Proposal Summary

2022 California Energy Code (Title 24, Part 6)

Covered Processes: Refrigeration

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Introduction

The California Energy Code (Title 24, Part 6) currently includes mandatory efficiency requirements for refrigeration systems serving refrigerated warehouses and retail spaces with walk-in coolers or freezers or refrigerated display cases. This measure proposes code change proposals that would improve energy performance and reduce greenhouse gas (GHG) emissions from refrigeration systems in refrigerated warehouse, retail stores, and commercial kitchens. Requirements for commercial kitchens would apply to a variety of building types including restaurants, schools, and hospitals.

Measure Description

Submeasure A: Establish Design and Control Requirements for Transcritical CO2 Systems

Historically, refrigeration systems have used halocarbon refrigerants that have high global warming potential (GWP), but these high GWP refrigerants are being phased out in California (Health and Safety Code Section 39730.5). Many types of refrigerants will no longer be allowed for use in supermarket refrigeration or refrigerated cold storage by the time the 2022 Title 24, Part 6 standards take effect in January 2023. As high GWP refrigerants are being phased out, transcritical CO_2 systems are becoming more prominent.

This submeasure would establish mandatory design and control requirements for transcritical CO_2 systems utilized in both commercial refrigeration and refrigerated warehouses. It does not mandate the use of CO_2 systems. Proposed requirements include minimum sizing for air-cooled gas coolers (defined as the temperature difference between ambient drybulb temperature and gas cooler outlet temperature), prohibiting the use of air-cooled gas coolers in most climate zones (Climate Zone 2, Climate Zone 4, Climate Zone 6, and Climate Zone 8 through 16), advanced optimized head pressure control with variable fan speed modulation, and a minimum saturated condensing temperature of 60°F.

Additionally, this proposal would include an exemption for space heat reclaim for commercial refrigeration systems utilizing transcritical CO_2 in selected climate zones where heat reclaim was not found to be cost-effective. Per stakeholder feedback, heat reclaim coils for CO_2 can be cost prohibitive due to the high operating pressure required, thus we need to evaluate the most cost-effective approach for heat reclaim (such as gas to water heat exchanger) and determine in which climate zones it is cost effective.

Submeasure B: Air Cooled Condenser Minimum Sizing Requirements for Packaged Systems

One of the challenges for central ammonia systems in refrigerated warehouses is that they require a large ammonia charge, which can be hazardous. To address this, multiple manufacturers have developed modular packaged systems, so that the ammonia charge at is smaller and primarily located outside of occupied spaces. These can reduce the typical ammonia charge by up to 90 percent compared to a large central system and are an important solution to help California meet its low-GWP targets.

The current requirement in Title 24, Part 6 for minimum condenser size creates an undue barrier for this new solution. It requires condenser size to meet a 10F temperature difference for freezer systems and 15F temperature difference for cooler systems. These minimums were intended for large central systems, but when applied to packaged systems they create a significant cost increase that prevents adoption. This measure would lower the minimum size requirement for packaged systems to 15F temperature difference between the design ambient drybulb and saturated condensing temperature for freezer systems, and 20F temperature difference for cooler systems for packages over a certain size. Packages below the size threshold would be exempt, similar to the existing exemption for condensing units below 100 horsepower. This would help packaged system manufacturers offer cost-effective solutions with low charge and low GWP refrigerants without entirely eliminating a condenser size requirement or incurring a large statewide energy penalty.

Submeasure C: Evaporator Minimum Specific Efficiency for Refrigerated Warehouses

This submeasure defines mandatory minimum specific efficiency requirements for evaporators in refrigerated warehouses. Evaporator specific efficiency is a metric that determines the amount of cooling an evaporator can provide per unit of fan input power required. This is similar to the metric of condenser specific efficiency currently defined in Title 24 for evaporative, air cooled, and adiabatic condensers. Evaporator specific efficiency requirements would be defined for flooded, recirculated liquid, and direct expansion (DX) coils for both halocarbon refrigerants and ammonia. Separate thresholds would be determined for cooler spaces and freezer spaces. The exemption for quick chilling/freezing process loads would still apply to the proposed specific efficiency requirements.

