6).

- Vent connector shall be as short as practical and the water heater located as close as practical to the vent. The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the vent. The maximum horizontal length of a type B connector shall be 100 percent of the height of the vent. The maximum length of an individual connector for a vent system serving multiple appliances, from the appliance outlet to the junction with the common vent or another connector, shall be 100 percent of the height of the vent. (CMC 802.10.9)
- Joints between sections of vent connector piping and connections to flue collars or draft hood outlets shall be fastened by sheet metal screws, in accordance with the manufacturer's instructions, or other approved means (CMC 802.10.7).
- Vent connectors shall be installed without any dips or sags and shall slope upward toward the vent not less than 1/4 inch per foot (CMC 802.10.8).
- Vent connectors shall be supported for the design and weight of the material employed to maintain clearances and prevent physical damage and separation of joints (CMC 802.10.10).
- Vent connectors serving two draft-hood equipped appliances shall be at least the area of the larger vent connector plus 50 percent of the areas of small flue collar outlets (CMC 802.10.3.4).
- Vent connector for an appliance with a single draft hood outlet shall be the size of the flue collar. The size of the connector when there is more than one outlet or more than one appliance served by a common connector shall be in accordance with CMC Section 803. (CMC 802.10.3)

### 3. **ENERGY REQUIREMENTS:**

- Low-rise residential buildings must comply with all applicable mandatory measures of the California Energy Code, including setback thermostats. Refer to the attached form MF-1R for a list of the mandatory requirements.
- Equipment must comply with the minimum equipment efficiencies listed on the attached CF-1R-ALT-HVAC form.
  - Minimum AFUE (Annual Fuel Utilization Efficiency) of all new gas fueled central furnaces must be at least 78% for equipment with output capacity less than 225,000 Btu/hr per prescriptive requirements for zone 4.
- Title 24 Energy Compliance Reports:** The following forms must be filled out and submitted with the permit application, or for online permits, attached to the permit:
  - Mandatory Measures form MF-1R.
  - Certificate of Compliance form CF-1R ALT-HVAC.
  - Installation Certificate CF-6R-MECH-04.

### 4. **INSPECTION PROCEDURES:**

- A rough inspection shall be scheduled if any work is inside walls or ceilings and will be covered with finish materials. A final inspection should be scheduled after all work is complete. For each inspection, the Permit Card with the Energy Compliance Report forms completely filled out and attached, and the Approved Job Copy of the Drawings (if any) must be presented to the inspector. Permits expire 180 days after issuance or last inspection passed, whichever is the latest.

### 5. **QUESTIONS:**

- If you have any questions regarding your project contact the Building & Safety Department at (408) 586-3240.

# Requirements for Contractor and Demolition Professionals

## THE Mercury Thermostat Collection Act OF 2008

The Mercury Thermostat Collection Act of 2008 requires construction and demolition professionals to properly remove and dispose of out-of-service mercury-added thermostats.

### Effective July 1, 2009, the law requires the following:

Contractors who install heating, ventilation, and air-conditioning components are required to:

- Handle and transport out-of-service mercury-added thermostats in accordance with the Universal Waste Regulations found in CA Code of Regulations, Title 22, Chapter 23.
- Take out-of-service mercury-added thermostats to a collection location that is operated in accordance with Universal Waste Regulations.

Persons engaged in building demolition are required to:

- Remove out-of-service mercury-added thermostats prior to demolition in accordance with all applicable California regulations.
- Handle and transport out-of-service mercury-added thermostats in accordance with the Universal Waste Regulations found in CA Code of Regulations, Title 22, Chapter 23.
- Take out-of-service mercury-added thermostats to a collection location that is operated in accordance with Universal Waste Regulations.



Collection bins for out-of-service mercury-added thermostats are required by law to be provided at HVAC wholesaler locations in California. To find a HVAC wholesaler near you, visit <http://www.thermostat-recycle.org><sup>1</sup>.

Collection bins may also be found at local government agency household hazardous waste (HHW) collection facilities. To find a HHW collection facility near you, visit <http://www.dtsc.ca.gov/HazardousWaste/UniversalWaste/HHW.cfm>

**Failure to comply with this law may result in penalties of up to twenty-five thousand dollars (\$25,000) for each separate violation or, for continuing violations, for each day that a violation continues.**

Learn more about the law and the obligations for contractors and building demolition at: [http://www.dtsc.ca.gov/HazardousWaste/Mercury\\_Therm\\_Act.cfm](http://www.dtsc.ca.gov/HazardousWaste/Mercury_Therm_Act.cfm)

For questions/concerns, contact DTSC at [thermostats@dtsc.ca.gov](mailto:thermostats@dtsc.ca.gov) or DTSC's Regulatory Assistance Officers at **800-72-TOXIC (800-728-6942)**.

