

2016 Refrigeration Machinery Rooms Equipment Reminder List

Applicable Codes and Standards

CBC 2016, CMC 2016, CFC 2016, CEC 2016

ASHRAE 15-2013, ASHRAE 34-2013, ASME 13.1-2007, IAR2-2014, NFPA 704-2012

I. SCOPE

1. The provisions of the California Mechanical Code shall apply to the installation, alterations, repairs and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and/or appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems. **CBC 101.4.2**
2. CMC Ch.11, Part I, governs the design, installation, and construction of refrigeration systems, equipment, refrigerant piping, pressure vessels, safety devices, replacement of parts, alterations, and substitution of different refrigerants. **CMC 1101.1**
3. Refrigerants are regulated under the provisions CFC Section 606 and CMC Chapter 11; refrigerant quantities are not regulated by CFC Chapter 50 or CBC Chapters 3 and 4. **CFC 5001.1, Exc. 6**
CBC 307.1.1, Exc. 7
CBC 414.1.2
4. Except as modified by the CMC, refrigeration systems shall comply with ASHRAE 15. In addition, ammonia refrigeration shall comply with IAR 2. **CMC 1102.1**

CHK.

N/A

II. CLASSIFICATION OF REFRIGERANTS/SYSTEMS

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. The refrigerant used shall be of a type listed in Table 1102.2 or in accordance with ASHRAE 34 where approved by AHJ. CMC 1102.2 |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Refrigerants shall be classified in accordance with Table 1102.2. CMC 1103.1 |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Refrigeration systems shall be classified as a High-Probability or Low-Probability System according to the degree of probability that a leakage of refrigerant could enter a normally occupied area. CMC 1103.2 |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. When a refrigeration system is located in a refrigeration machinery room, the classification of the refrigeration system is not required. CMC 1104.2 |

CHK.

N/A

III. LOCATION OF REFRIGERATION SYSTEMS

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|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. The concentration of refrigerant in a complete discharge of an independent circuit of high-probability systems shall not exceed the amounts shown in Table 1102.2, except as provided in Sec. 1104.3 and Sec. 1104.4. The volume of occupied space shall be in accordance with Sec. 1104.2.1 through Section 1104.2.3. CMC 1104.2 |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Refrigeration systems or portions thereof shall not be located within a required exit enclosure. CMC 1105.6 |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Refrigeration compressors >5 horsepower (3.7 kW) rating shall be located at least 10 feet from an exit opening in a Group A, B, E, F, I, R Div. 1, S Occupancy unless separated by a one-hour fire-resistive occupancy separation. CMC 1105.6 |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. Refrigerant piping shall not be located within a required exit. CMC 1109.4.1 |