Submeasure D: Require Automatic Door Closers

This measure would require cooler and freezer spaces in refrigerated warehouses to have automatic door closers for personnel doors. There are two types of closers. One is a spring or gravity/cam hinge that closes the door from a standing-open position to a closed position. The second snaps the door tightly closed (when magnetic gaskets are not applicable). This code change proposal would define both types of closers and require them for doors designed with the primary purpose of people traffic that separate a freezer or cooler space from a warmer adjacent area.

Submeasure E: Acceptance Testing for Commercial Refrigeration

This proposed measure would add acceptance testing to verify compliance with existing code requirements for commercial refrigeration systems. The existing code requirements that would have new acceptance testing are the following:

- Ambient temperature following head pressure control
- Floating suction pressure control
- Mechanical subcooling
- Refrigerated case lighting control
- Heat reclaim

Sample Code Language

The draft code language is shown below.

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

(b) Definitions. Terms, phrases, words and their derivatives in Part 6 shall be defined as specified in Section 100.1. Terms, phrases, words and their derivatives not found in Section 100.1 shall be defined as specified in the "Definitions" chapters of Title 24, Parts 1 through 5 of the California Code of Regulations. Where terms, phrases, words and their derivatives are not defined in any of the references above, they shall be defined as specified in Webster's Third New International Dictionary of the English Language, Unabridged (1961 edition, through the 2002 addenda), unless the context requires otherwise.

PACKAGED REFRIGERATION SYSTEMS are single-packaged mechanical refrigeration systems consisting of compressors, condensers, evaporators and vessels used to provide cooling for refrigerated spaces or processes that have been integrated into a single packaged unit designed to be installed on the roof of a refrigerated warehouse or on grade.

SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.6(a) through 120.6(g).

(a) **Mandatory Requirements for Refrigerated Warehouses**

Refrigerated Warehouses that are greater than or equal to 3,000 square feet and refrigerated spaces with a sum total of 3,000 square feet or more that are served by the same refrigeration system shall meet the requirements of Section 120.6(a).

Refrigerated Spaces that are less than 3,000 square feet shall meet the requirements of the Appliance Efficiency Regulations for walk-in coolers or freezers contained in the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through 1608).

1. **Insulation Requirements.** Exterior surfaces of refrigerated warehouses shall be insulated at least to the R-values in TABLE 120.6-A.

TABLE 120.6-A REFRIGERATED WAREHOUSE INSULATION

SPACE	SURFACE	MINIMUM R-VALUE (°F·hr·sf/Btu)
Freezers	Roof/Ceiling	R-40
	Wall	R-36
	Floor	R-35
	Floor with all heating from productive refrigeration capacity[1]	R-20
Coolers	Roof/Ceiling	R-28
	Wall	R-28

1. All underslab heating is provided by a heat exchanger that provides refrigerant subcooling or other means that result in productive refrigeration capacity on the associated refrigerated system.

2. **Underslab heating.** Electric resistance heat shall not be used for the purposes of underslab heating.

   EXCEPTION to Section 120.6(a)2: Underslab heating systems controlled such that the electric resistance heat is thermostatically controlled and disabled during the summer on-peak period defined by the local electric utility.

3. **Evaporators.** New fan-powered evaporators used in coolers and freezers shall conform to the following:

   A. Single phase fan motors less than 1 hp and less than 460 Volts in newly installed evaporators shall be electronically commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions.

   B. Evaporator fans served either by a suction group with multiple compressors, or by a single compressor with variable capacity capability shall be variable speed and the speed shall be controlled in response to space temperature or humidity.

      EXCEPTION 1 to Section 120.6(a)3B: Addition, alteration or replacement of less than all of the evaporators in an existing refrigerated space that does not have speed-controlled evaporators.

      EXCEPTION 2 to Section 120.6(a)3B: Coolers within refrigerated warehouses that maintain a Controlled Atmosphere for which a licensed engineer has certified that the types of products stored will require constant operation at 100 percent of the design airflow.

      EXCEPTION 3 to Section 120.6(a)3B: Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products, including but not limited to spaces with design cooling capacities of greater than 240 Btu/hr-ft² (2 tons per 100 ft²).

   C. Evaporator fans served by a single compressor that does not have variable capacity shall utilize controls to reduce airflow by at least 40 percent for at least 75 percent of the time when the compressor is not running.

      EXCEPTION to Section 120.6(a)3C: Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products (space with design cooling capacities of greater than 240 Btu/hr-ft² (2 tons per 100 ft²)).

   D. Fan-powered evaporators shall meet the evaporator specific efficiency requirements listed in TABLE 120.6-X and 120.6-X at the conditions listed in TABLE 120.6-X. Evaporator specific efficiency is defined as the total refrigeration capacity (Btu/h) divided by the electrical input power at 100 percent fan speed. Capacity is rated at 10°F of temperature difference between the incoming air temperature and the saturated evaporating temperature. For glide refrigerants, the saturated evaporating temperature is defined as the midpoint temperature. Input power is rated at 100% fan speed at rated temperature conditions.

      EXCEPTION to Section 120.6(a)3D: Evaporators used in process cooling or process freezing applications.

TABLE 120.6-X EVAPORATOR SPECIFIC EFFICIENCY RATING CONDITIONS

	FREEZER APPLICATION	**COOLER/DOCK APPLICATION**
Saturated evaporating temperature (°F)	-20	25
Entering air temperature (°F)	-10	35
External Static pressure (in. WC)	0	0
Rating type	Dry Coil	Dry Coil

TABLE 120.6-X EVAPORATOR SPECIFIC EFFICIENCY FOR FREEZER APPLICATIONS

LIQUID FEED TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY (Btuh/Watt)
Direct Expansion	Halocarbon	35
	Ammonia	25
Flooded/Recirculated Liquid	Ammonia	45

TABLE 120.6-X EVAPORATOR SPECIFIC EFFICIENCY FOR COOLER APPLICATIONS

EVAPORATOR TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY (Btuh/Watt)
Direct Expansion	Halocarbon	40
	Ammonia	35
Flooded/Recirculated Liquid	Ammonia	50

E. The applied static pressure drop for evaporators installed in refrigerated warehouses shall not exceed 0.5" water column.

EXCEPTION to Section 120.6(a)3E: Evaporators used in process cooling or process freezing applications.

4. **Condensers.** New fan-powered condensers on all new refrigeration systems except transcritical CO2 systems shall conform to the following:

A. Design saturated condensing temperatures for evaporative-cooled condensers and water-cooled condensers served by fluid coolers or cooling towers shall be less than or equal to:

i. The design wetbulb temperature plus 20°F in locations where the design wetbulb temperature is less than or equal to 76°F; or

ii. The design wetbulb temperature plus 19°F in locations where the design wetbulb temperature is between 76°F and 78°F; or

iii. The design wetbulb temperature plus 18°F in locations were the design wetbulb temperature is greater than or equal to 78°F.

EXCEPTION 1 to Section 120.6(a)4A: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

B. Design saturated condensing temperatures for air-cooled condensers shall be less than or equal to the following:

i. Condensing units and packaged refrigeration systems

1. The design drybulb temperature plus 15°F for systems serving freezers;

2. The design drybulb temperature plus 20°F for systems serving coolers.

ii. All other refrigeration systems

~~i~~ 1. The design drybulb temperature plus 10°F for systems serving freezers;

~~ii~~ 2. The design drybulb temperature plus 15°F for systems serving coolers.

~~**EXCEPTION 1 to Section 120.6(a)4B:** Condensing units with a total compressor horsepower less than 100 HP.~~

EXCEPTION ~~2~~ to Section 120.6(a)4B: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

C. The saturated condensing temperature necessary for adiabatic condensers to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to:

i. The design drybulb temperature plus 20°F for systems serving freezers;

ii. The design drybulb temperature plus 30°F for systems serving coolers.

EXCEPTION 1 to Section 120.6(a)4C: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

D. All condenser fans for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.

E. The minimum condensing temperature setpoint shall be less than or equal to 70°F for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water-cooled fluid coolers or cooling towers.

F. Condensing temperature reset. The condensing temperature set point of systems served by air-cooled condensers shall be reset in response to ambient drybulb temperature. The condensing temperature set point of systems served by evaporative-cooled condensers or water-cooled condensers (via cooling towers or fluid coolers) shall be reset in response to ambient wetbulb temperatures. The condensing temperature set point for systems served by adiabatic condensers shall be reset in response to ambient drybulb temperature while operating in dry mode.

EXCEPTION 1 to Section 120.6(a)4F: Condensing temperature control strategies approved by the Executive Director that have been demonstrated to provide at least equal energy savings.

EXCEPTION 2 to Section 120.6(a)4F: Systems served by adiabatic condensers in Climate Zones 1, 3, 5, 12, 14 and 16.

G. Fan-powered condensers shall meet the condenser efficiency requirements listed in TABLE 120.6-B. Condenser efficiency is defined as the Total Heat of Rejection (THR) capacity divided by all electrical input power including fan power at 100 percent fan speed, and power of spray pumps for evaporative condensers.

EXCEPTION to Section 120.6(a)4G: Adiabatic condensers with ammonia as refrigerant.

H. Air-cooled condensers shall have a fin density no greater than 10 fins per inch.

EXCEPTION to Section 120.6(a)4H: Micro-channel condensers.

EXCEPTION to Section 120.6(a)4A, 4B, 4C, 4G, and 4H: Condensing units or packaged refrigeration systems with a total compressor horsepower less than 100 HP.

~~**EXCEPTION to Section 120.6(a)1A, 1B, 1C, 1E, 1F and 1G:** Transcritical CO_2 refrigeration systems.~~

TABLE 120.6-B FAN-POWERED CONDENSERS – MINIMUM EFFICIENCY REQUIREMENTS

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 Air-Cooled	Ammonia	75 Btuh/Watt	105°F Saturated Condensing Temperature (SCT), 95°F Outdoor Drybulb Temperature
	Halocarbon	65 Btuh/Watt	
Adiabatic Dry Mode	Halocarbon	45 Btuh/W	105°F Saturated Condensing Temperature (SCT), 95°F Outdoor Drybulb Temperature
Indoor Air-Cooled	All	Exempt	

5. **Transcritical CO2 Gas Coolers.** New fan-powered gas coolers on all new transcritical CO2 refrigeration systems shall conform to the following:

   A. Air cooled gas coolers are prohibited in the following climate zones: CZ 2, CZ 4, and CZ6 through CZ 16.

   B. Design leaving gas temperature for air-cooled gas coolers shall be less than or equal to the design drybulb temperature plus [TBD].

   C. While operating below the critical point, the gas cooler pressure shall be controlled in accordance to 120.6(a)4F.

   D. While operating above the critical point, the gas cooler pressure setpoint shall be reset based on ambient conditions such that the compressor efficiency is maximized. The gas cooler fans shall be variable speed and controlled in unison in order to maintain a fixed temperature difference between the gas cooler outlet temperature and ambient temperature.

      EXCEPTION 1 to Section 120.6(a)5D: Head pressure control strategies approved by the executive director that have been demonstrated to provide equal energy savings.

      EXCEPTION 2 to Section 120.6(a)5D: Climate Zone CZ1.

   E. All condenser fans for air-cooled gas coolers, evaporative-cooled gas coolers, adiabatic gas coolers, air or water fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.

   E. The minimum condensing temperature setpoint shall be less than or equal to 60°F for air-cooled gas coolers, evaporative-cooled gas coolers, adiabatic gas coolers, air or water-cooled fluid coolers or cooling towers.

   G. Fan-powered gas coolers shall meet the gas cooler efficiency requirements listed in TABLE 120.6-xxx. Gas cooler efficiency is defined as the Total Heat of Rejection (THR) capacity divided by all electrical input power (fan power at 100 percent fan speed).

   EXCEPTION to Section 120.6(a)5G: Evaporative-cooled gas coolers

H. Air-cooled gas coolers shall have a fin density no greater than 10 fins per inch.

EXCEPTION to Section 120.6(a)5H: Micro-channel condensers.