<sup>1</sup> The link provides additional information that may be useful or interesting and is being provided consistent with the intended purpose of the Mercury Thermostat Collection Act. However, DTSC cannot attest to the accuracy of information provided by this link or any other linked site. Providing links to a non-DTSC Web site does not constitute an endorsement by DTSC or any of its employees of the sponsors of the site or the information or products presented on the site.



Department of  
Toxic Substances  
Control



# CITY OF MILPITAS

## BUILDING AND SAFETY DEPARTMENT

455 East Calaveras Boulevard, Milpitas, CA 95035-5479 – Tel. 408.586.3240, Fax 408.586.3285

[www.ci.milpitas.ca.gov](http://www.ci.milpitas.ca.gov)

### **2008 Building Energy Efficiency Standards Residential HVAC Alterations Climate Zone 4**

#### **BUSINESS AND PROFESSIONS CODE, SECTION 7110**

Willful or deliberate disregard and violation of the building laws, including the California Building Code, and local permit requirements constitutes a cause for disciplinary action from the Contractors State License Board working in conjunction with the local building department. This action may consist of fines up to \$5,000 per violation or suspension/revocation of a contractor's license.

#### **WHEN IS A PERMIT REQUIRED?**

A written construction permit shall be obtained from the enforcement agency prior to the erection, construction, reconstruction, installation, relocation, or alteration of any mechanical system, except as permitted in Appendix Chapter 1, Section 112.2 of the 2007 California Mechanical Code. Projects requiring permits include, but are not limited to:

- New HVAC installation
- HVAC Changeout
- Replacement of furnace, coil, FAU, or condenser
- Relocation of an existing HVAC unit
- Adding or replacing more than 40 ft. ducting in unconditioned space

#### **2008 BUILDING ENERGY EFFICIENCY STANDARDS (Tile 24, Part 6) REQUIREMENTS INCLUDE:**

1. Heating equipment must have a minimum 78% AFUE (Exception: Wall & floor furnaces; room heaters).
2. Central air conditioners & heat pumps less than 65,000 Btu/hr must have a minimum 13 SEER.
3. Newly installed or replaced ducts must have a minimum insulation value of R-4.2.
4. A setback type thermostat (24 hr clock with four set points) is required for all alterations.
5. New or replacement ducts must meet the mandatory requirements of Section 150(m):
  - All joints and openings in the HVAC system must be sealed.
  - Only UL 181, UL 181A or UL181B approved types or mastic shall be used to seal duct openings.
  - Connections of metal ducts and the inner core of flex ducts shall be mechanically fastened. Flex ducts must be connected using a metal sleeve/coupling.
  - Flex ducts that are suspended must be supported every 4 ft. max for horizontal runs with no more than 2" of sag between supports and 6 ft. max for vertical runs.
6. The **CF-6R-MECH-04** must be completed and signed by the installing contractor. The Inspector will collect this form and verify that the model numbers are the same as the installed equipment.

# Mandatory Measures Summary

MF-1R

## Residential

Site Address:

Enforcement Agency:

City of Milpitas

Date:

*NOTE: Low-rise residential buildings subject to the Standards must comply with all applicable mandatory measures listed, regardless of the compliance approach used. More stringent energy measures listed on the Certificate of Compliance (CF-1R, CF-1R-ADD, or CF-1R-ALT Form) shall supersede the items marked with an asterisk (\*) below. This Mandatory Measures Summary shall be incorporated into the permit documents and the applicable features shall be considered by all parties as minimum component performance specifications whether they are shown elsewhere in the documents or in this summary. Submit all applicable sections of the MF-1R Form with plans.*

## DESCRIPTION

### Space Conditioning, Water Heating and Plumbing System Measures:

§110-§113: HVAC equipment, water heaters, showerheads, faucets and all other regulated appliances are certified by the Energy Commission.

§113(c)5: Water heating recirculation loops serving multiple dwelling units and High-Rise residential occupancies meet the air release valve, backflow prevention, pump isolation valve, and recirculation loop connection requirements of §113(c)5.

