

# 2016

## **BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS**

**FOR THE 2016 BUILDING  
ENERGY EFFICIENCY  
STANDARDS**

**TITLE 24, PART 6, AND ASSOCIATED  
ADMINISTRATIVE REGULATIONS  
IN PART 1.**



JUNE 2015  
CEC-400-2015-037-CMF

**CALIFORNIA ENERGY COMMISSION**  
Edmund G. Brown Jr., Governor

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## SECTION 120.3 – REQUIREMENTS FOR PIPE INSULATION

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.3(a) through 120.3(c).

(a) **General Requirements.** The piping conditions listed below for space-conditioning and service water-heating systems with fluid temperatures listed in TABLE 120.3-A, shall have the amount of insulation specified in Subsection (c):

1. **Space Cooling Systems.** All refrigerant suction, chilled water and brine lines.
2. **Space Heating Systems.** All steam, steam condensate and hot water lines.
3. **Service water-heating systems.**
  - A. Recirculating system piping, including the supply and return piping of the water heater.
  - B. The first 8 feet of hot and cold outlet piping for a nonrecirculating storage system.
  - C. The inlet pipe between the storage tank and a heat trap in a nonrecirculating storage system.
  - D. Pipes that are externally heated.

Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in TABLE 120.3-A, and shall be rounded to the nearest 1/100 Btu-inch per hour per square foot per °F.

(b) **Insulation Protection** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind, including but not limited to, the following:

1. Insulation exposed to weather shall be installed with a cover suitable for outdoor service. The cover shall be water retardant and provides shielding from solar radiation that can cause degradation of the material.
2. Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall have a Class I or Class II vapor retarder. All penetrations and joints of which shall be sealed.

(c) **Insulation Thickness**

1. For insulation with a conductivity in the range shown in TABLE 120.3-A for the applicable fluid temperature range, the insulation shall have the applicable thickness shown in TABLE 120.3-A.
2. For insulation with a conductivity outside the range shown in TABLE 120.3-A for the applicable fluid temperature range, the insulation shall have a minimum thickness as calculated with:

*INSULATION THICKNESS EQUATION*

$$T = PR \left[ \left( 1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

- T = Minimum insulation thickness for material with conductivity *K*, inches.
- PR = Pipe actual outside radius, inches.
- t = Insulation thickness from TABLE 120.3-A, inches.
- K = Conductivity of alternate material at the mean rating temperature indicated in TABLE 120.3-A for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.
- k = The lower value of the conductivity range listed in TABLE 120.3-A for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

TABLE 120.3-A PIPE INSULATION THICKNESS

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)					
			< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger	
			INSULATION THICKNESS REQUIRED (in inches)					
Space heating, Hot Water systems (steam, steam condensate and hot water) and Service Water Heating Systems (recirculating sections, all piping in electric trace tape systems, and the first 8 feet of piping from the storage tank for nonrecirculating systems)								
Above 350	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0	
251-350	0.29-0.32	200	3.0	4.0	4.5	4.5	4.5	
High Pressure Vapor 201-250	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0	
141-200	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0	
Liquid 105-140	0.22-0.28	100	1.0	1.5	1.5	1.5	1.5	
Space cooling systems (chilled water, refrigerant and brine)								
Low Pressure Vapor 40-60	0.21-0.27	75	Nonres 0.5	Res 0.75	Nonres 0.5	Res 0.75	1.0	1.0
Below 40	0.20-0.26	50	1.0		1.5		1.5	1.5

**EXCEPTION 1 to Section 120.3:** Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

**EXCEPTION 2 to Section 120.3:** Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.

**EXCEPTION 3 to Section 120.3:** Gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.

**EXCEPTION 4 to Section 120.3:** Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.

**EXCEPTION 5 to Section 120.3:** Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing.