

BSR/ACCA 14 QMref Standard
*Quality Maintenance of Commercial
Refrigeration Systems*

[New Standard]

DRAFT

3rd Public Review Draft – 11 August 2015

Comments on this draft are to be submitted on the “ACCA Public Response Form” (available at www.acca.org/ansi) with the subject line “QMref Public Comment from {your last name}” during the ANSI Public Review Period:

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INTRODUCTION

[This Introduction is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ACCA or ANSI.]

Commercial refrigeration equipment and systems require routine monitoring, evaluation, adjustments, cleaning, and eventual replacement of components. Regularly scheduled inspections and maintenance are often required to maintain the original equipment manufacturer (OEM) warranty.

This standard prescribes inspection tasks and offers recommended corrective actions to maintain commonly installed commercial refrigeration equipment and systems found in supermarkets, convenience stores, refrigerated warehouses, etc. Equipment checklists are provided by equipment type and detail the minimum visual inspections, performance tests, measurements, and component evaluations. Recommended corrective actions in the standard provide generic guidance designed to maintain refrigeration equipment in good working order. Specific instructions from the equipment manufacturer are also to be followed. Additionally, the Standard provides guidance when special operating circumstances may require additional attention.

Conducting regularly scheduled inspections, maintenance, and remediation of commercial refrigeration equipment prolongs its efficiency, promotes product safety, supports lower utility costs, guards against unexpected failures, and prolongs equipment life. Everyone benefits when refrigeration systems operate efficiently within the required temperature ranges.

To maximize the effectiveness of a maintenance program, the equipment must first be designed and installed according to the manufacturer's instructions and applicable codes.

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1.0 PURPOSE

This standard establishes a minimum maintenance program for maintaining refrigeration equipment found in supermarkets, convenience stores, food service, and warehouses operating with saturated suction temperatures between -40F and +40F.

2.0 SCOPE

- 2.1 This standard provides minimum requirements for the assessment and maintenance of commercial refrigeration equipment typically found in supermarkets, convenience stores, institutional applications, food services, warehouses, and similar applications operating at medium- and low-temperature refrigeration conditions (e.g., saturated suction temperatures between -40°F and 40°F).
- 2.2 This standard includes checklist tasks for inspecting, testing, and measuring the mechanical, electrical, and controls systems of commercial refrigeration systems. The checklists also provide recommended corrective actions to remedy identified faults (e.g., cleaning, adjusting, and/or replacing components and equipment).
- 2.3 This standard presumes that the refrigeration system was designed, installed, and operated in accordance with original equipment manufacturer (OEM) instructions, applicable codes, and other industry requirements.
- 2.4 This standard shall not be used to circumvent safety, health, environmental, local/state ordinances, or the equipment manufacturer's requirements.
- 2.5 Systems utilizing ammonia, carbon dioxide (CO₂), or flammable refrigerants (such as hydrocarbons) may require additional or different inspection tasks and/or corrective actions. This standard defers to the OEM's instructions and to the industry standards contained in Appendix B – Bibliography.
- 2.6 This standard excludes transport refrigeration.

3.0 PROGRAM EXECUTION

A maintenance program seeks to eliminate deficiencies that degrade or impair the refrigeration system, including its components. The technician shall recommend actions to correct these deficiencies. The following are the responsibilities and elements for a maintenance program:

- 3.1 *Facility owner's responsibilities:* The owner is ultimately responsible for the refrigeration equipment's required maintenance. Owners shall use appropriately licensed and certified commercial refrigeration technicians and/or a contractor to perform inspection tasks or to implement a maintenance program. The owner is responsible for authorizing corrective actions, as included in the contract, and determining which corrective actions will require further authorization to be performed.
- 3.2 *Commercial refrigeration contractor's responsibilities:* Appropriately licensed and certified technicians shall:
 - Inspect all pertinent refrigeration equipment and components to identify the faults which violate the following applicable documents: manufacturer's instructions, manufacturer's warranty requirement, building codes, occupant safety or health standards, environmental regulations, and recognized industry good practices.
 - Inform the customer of improper operation finding(s), corrective action(s) taken, corrective action(s) recommended, and the price to undertake the recommended action(s).