§115: Continuously burning pilot lights are prohibited for natural gas: fan-type central furnaces, household cooking appliances (appliances with an electrical supply voltage connection with pilot lights that consume less than 150 Btu/hr are exempt), and pool and spa heaters.

§150(h): Heating and/or cooling loads are calculated in accordance with ASHRAE, SMACNA or ACCA.

§150(i): Heating systems are equipped with thermostats that meet the setback requirements of Section 112(c).

§150(j)1A: Storage gas water heaters rated with an Energy Factor no greater than the federal minimal standard are externally wrapped with insulation having an installed thermal resistance of R-12 or greater.

§150(j)1B: Unfired storage tanks, such as storage tanks or backup tanks for solar water-heating system, or other indirect hot water tanks have R-12 external insulation or R-16 internal insulation where the internal insulation R-value is indicated on the exterior of the tank.

§150(j)2: First 5 feet of hot and cold water pipes closest to water heater tank, non-recirculating systems, and entire length of recirculating sections of hot water pipes are insulated per Standards Table 150-B.

§150(j)2: Cooling system piping (suction, chilled water, or brine lines), and piping insulated between heating source and indirect hot water tank shall be insulated to Table 150-B and Equation 150-A.

§150(j)2: Pipe insulation for steam hydronic heating systems or hot water systems >15 psi, meets the requirements of Standards Table 123-A.

§150(j)3A: Insulation is protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind.

§150(j)3A: Insulation for chilled water piping and refrigerant suction lines includes a vapor retardant or is enclosed entirely in conditioned space.

§150(j)4: Solar water-heating systems and/or collectors are certified by the Solar Rating and Certification Corporation.

### Ducts and Fans Measures:

§150(m)1: All air-distribution system ducts and plenums installed, are sealed and insulated to meet the requirements of CMC Sections 601, 602, 603, 604, 605 and Standard 6-5; supply-air and return-air ducts and plenums are insulated to a minimum installed level of R-4.2 or enclosed entirely in conditioned space. Openings shall be sealed with mastic, tape or other duct-closure system that meets the applicable requirements of UL 181, UL 181A, or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

§150(m)1: Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.

§150(m)2D: Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and draw bands.

§150(m)7: Exhaust fan systems have back draft or automatic dampers.

§150(m)8: Gravity ventilating systems serving conditioned space have either automatic or readily accessible, manually operated dampers.

§150(m)9: Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

§150(m)10: Flexible ducts cannot have porous inner cores.

§150(o): All dwelling units shall meet the requirements of ANSI/ASHRAE Standard 62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. Window operation is not a permissible method of providing the Whole Building Ventilation required in Section 4 of that Standard.

**Simplified Prescriptive Certificate of Compliance: 2008 Residential HVAC Alterations** CF-1R-ALT-HVAC

Climate Zones 1 and 3 - 7

<b>Site Address:</b>		<b>Enforcement Agency:</b>		<b>Date:</b>	<b>Permit #:</b>
<b>Equipment Type<sup>1</sup></b>	<b>List Minimum Efficiency<sup>2</sup></b>		<b>Conditioned Floor Area</b>	<b>Duct insulation requirement</b>	<b>Thermostat</b>
<input type="checkbox"/> Packaged Unit <input type="checkbox"/> Furnace <input type="checkbox"/> Indoor Coil <input type="checkbox"/> Condensing Unit <input type="checkbox"/> Other _____	<input type="checkbox"/> AFUE _____ <input type="checkbox"/> SEER _____ <input type="checkbox"/> EER _____	<input type="checkbox"/> COP _____ <input type="checkbox"/> HSPF _____ <input type="checkbox"/> Resistance _____	Served by system _____ sf	Over 40 ft of ducts added or replaced in unconditioned space <input type="checkbox"/> R 6 (CZ 1, 3-5)	<input type="checkbox"/> Setback <i>(If not already present, must be installed)</i>
1. <b>Equipment Type:</b> Choose the equipment being installed; if more than one system, use another CF-1R-ALT-HVAC for each system. 2. <b>Minimum Equipment Efficiencies:</b> 13 SEER, 78% AFUE, 7.7HSPF for typical residential systems.					
<b>Contractor (Documentation Author's /Responsible Designer's Declaration Statement)</b> <ul style="list-style-type: none"> <li>I certify that this Certificate of Compliance documentation is accurate and complete.</li> <li>I am eligible under Division 3 of the California Business and Professions Code to accept responsibility for the design identified on this Certificate of Compliance.</li> <li>I certify that the energy features and performance specifications for the design identified on this Certificate of Compliance conform to the requirements of Title 24, Parts 1 and 6 of the California Code of Regulations.</li> <li>The design features identified on this Certificate of Compliance are consistent with the information documented on other applicable compliance forms, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with the permit application.</li> </ul>					
Name:			Signature:		
Company:				Date:	
Address:				License:	
City/State/Zip:				Phone:	