TABLE 120.6-xxx TRANSCRITICAL CO2 FAN-POWERED GAS COOLERS – MINIMUM EFFICIENCY REQUIREMENTS

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor Air-Cooled	Transcritical CO2	[TBD] Btuh/W	80°F Saturated Condensing Temperature (SCT), 70°F Outdoor Drybulb Temperature
Adiabatic Dry Mode	Transcritical CO2	[TBD] Btuh/W	80°F Saturated Condensing Temperature (SCT), 70°F Outdoor Drybulb Temperature
Indoor Air-Cooled	Transcritical CO2	Exempt	

~~5~~ 6. **Compressors.** Compressor systems utilized in refrigerated warehouses shall conform to the following:

A. Compressors for transcritical CO2 refrigeration systems shall be designed to operate at a minimum condensing temperature of 60°F or less.

~~A~~B. Compressors serving refrigeration systems that are not transcritical CO2, shall be designed to operate at a minimum condensing temperature of 70°F or less.

~~B~~ C. New open-drive screw compressors in new refrigeration systems with a design saturated suction temperature (SST) of 28°F or lower that discharges to the system condenser pressure shall control compressor speed in response to the refrigeration load.

EXCEPTION 1 to Section 120.6(a)~~5 B~~ 6C: Refrigeration plants with more than one dedicated compressor per suction group.

EXCEPTION 2 to Section 120.6(a)~~ 5 B~~ 6C: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

C. New screw compressors with nominal electric motor power greater than 150 HP shall include the ability to automatically vary the compressor volume ratio (Vi) in response to operating pressures.

~~6~~ 7. **Infiltration Barriers.** Passageways between freezers and higher-temperature spaces, and passageways between coolers and nonrefrigerated spaces, shall have an infiltration barrier consisting of strip curtains, an automatically-closing door, or an air curtain designed by the manufacturer for use in the passageway and temperature for which it is applied.

EXCEPTION 1 to Section 120.6(a)~~6~~ 7: Openings with less than 16 square feet of opening area.

EXCEPTION 2 to Section 120.6(a)~~6~~ 7: Dock doorways for trailers.

8. **Automatic Door Closers**. Doors no wider than 3 feet 9 inches and no taller than 7 feet between freezers and higher-temperature spaces, and between coolers and nonrefrigerated spaces, shall have automatic door closers that automatically close all doors from an open position and firmly close all doors that have been closed to within 1 inch of full closure.

~~7~~ 9. **Refrigeration System Acceptance.** Before an occupancy permit is granted for a new refrigerated warehouse, or before a new refrigeration system serving a refrigerated warehouse is operated for normal use, the following equipment and systems shall be certified as meeting the Acceptance Requirements for

Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:

A. Electric resistance underslab heating systems shall be tested in accordance with NA7.10.1.

B. Evaporators fan motor controls shall be tested in accordance with NA7.10.2.

C. Evaporative condensers shall be tested in accordance with NA7.10.3.1.

D. Air-cooled condensers shall be tested in accordance with NA7.10.3.2.

E. Adiabatic condensers shall be tested in accordance with NA7.10.3.3

F. Variable speed compressors shall be tested in accordance with NA7.10.4.

120.6 (b) Mandatory Requirements for Commercial Refrigeration

Retail food or beverage stores with 8,000 square feet or more of conditioned floor area, and that utilize either refrigerated display cases, or walk-in coolers or freezers, shall meet all applicable State and federal appliance and equipment standards consistent with Section 110.0 and 110.1 or, for equipment not subject to such standards, the requirements of Subsections 1 through 4.

1. **Condensers serving refrigeration systems.** Fan-powered condensers shall conform to the following requirements:

   A. All condenser fans for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water-cooled fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.

   B. The refrigeration system condenser controls for systems with air-cooled condensers shall use variable-setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature.

   C. The refrigeration system condenser controls for systems with evaporative-cooled condensers shall use variable-setpoint control logic to reset the condensing temperature setpoint in response to ambient wetbulb temperature.