3.3 *Maintenance inspection elements:*

- 3.3.1 *Inventory:* Identify and record the refrigeration system(s) inventory of equipment, controls, components, and accessories.
- 3.3.2 *Equipment maintenance checklists:* From Section 5 (Maintenance Tasks), identify appropriate checklists for each piece of equipment in the inventory.
- 3.3.3 *Code requirements:* Identify and observe the applicable code references (e.g., International Mechanical Code, Uniform Mechanical Code, National Fire Protection Association, etc.).
- 3.3.4 *Performance objectives:* Identify minimum equipment performance criteria based on the manufacturer's performance data, code requirements, and industry standards.
- 3.3.5 *Industry standards:* Follow recognized industry standards and practices; see Appendix B.

4.0 DOCUMENTATION

The commercial refrigeration technician records measurements, observations, and recommends corrective action(s) to maintain the system's ability to efficiently function properly. The minimum documentation shall identify:

- 4.1 *Inventory:* The inventory of the equipment for the facility's refrigeration system(s) per Section 3.3.1.
- 4.2 *Checklists:* Those applicable tasks for the inspected equipment from Section 5.0 Inspection Tasks and Recommended Corrective Actions.
- 4.3 *Code violations:* Violations of the applicable codes.
- 4.4 *Performance objectives:* The refrigeration system's measured performance compared to the performance objectives per Section 3.3.4.
- 4.5 *External conditions:* Observed circumstances apart from the refrigeration system which cause health and safety issues, accelerated wear, poor performance, or increased energy use.
- 4.6 *Inaccessible items:* Components that are inaccessible or if the limited accessibility of the component impairs the inspection or maintenance task.
- 4.7 *Corrective actions:* Those tasks, included in the contractual agreement or authorized by the owner, undertaken to meet the performance objectives, improve system performance, safety, efficiency, or durability.

5.0 MAINTENANCE TASKS

This section identifies inspection tasks and recommended corrective actions for commercial refrigeration equipment.

- *Inspection tasks:* This portion of the checklist describes the minimum tasks required for most major pieces of commercial equipment.
- *Recommended corrective actions:* The checklists offer remedies for faults identified during the inspection process. The technician shall inform (or follow guidance for informing) the facility owner of remedies included as part of the inspection and coordinate prior approval for remedies, which are excluded from the inspection. All corrective actions shall be performed in accordance with the applicable OEM's instructions and applicable building codes.
- *Inspection scheduling:*
 1. The commercial refrigeration technician shall advise of the need to change the inspection tasks or frequency of inspection to address deficiencies if unacceptable performance is found during two successive inspections. Changes are subject to the terms of the contractual agreement.
 2. The commercial refrigeration technician shall advise of the need to change the inspection tasks or frequency of inspection if acceptable performance is found during three successive inspections. Changes are subject to the terms of the contractual agreement.
- *Component / equipment listings:* The major pieces of refrigeration equipment and accessories shall have checklists. If a system in the commercial facility is not covered by a checklist, a checklist from functions similar to those listed on checklists 5.1 – 5.14 shall be assembled.

