THE CALIFORNIA ENERGY COMMISSION | EFFICIENCY DIVISION

Refrigerated Warehouses

When do the Standards Apply?

The *2016 Building Energy Efficiency Standards, Title 24, Part 6* **(Energy Code)** apply to all refrigerated warehouses and refrigerated spaces served by a single refrigeration system where the sum of the refrigerated spaces is greater than or equal to 3,000 square feet. The Energy Code's definition of a refrigerated warehouse is:

> "A building or a space greater than or equal to 3,000 square feet constructed for storage or handling of products, where mechanical refrigeration is used to maintain the space temperature at 55°F or less."

The energy requirements specific to refrigerated warehouses can be found in §120.6(a) of Title 24, Part 6. The requirements for refrigerated warehouses are mandatory and must be met or exceeded.

What is Covered?

Insulation

- Exterior surfaces of refrigerated warehouses must be insulated, at a minimum, to the R-values shown in **TABLE 1**.

Underslab Heating

- Electric resistance heat must not be used for underslab heating unless it is thermostatically controlled and disabled during the summer on-peak period.

Evaporators

- Single-phase fan motors less than 1 horsepower and less than 460 Volts in newly installed evaporators must be electronically commutated motors, or must have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions.
- Evaporator fans served either by a suction group with multiple compressors, or by a single compressor with variable capcity capability, must be variable speed and the speed shall be controlled in response to space temperature and humidity.*

Condensers

- The design saturated condensing temperature setpoint must be based on local design conditions.*
- The minimum condensing temperature setpoint must be 70°F or less and must be reset in response to ambient conditions.*

Table 1: Refrigerated Warehouse Insulation

SPACE	SURFACE	MINIMUM R-VALUE (°F·hr·sf/Btu)
Freezers (spaces <28°F)	Roof/Ceiling	R-40
	Wall	R-36
	Floor	R-35
	Floor with all heating from productive refrigeration capacity	R-20
Coolers (spaces ≥ 28°F and ≤ 55°F)	Roof Ceiling	R-28
	Wall	R-28

- Condenser fans must be continuously variable speed, and fan power shall meet the efficiency requirements listed in **TABLE 2** where efficiency is defined as the Total Heat of Rejection (THR) capacity divided by all electrical input power, including fan power at 100 percent speed and power of spray pumps for evaporative condensers.
- Air-cooled condensers shall have a fin density no greater than 10 fins per inch unless it is a microchannel condenser type.

Compressors

- Compressors must be designed to operate at a minimum condensing temperature of 70°F or less.
- Open-drive screw compressors with a design saturated suction temperature (SST) of 28°F or lower that discharges to the system condenser pressure must control compressor speed in response to the refrigeration load.*
- Screw compressors with nominal electric motor power greater than 150 HP must include the ability to automatically vary the compressor volume ration (Vi) in response to operating pressures.

Infiltration Barriers

- Passageways between freezers and higher-temperature spaces, and passageways between coolers and nonrefrigerated spaces must have an infiltration barrier consisting of strip curtains, an automatically closing door, or an air curtain.

Refrigeration System Acceptance

- The following acceptance tests, as specified in Reference Nonesidential Appendix NA7, must be completed as applicable:
  - » Electric resistance underslab heating systems are tested in accordance with NA7.10.1
  - » Evaporator fan motor controls are tested in accordance with NA7.10.2
  - » Evaporative condensers are tested in accordance with NA7.10.3.1
  - » Air-cooled condensers are tested in accordance with NA7.10.3.2.
  - » Variable speed compressors are tested in accordance with NA7.10.4

Table 2: Refrigerated Warehouse Insulation

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor Evaporative-Cooled with THR Capacity > 8,000 MBH	All	350 Btuh/Watt	100°F Saturated Condensing Temperature (SCT), 70°F Outdoor Wetbulb Temperature
Outdoor Evaporative-Cooled with THR Capacity < 8,000 MBH and Indoor Evaporative-Cooled	All	160 Btuh/Watt	
Outdoor Aircooled	Ammonia	75 Btuh/Watt	105°F Saturated Condensing Temperature (SCT) 95°F Outdoor Wetbulb Temperature
	Halocarbon	65 Btuh/Watt	
Indoor Air-cooled	All	Exempt	Exempt

*Exceptions may apply, see §120.6(a) in the Energy Code for details.

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