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<u>CHK.</u>	<u>N/A</u>	IV. REFRIGERATION MACHINERY ROOMS	
		1. Refrigeration systems shall be provided with a refrigeration machinery room when any of the following conditions exist:	CMC 1106.1
<input type="checkbox"/>	<input type="checkbox"/>	The quantity of refrigerant in a single system exceeds Table 1102.2 amounts.	CMC 1106.1.1
<input type="checkbox"/>	<input type="checkbox"/>	Direct-fired and indirect-fired absorption equipment, except lithium bromide systems using water as the refrigerant.	CMC 1106.1.2
<input type="checkbox"/>	<input type="checkbox"/>	An A1 system having an aggregate compressor horsepower of 100 (74.6 kW) or more.	CMC 1106.1.3
<input type="checkbox"/>	<input type="checkbox"/>	The system contains other than a Group A1 refrigerant. (see exceptions)	CMC 1106.1.4
		See the following exceptions where a machinery room is not required:	CMC 1106.1.4
		(1) Lithium bromide absorption systems using water as the refrigerant.	CMC 1106.1.4
		(2) Ammonia-water absorption unit systems installed outdoors, provided that the quantity of refrigerant in a single system does not exceed Table 1102.2 amounts and the discharge is shielded and dispersed.	CMC 1106.1.4
		(3) Systems containing less than 300 pounds (136.1 kg) of refrigerant R-123 and located in an approved exterior location.	CMC 1106.1.4
		(4) Systems containing less than 35 pounds (15.9 kg) of refrigerant R-717 and located in an approved exterior location.	CMC 1106.1.4
<input type="checkbox"/>	<input type="checkbox"/>	2. All components containing refrigerant shall be located either in a machinery room or outdoors.	ASHRAE 15, 7.4 CMC 1106.1
<input type="checkbox"/>	<input type="checkbox"/>	3. When a refrigeration system is located outdoors more than 20 ft from building openings and is enclosed by a penthouse, lean-to, or other open structure, natural or mechanical ventilation shall be provided.	ASHRAE 15, 8.11.5 CMC 1107.3
<u>CHK.</u>	<u>N/A</u>	V. REFRIGERATION MACHINERY ROOM CONSTRUCTION	
<input type="checkbox"/>	<input type="checkbox"/>	1. Refrigeration machinery rooms shall be separated from other portions of the building per CBC Table 509.	CBC 509.1
<input type="checkbox"/>	<input type="checkbox"/>	2. Penetrations into machinery rooms shall be sealed to inhibit the passage of refrigerant vapor.	CMC 1106.5
<u>CHK.</u>	<u>N/A</u>	VI. REFRIGERATION MACHINERY ROOM CONTENTS	
<input type="checkbox"/>	<input type="checkbox"/>	1. Refrigeration machinery rooms shall house all refrigerant-containing portions of the system other than the piping and evaporators permitted by CMC Section 1104.4, discharge piping required by CMC Chapter 11, and cooling towers regulated by CMC Chapter 11, Part II and their essential piping.	CMC 1106.1.4

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<input type="checkbox"/>	<input type="checkbox"/>	2. Open flames or devices having an exposed surface exceeding 800°F are prohibited in refrigeration machinery rooms.	CMC 1106.8
<input type="checkbox"/>	<input type="checkbox"/>	3. Combustion air or return air shall not be taken from or through a refrigeration machinery room unless ducted and sealed to prevent refrigerant leakage into the airstream or a refrigerant leak detector shall automatically shut down such equipment in the event of refrigerant leakage.	CMC 1106.6
<input type="checkbox"/>	<input type="checkbox"/>	4. Equipment, piping, ducts, vents or similar devices which are not essential for the refrigeration process, maintenance of the equipment or for the illumination, ventilation or fire protection of the room shall not be placed in or pass through a refrigeration machinery room.	CMC 1108.1
CHK.	N/A	VII. REFRIGERATION MACHINERY ROOM ACCESS/EGRESS	
<input type="checkbox"/>	<input type="checkbox"/>	1. Refrigeration machinery rooms shall be of such dimensions that all system parts are readily accessible with adequate space for maintenance and operations.	CMC 1106.2
<input type="checkbox"/>	<input type="checkbox"/>	2. An unobstructed walking space at least 3 feet in width and 6 feet 8 inches in height shall be maintained throughout allowing free access to at least two sides of all moving machinery and approaching each stop valve.	CMC 1106.2
<input type="checkbox"/>	<input type="checkbox"/>	3. Access to refrigeration machinery rooms shall be restricted to authorized personnel and posted with a permanent sign.	CMC 1106.2
<input type="checkbox"/>	<input type="checkbox"/>	4. Refrigeration systems having more than 220 lbs of A1 or 30 lbs any other group refrigerant shall be accessible to the fire department at all times.	CFC 606.5
<input type="checkbox"/>	<input type="checkbox"/>	5. Refrigeration machinery rooms larger than 1,000 sq. ft. shall have access to not less than 2 exits.	CBC 1006.2.2.2
<input type="checkbox"/>	<input type="checkbox"/>	6. The exits shall be separated by a minimum distance equal to 1/2 the maximum horizontal dimension of the room.	CBC 1006.2.2.2
<input type="checkbox"/>	<input type="checkbox"/>	7. When 2 exits are required, one such exit may be by a fixed ladder or alternating tread device.	CBC 1006.2.2.2
<input type="checkbox"/>	<input type="checkbox"/>	8. All portions of machinery rooms must be within 150 ft. travel of an exit or exit access door and doors shall swing in direction of egress travel.	CBC 1006.2.2.2
<input type="checkbox"/>	<input type="checkbox"/>	9. Doors shall be tight-fitting and self-closing.	CBC 1006.2.2.2
CHK.	N/A	VIII. REFRIGERANT VAPOR DETECTION AND ALARMS	
<input type="checkbox"/>	<input type="checkbox"/>	1. Machinery rooms shall have approved refrigerant-vapor detectors.	CFC 606.8
<input type="checkbox"/>	<input type="checkbox"/>	2. Refrigerant-vapor detectors or sampling tube shall be located in an area where refrigerant from a leak will concentrate and will activate visual and audible alarms inside the room and outside each entrance.	CFC 606.8 & CMC 1106.4
<input type="checkbox"/>	<input type="checkbox"/>	3. The alarm shall have manual reset type and shall be located inside the refrigeration machinery room	CMC 1106.4
<input type="checkbox"/>	<input type="checkbox"/>	4. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values shown in the CMC for the refrigerant classification.	CFC 606.8
<input type="checkbox"/>	<input type="checkbox"/>	5. Approved refrigerant-vapor detection and alarm systems shall utilize alarm signaling devices of at least 15 dba above the operating ambient noise level of the space installed and shall provide an approved, distinctive visual alarm.	CMC 1106.4