Component / Equipment	Component / Equipment Description	Checklist Number
Beverage Dispensers	A refrigeration system designed to mix and chill beverages to the serving temperature.	5.1
Cascade	A system containing two or more refrigeration cycles, which may use different refrigerants, and linked through a heat exchanger. Often used to provide lower temperatures more economically.	5.2
Service Case	A refrigerated unit designed without customer access, having reach-in access from the service side only.	5.3
Food Prep Tables	Food working and service refrigeration units that come in many styles and configurations often designed to hold products in reach-in doors or drawers. Two main types are available: (1) food prep tables have food containers that are accessed from the top at the specified temperature, and (2) cold-top tables generally have a marble top and are designed for working on cold service food prep.	5.4
Frozen Carbonated Beverage Machine	A refrigerated dispenser designed to stir and chill carbonated beverages and provide a frozen product in the form of a semi-frozen slush.	5.5
Heat Recovery	A method of utilizing refrigeration system waste heat to increase energy efficiency elsewhere.	5.6
Ice Makers and Ice Machines	A refrigerated unit that freezes water to make ice in many configurations, e.g., flakes, cubes, and chips.	5.7
Industrial Refrigeration (Built-Up Systems) (100 ton and above)	A system engineered for an industrial setting where variable loads are taken into consideration.	5.8
Parallel Rack	A configuration for compressors, piped in parallel, and a condenser or condensers located remotely, away from the refrigeration evaporators and cooling units.	5.9
Reach-In	A commercial refrigeration unit, horizontal or vertical, generally designed to operate between -40F and +40F, where the consumer has access by opening a door. These units are either remote or self-contained.	5.10
Service Over Counter (Display Deli)	Refrigerated units designed to display products below a solid countertop. These units may or may not have an accessible reach-in refrigerated or non-refrigerated storage built-in below.	5.11
Single Condensing Unit	A package unit designed for use with one or more evaporators.	5.12
Soft-Serve Ice Cream	A refrigerated dispenser designer to stir and chill liquid mixes and provide frozen custard, ice cream, and yogurt.	5.13
Walk-In (Cooler and Freezer)	Refrigerated cooling or freezing units with walk-in access. Often a walk-in freezer is located within a walk-in cooler.	5.14

Table 1: Component and Equipment Descriptions

Checklist 5.1 Beverage Dispensers		
Inspection Task	Rec. Corrective Actions	Frequency
1. Check for general cleanliness.	Clean drain pan, grid, splash panel, nozzles and diffusers as required or permitted.	Monthly
2. Check refrigeration system for proper operation (see condensing units from reach-ins systems for specifics).	Clean, repair or replace as necessary.	Monthly
3. Check water regulating valve.	Adjust as required. Repair or replace as needed.	Monthly
4. Check carbonator for proper operation.	Repair/replace carbonator pump, motor, electrode or liquid level control as needed.	Monthly
5. Check high pressure regulator.	Repair/replace as needed.	Monthly
6. Check CO2 supply.	Adjust CO2 pressure or replace tank as needed.	Monthly
Independent Notes:		
<ul style="list-style-type: none"> All cleaning must meet local health department regulations. 		

Checklist 5.2 Cascade		
Inspection Task	Rec. Corrective Actions	Frequency
NOTE: By definition, cascade systems are two or more refrigeration systems. Hence, the appropriate number of checklists are to be selected (or assembled) and those actions undertaken.		
1. Check condenser fan, as appropriate.	Vacuum or clean as necessary.	Bi-annual
2. Check condenser filter, as appropriate.	Clean or replace as necessary.	Bi-annual
3. Check gasket for punctures or tears	Clean or replace as necessary.	Bi-annual
4. (Controls) Check control strategy for consistency with customer expectations.	Reprogram as required.	Annually
5. (Controls) Check function of transducers and temperature sensors for accuracy.	Calibrate or replace.	Annually
6. (Heat exchanger) Check for ice buildup on the heat exchanger.	Reinsulate if frost or ice is found.	Annually
Independent Notes: <ul style="list-style-type: none"> • Find appropriate other checklist for the system being worked on. • These systems are ultra-low temperature freezers, generally seen in laboratories. • Typical maintenance is for electrical components; generally, once the technician has to go into the system then it will be replaced. 		