   D. The refrigeration system condenser controls for systems with adiabatic condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature while operating in dry mode.

   EXCEPTION 1 to Section 120.6(b)1B, C and D: Condensing temperature control strategies approved by the executive director that have been demonstrated to provide equal energy savings.

   EXCEPTION 2 to Section 120.6(b)1D: Systems served by adiabatic condensers in Climate Zone 16.

   E. The saturated condensing temperature necessary for adiabatic condensers to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to:

      i. The design drybulb temperature plus 20°F for systems serving freezers;

      ii. The design drybulb temperature plus 30°F for systems serving coolers.

   F. The minimum condensing temperature setpoint shall be less than or equal to 70°F.

   G. Fan-powered condensers shall meet the specific efficiency requirements listed in Table 120.6-C.

TABLE 120.6-C FAN-POWERED CONDENSERS –SPECIFIC EFFICIENCY REQUIREMENTS

CONDENSER TYPE	MINIMUM SPECIFIC EFFICIENCY[a]	RATING CONDITION
Evaporative-Cooled	160 Btuh/W	100°F Saturated Condensing Temperature (SCT), 70°F Entering Wetbulb Temperature
Air-Cooled	65 Btuh/W	105°F Saturated Condensing Temperature (SCT), 95°F Entering Drybulb Temperature
Adiabatic Dry Mode	45 Btu/W (halocarbon)	105°F Saturated Condensing Temperature (SCT), 95°F Entering Drybulb Temperature
[a] See Section 100.1 for definition of condenser specific efficiency.		

EXCEPTION 1 to Section 120.6(b)1G: Condensers with a Total Heat Rejection capacity of less than 150,000 Btuh at the specific efficiency rating condition.

EXCEPTION 2 to Section 120.6(b)1G: Stores located in Climate Zone 1.

EXCEPTION 3 to Section 120.6(b)1G: Existing condensers that are reused for an addition or alteration.

H. Air-cooled condensers shall have a fin density no greater than 10 fins per inch.

EXCEPTION 1 to Section 120.6(b)1H: Microchannel condensers.

EXCEPTION 2 to Section 120.6(b)1H: Existing condensers that are reused for an addition or alteration.

EXCEPTION to Section 120.6(b)1B, 1C, 1D, 1E, 1F, 1G: Transcritical CO2 refrigeration systems.

EXCEPTION to Section 120.6(b)1: New condensers replacing existing condensers when the attached compressor system Total Heat of Rejection does not increase and less than 25 percent of both the attached compressors and the attached display cases are new.

2. **Transcritical CO2 Gas Coolers.** New fan-powered gas coolers on all new transcritical CO2 refrigeration systems shall conform to the following:

A. Air cooled gas coolers are prohibited in the following climate zones: CZ 2, CZ 4, and CZ6 through CZ 16.

B. Design leaving gas temperature for air-cooled gas coolers shall be less than or equal to the design drybulb temperature plus [TBD].

C. While operating below the critical point, the gas cooler pressure shall be controlled in accordance to 120.6(b)1A.

D. While operating above the critical point, the gas cooler pressure setpoint shall be reset based on ambient conditions such that the compressor efficiency is maximized. The gas cooler fans shall be variable speed and controlled in unison in order to maintain a fixed temperature difference between the gas cooler outlet temperature and ambient temperature.

EXCEPTION 1 to Section 120.6(b)2D: Head pressure control strategies approved by the executive director that have been demonstrated to provide equal energy savings.

EXCEPTION 2 to Section 120.6(b)2D: Climate Zone CZ1.

E. All gas cooler fans for air-cooled gas coolers, evaporative-cooled gas coolers, adiabatic gas coolers, air or water fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.

E. The minimum condensing temperature setpoint shall be less than or equal to 60°F for air-cooled gas coolers, evaporative-cooled gas coolers, adiabatic gas coolers, air or water-cooled fluid coolers or cooling towers.

G. Fan-powered gas coolers shall meet the condenser efficiency requirements listed in TABLE 120.6-yyyy. Gas cooler efficiency is defined as the Total Heat of Rejection (THR) capacity divided by all electrical input power (fan power at 100 percent fan speed).