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- | | | | |
|--------------------------|--------------------------|--|-------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Detectors and alarms shall be placed in approved locations. | CFC 606.8 |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. The detector shall transmit to an approved location. | CFC 606.8 |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Refrigerant vapor-detectors shall activate fans providing emergency purge ventilation. | CMC 1107.6 |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Detection and alarm systems shall be installed, maintained, and tested in accordance with the CFC and with the equipment manufacturer's specifications. | CMC 1108.4 |

CHK.

N/A

IX. REFRIGERATION ROOM VENTILATION

- | | | | |
|--------------------------|--------------------------|--|-------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. Refrigeration machinery rooms shall be provided with a source of outside air for ventilation and removal of rejected heat. | CMC 1107.1 |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Exhaust inlets or permanent openings shall be arranged to provide ventilation throughout the entire machinery room. | CMC 1107.4 |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Fans providing machinery room temperature control or automatic purge of refrigerant-vapor are allowed to be automatically or manually controlled to provide intermittent ventilation as conditions require. | CMC 1107.5 |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. Emergency purge fans shall have a break-glass type or tamper resistant covered on-only control switch immediately adjacent to and outside each principal refrigeration machinery room exit. | CMC 1107.6 |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. Two colored and labeled indicator lamps responding to the differential pressure across the purge fan or current through the fan motor shall be provided for each switch. One lamp shall indicate flow; the other shall indicate no flow. | CMC 1107.6 |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Exhaust from mechanical ventilation systems shall comply with CMC Section 502.2. | CMC 1107.7 |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Exhausts capable of discharges exceeding 25% of the LFL or 50% of the IDLH shall be provided with an approved treatment system, except ammonia. | CFC 606.13 |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Emergency purge fans and their associated equipment provided for the exhausting of other than Group A1 and Group B1 refrigerants shall meet the requirements of Class I, Division 1 hazardous locations. | CMC 1107.8 |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Makeup-air intakes to replace exhaust air shall provide air directly from the outside of the building. | CMC 1107.9 |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Intakes shall be fitted with backdraft dampers or similar flow-control means to prevent reverse flow. | CMC 1107.9 |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. Distribution of makeup-air shall be arranged to provide thorough mixing within the room to prevent short circuiting of makeup-air directly to exhaust. | CMC 1107.9 |
| <input type="checkbox"/> | <input type="checkbox"/> | 12. Refrigeration machinery rooms shall be provided with dedicated mechanical exhaust systems. The exhaust systems shall have the capacity to provide emergency purge of escaping refrigerant at a rate of 30 air changes per hour (ACH) for ammonia, or for other refrigerants as determined in accordance with Equation 1107.2 | CMC 1107.2 |