Site Address:	Enforcement Agency:	Permit Number:
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**Space Conditioning Systems**

*Heating Equipment*

Equip Type (package-heat pump)	CEC Certified Mfr. Name and Model Number	ARI Reference Number <sup>2</sup>	# of Identical Systems	Efficiency (AFUE, etc.) <sup>1,3</sup> (≥CF-1R value) <sup>4</sup>	Duct Location (attic, crawl-space, etc.)	Duct R-value	Heating Load (Btu/hr)	Heating Capacity (Btu/hr)

*Cooling Equipment*

Equip Type (package heat pump)	CEC Certified Mfr. Name and Model Number	ARI Reference Number <sup>2</sup>	# of Identical Systems	Efficiency (SEER and EER) <sup>1,3</sup> (≥CF-1R value) <sup>4</sup>	Duct Location (attic, crawl-space, etc.)	Duct R-value	Cooling Load (Btu/hr)	Cooling Capacity (Btu/hr)

1. If project is new construction, see Footnotes to Standards Table 151-B and Table 151-C for duct ceiling alternative compliance.
2. ARI Reference Number can be found by entering the equipment model number at <http://www.aridirectory.org/ari/ac.php#>
3. Listed efficiency on this page must be greater than or equal (≥) to the value shown on the CF-1R form.
4. When CF-1R is reference it is also applicable to the CF-1R, CF-1R-AA or CF-1R-ALT

**ALL BOXES MUST BE CHECKED TO BE A VALID FORM**

- §110-§113: HVAC equipment is certified by the California Energy Commission.
- §150(h): Heating and/or cooling loads calculated in accordance with ASHRAE, SMACNA, or ACCA.
- §150(i): Setback Thermostat on all applicable heating and/or cooling systems meet the requirements of §112(c).
- §150(j)2: Pipe insulation for cooling system refrigerant suction, chilled water and brine lines meets minimum requirements of Table 150-B and includes a vapor retardant or is enclosed entirely in conditioned space.

<b>INSTALLATION CERTIFICATE</b>		<b>CF-6R-MECH-04</b>
<b>Space Conditioning Systems, Ducts and Fans</b>		<b>(Page 2 of 2)</b>
<b>Site Address:</b>	<b>Enforcement Agency:</b>	<b>Permit Number:</b>

**Ducts and Fans**

§150(m): Duct and Fans

- 1. All air-distribution system ducts and plenums installed, sealed and insulated to meet the requirements of CMC Sections 601, 602, 603, 604, 605 and Standard 6-5; supply-air and return-air ducts and plenums are insulated to a minimum installed level of R-4.2 or enclosed entirely in conditioned space. Openings shall be sealed with mastic, tape or other duct-closure system that meets the applicable requirements of UL 181, UL 181A, or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used; and
- 1. Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.
- 2D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and draw bands.
- 7. Exhaust fan systems have back draft or automatic dampers.
- 8. Gravity ventilating systems serving conditioned space have either automatic or readily accessible, manually operated dampers.
- 9. Protection of Insulation. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
- 10. Flexible ducts cannot have porous inner cores.

**DECLARATION STATEMENT**

- I certify under penalty of perjury, under the laws of the State of California, the information provided on this form is true and correct.
- I am eligible under Division 3 of the Business and Professions Code to accept responsibility for construction, or an authorized representative of the person responsible for construction (responsible person).
- I certify that the installed features, materials, components, or manufactured devices identified on this certificate (the installation) conforms to all applicable codes and regulations, and the installation is consistent with the plans and specifications approved by the enforcement agency.
- I reviewed a copy of the Certificate of Compliance (CF-1R) form approved by the enforcement agency that identifies the specific requirements for the installation. I certify that the requirements detailed on the CF-1R that apply to the installation have been met.
- **I will ensure that a completed, signed copy of this Installation Certificate shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a signed copy of this Installation Certificate is required to be included with the documentation the builder provides to the building owner at occupancy.**

Company Name: (Installing Subcontractor or General Contractor or Builder/Owner)		
Responsible Person's Name:		Responsible Person's Signature:
CSLB License:	Date Signed:	Position With Company (Title):