EXCEPTION to Section 120.6(b)5G: Evaporative-cooled gas coolers

H. Air-cooled gas coolers shall have a fin density no greater than 10 fins per inch.

EXCEPTION to Section 120.6(b)2H: Micro-channel gas coolers.

TABLE 120.6-xxx TRANSCRITICAL CO2 FAN-POWERED GAS COOLERS – MINIMUM EFFICIENCY REQUIREMENTS

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor Air-Cooled	Transcritical CO2	[TBD] Btuh/W	80°F Saturated Condensing Temperature (SCT), 70°F Outdoor Drybulb Temperature
Adiabatic Dry Mode	Transcritical CO2	[TBD] Btuh/W	80°F Saturated Condensing Temperature (SCT), 70°F Outdoor Drybulb Temperature
Indoor Air-Cooled	Transcritical CO2	Exempt	

~~2~~ 3. **Compressor Systems.** Refrigeration compressor systems and condensing units shall conform to the following requirements.

A. Compressors and multiple-compressor suction groups shall include control systems that use floating suction pressure logic to reset the target saturated suction temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

EXCEPTION 1 to Section 120.6(b)~~2~~ 3A: Single compressor systems that do not have continuously variable capacity capability.

EXCEPTION 2 to Section 120.6(b)~~2~~ 3A: Suction groups that have a design saturated suction temperature of 30°F or higher, or suction groups that comprise the high stage of a two-stage or cascade system or that primarily serve chillers for secondary cooling fluids.

B. Liquid subcooling shall be provided for all low temperature compressor systems with a design cooling capacity equal or greater than 100,000 Btu/hr with a design saturated suction temperature of -10°F or lower, with the subcooled liquid temperature maintained continuously at 50°F or less at the exit of the subcooler, using compressor economizer port(s) or a separate medium or high temperature suction group operating at a saturated suction temperature of 18°F or higher.

EXCEPTION 1 to Section 120.6(b)~~2~~ 3B: Low temperature cascade systems that condense into another refrigeration system rather than condensing to ambient temperature.

EXCEPTION 2 to Section 120.6(b)3B: Transcritical CO2 systems.

C. Compressors for Transcritical CO2 refrigeration systems shall be designed to operate at a minimum condensing temperature of 60°F or less.

EXCEPTION to Section 120.6(b)2A and 2B: Existing compressor systems that are reused for an addition or alteration.

~~3~~ 4. **Refrigerated Display Cases.** Lighting in refrigerated display cases, and lights on glass doors installed on walk-in coolers and freezers shall be controlled by one of the following:

A. Automatic time switch controls to turn off lights during nonbusiness hours. Timed overrides for any line-up or walk-in case may only be used to turn the lights on for up to one hour. Manual overrides shall time-out automatically to turn the lights off after one hour.

B. Motion sensor controls on each case that reduce display case lighting power by at least 50 percent within 30 minutes after the area near the case is vacated.

~~4~~ 5. Refrigeration Heat Recovery.

A. HVAC systems shall utilize heat recovery from refrigeration system(s) for space heating, using no less than 25 percent of the sum of the design Total Heat of Rejection of all refrigeration systems that have individual Total Heat of Rejection values of 150,000 Btu/h or greater at design conditions.

EXCEPTION 1 to Section 120.6(b)~~4~~ 5A: Stores located in Climate Zone 15.

EXCEPTION 2 to Section 120.6(b)5A: Transcritical CO2 systems in Climate Zones [TBD]

EXCEPTION ~~2~~ 3 to Section 120.6(b)~~4~~ 5A: HVAC systems or refrigeration systems that are reused for an addition or alteration.

EXCEPTION 4 to Section 120.6(b)5A: Stores that utilize less than [TBD] design tons of refrigeration per square feet of conditioned food and beverage sales floor area.

B. The increase in hydrofluorocarbon refrigerant charge associated with refrigeration heat recovery equipment and piping shall be no greater than 0.35 lbs per 1,000 Btu/h of heat recovery heating capacity.