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<u>CHK.</u>	<u>N/A</u>	X. EMERGENCY CONTROL	
<input type="checkbox"/>	<input type="checkbox"/>	1. Regardless of the refrigerant group or the type of electrical installation provided, an emergency break-glass type off-only control switch shall be provided immediately adjacent and outside the principal machinery room exit.	CMC 1108.3
<input type="checkbox"/>	<input type="checkbox"/>	2. The emergency control switch shall provide off-only control of refrigerant compressors, pumps and normally closed automatic refrigerant valves located in the machinery room.	CMC 1108.3
<input type="checkbox"/>	<input type="checkbox"/>	3. The emergency control switch shall be automatically shutoff where the refrigerant vapor concentration in the machinery room exceeds the vapor detector's upper detection limit or 25 percent of the LFL, whichever is lower.	CMC 1108.3 & CMC 1106.4(2)
<input type="checkbox"/>	<input type="checkbox"/>	4. Refrigeration machinery rooms are not required to be classified as a hazardous location for electrical equipment except as provided in Section 1107.8.	CMC 1108.2
<input type="checkbox"/>	<input type="checkbox"/>	5. Where refrigerants of A2, A3, B2 and B3 are used, the machinery room shall conform to the Class I, Division 2 hazardous location requirement of the CEC.	CFC 606.16
<input type="checkbox"/>	<input type="checkbox"/>	6. Refrigeration systems containing more than 6.6 lbs of flammable, toxic or highly toxic refrigerant or ammonia shall be provided with an automatic crossover valve and automatic emergency stop.	CFC 606.10
 <u>CHK.</u>	 <u>N/A</u>	 XI. Control Valves	
		1. Systems containing more than 6.6 pounds of refrigerant shall have stop valves installed at the following locations:	CMC 1110.1
<input type="checkbox"/>	<input type="checkbox"/>	(1) The suction inlet of a compressor, compressor unit, or condensing unit.	CMC 1110.1
<input type="checkbox"/>	<input type="checkbox"/>	(2) The discharge of a compressor unit, or condensing unit.	CMC 1110.1
<input type="checkbox"/>	<input type="checkbox"/>	(3) At refrigerant outlet from a liquid receiver.	CMC 1110.1
		Exceptions:	
		(1) Systems that have a refrigerant pumpout function capable of storing the refrigerant charge, or are with the provisions for pumpout of the refrigerant.	CMC 1110.1
		(2) Self-contained systems. [ASHRAE 15:9.12.4]	CMC 1110.1
		2. Systems containing more than 110 pounds of refrigerant shall have stop valves installed at the following locations:	CMC 1110.2
<input type="checkbox"/>	<input type="checkbox"/>	(1) The suction inlet of a compressor, compressor unit, or condensing unit.	CMC 1110.2
<input type="checkbox"/>	<input type="checkbox"/>	(2) The discharge outlet of a compressor, compressor unit, or condensing unit.	CMC 1110.2
<input type="checkbox"/>	<input type="checkbox"/>	(3) The inlet of a liquid receiver, except for self-contained systems or where the receiver is an integral part of the condenser or condensing unit.	CMC 1110.2
<input type="checkbox"/>	<input type="checkbox"/>	(4) The outlet of a liquid receiver.	CMC 1110.2
<input type="checkbox"/>	<input type="checkbox"/>	(5) The inlets and outlets of condensers where more than one condenser is used in parallel in the systems.	CMC 1110.2
		Exception:	
		Systems that have a refrigerant pumpout function capable of storing the refrigerant charge, or are equipped with the provisions for pumpout of the refrigerant or self-contained systems. [ASHRAE 15.9.12.5]	CMC 1110.2
<input type="checkbox"/>	<input type="checkbox"/>	3. Stop valves shall be readily accessible from the refrigeration floor or platform.	CMC1110.4

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<u>CHK.</u>	<u>N/A</u>	XII. EMERGENCY SIGNS AND LABELS	
<input type="checkbox"/>	<input type="checkbox"/>	1. Stop valves shall be identified by tagging in accordance with the referenced standard for identification. (ASME A 13.1-2007)	CMC 1110.5
<input type="checkbox"/>	<input type="checkbox"/>	2. A valve chart shall be mounted under glass at a location near the principal entrance to the machinery room.	CMC 1110.5
<input type="checkbox"/>	<input type="checkbox"/>	3. Piping shall be identified with the type of refrigerant, function and pressure.	CMC 1109.10
<input type="checkbox"/>	<input type="checkbox"/>	4. Refrigeration units or systems with over 220 lbs of group A1 or other group over 30 lbs shall be provided with approved emergency signs, charts and labels in accordance with NFPA 704. Hazard signs shall be in accordance with the CMC for the classification of refrigerants listed therein.	CFC 606.7

<u>CHK.</u>	<u>N/A</u>	XIII. PROTECTION OF PIPING AND EQUIPMENT	
<input type="checkbox"/>	<input type="checkbox"/>	1. Refrigeration systems and portions thereof shall not be located in an elevator shaft, dumbwaiter shaft or a shaft containing moving objects nor in a location where they will be subject to mechanical damage.	CMC 1109.4.1
<input type="checkbox"/>	<input type="checkbox"/>	2. Air conditioning refrigerant circuit access ports located outdoors shall be protected from unauthorized access with locking-type tamper resistant caps or in a manner approved by the Authority Having Jurisdiction.	CMC 1105.11
<input type="checkbox"/>	<input type="checkbox"/>	3. Equipment subject to vehicular damage shall be protected in accordance with CFC Section 312.	CMC 1109.7

<u>CHK.</u>	<u>N/A</u>	XIV. PRESSURE RELIEF DEVICES	
<input type="checkbox"/>	<input type="checkbox"/>	1. Refrigeration systems shall be protected by a pressure relief device or other means to safely relieve pressure due to fire or abnormal conditions.	CMC 1112.1
<input type="checkbox"/>	<input type="checkbox"/>	2. Pressure relief devices, fusible plugs and purge systems discharging to the atmosphere from refrigeration systems containing flammable, toxic or highly toxic refrigerants or ammonia shall comply with CFC Sections 606.12.3 through 606.12.5.	CFC 606.12

NOTE

Compliance with all items on this list does not necessarily assure compliance with all provisions of the applicable codes and standards. This check list should be used only by persons with a comprehensive knowledge of the applicable codes and standards.

APPLICABLE CODES AND STANDARDS

2016 California Building Code - Part 2, Title 24, CCR
(2015 International Building Code and 2016 California Amendments)

2016 California Mechanical Code - Part 4, Title 24, CCR
(2015 Uniform Mechanical Code and 2016 California Amendments)

2016 California Fire Code - Part 9, Title 24, CCR
(2015 International Fire Code and 2016 California Amendments)

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ASHRAE 15-2013 Safety Refrigeration Systems
ASHRAE 34-2013 Designation and Safety Classification of Refrigerants
ASME A13.1-2007 Scheme for the Identification of Piping Systems
IIAR2-2014 Mechanical Refrigeration, Equipment, Design,
and Installation of Ammonia Systems
NFPA 704-2012 Standard System for Identification of the Hazards of
Materials for Emergency Response

OSHPD Policy Intent Notices and Code Application Notices.
<http://www.oshpd.ca.gov/FDD/Regulations/CANs/index.html>
OSHPD Project Review Status
http://www.oshpd.ca.gov/FDD/project_status/index.asp
OSHPD Public Use Forms
<http://www.oshpd.ca.gov/FDD/Forms/index.html>