Checklist 5.3 Service Case		
Inspection Task	Rec. Corrective Actions	Frequency
Exterior Surroundings		
1. Check that store conditions do not exceed 75DB 55%RH.	Make sure that environmental system at the location is functioning properly.	Annually
2. Check that there is no air infiltrating into case.	Take required steps to remove the cause of infiltration (e.g., an errant air duct).	Annually
3. <u>Check automatic door closure for proper operation.</u>	<u>Repair or replace as necessary.</u>	<u>Quarterly</u>
4. Check that no water is coming from the display case (e.g., condensation) or water is present around display case (e.g., drainage issue).	Take required steps to ensure that condensate pan and drain line are not obstructed. Ensure that the anti-sweat heater is functioning properly.	Quarterly
5. Check that all trim is properly attached and that electrical covers are secure.	Repair as needed.	Quarterly
6. Check that the case is being properly loaded.	Inform the owner/location manager of improper loading.	Quarterly
7. <u>Check that the case is properly plumbed and level.</u>	<u>Inform the owner when the service case is not level and/or condensate drainage is not sloped properly.</u>	<u>Annually</u>
8. Check the display case ambient fans for proper operation (e.g., motor end plate noise).	Repair or replace as needed.	Quarterly
9. Check for ice build-up and air leakage in seams of display case.	Remove build-up, and use food grade sealant for leaks.	Quarterly
Refrigerated Area		
10. Check for ice build-up <u>at TXV area, U-bends, or</u> in seams of display case.	Remove build-up, and use food grade sealant for leaks.	Quarterly
11. Check for refrigerant leaks.	Consult with the manager and schedule repair as needed.	Quarterly
12. Check that the drain area is clear.	Clean the interior per the manufacturer's instructions and flush the drain.	Quarterly
13. Check discharge air grille (honeycomb) for cleanliness.	Clean as necessary.	Quarterly
14. Check display case lighting for proper operation.	Advise the manager if not operating properly.	Quarterly
15. Check display case wiring connections and that the wire is properly stowed.	Secure as needed.	Quarterly
16. Check anti-sweat heater for proper operation.	Repair or replace as needed.	Annually
17. Check fan operation and drain heaters.	Repair or replace as needed.	Annually
18. <u>Check for OEM minimum rated feet per minute (fpm) airflow at the air discharge.</u>	<u>Inform owner/location manager when airflow is lower than OEM minimum requirements.</u>	<u>Quarterly</u>
19. Check defrost and defrost	Adjust, program, repair, or replace	Annually

termination for proper operation.	as needed.	
20. Check temperature control settings.	Adjust to design or manufacturer's specifications as needed.	Annually
21. Check EPR settings.	Adjust to design or manufacturer's specifications as needed.	Annually
22. Check TXV has proper superheat.	Ascertain the cause of improper superheat, and take relevant corrective actions based on the cause.	Annually
If Self-Contained		
23. Check the condenser and compressor compartment area for debris, fan proper operation.	Remove debris, check airflow, clean condenser coil, and replace fan motor as needed.	Quarterly
24. Check re-evaporator pan.	Clean or repair as needed.	Quarterly
25. Check electrical wiring in compressor compartment area.	Repair, replace, and stow as needed.	Quarterly
Independent Notes:		
<ul style="list-style-type: none"> • Before taking any corrective action that would require turning off the case, consult with the manager so that the proper steps are taken with respect to contents of the case and scheduling. 		

Checklist 5.4 Food Prep Tables (Reach-In)		
Inspection Task¹	Rec. Corrective Actions	Frequency
Condenser²		
1. Check condenser coil surface for dust, dirt, and lint.	Clean as necessary per manufacturer's specifications.	Monthly
2. Check condenser intake air filter.	Clean or replace as necessary.	Monthly
3. Shine a light on the condenser surface to check for dirt inside the condenser.	Remove light build-up with a brush or a vacuum with a brush attachment. Remove moderate buildup with compressed air, followed by brushing as necessary. Remove heavy buildup per manufacturer's specifications.	Quarterly
4. Check fan blades and motor for cleanliness.	Clean as necessary. If washing the fan blades is necessary, cover the fan motor to prevent moisture damage.	Quarterly
5. Check condenser for adequate airflow and no recirculation of discharge air.	Clean the louvers on the downstream side of the condenser and/or gravity dampers if applicable. Ensure sure that the fan shroud is present and intact.	Quarterly
6. Check condition of fins as applicable.	Straighten with fin comb as necessary.	Quarterly
Evaporator Coil		
7. Check drain tap.	Ensure it is level and trapping.	Quarterly
8. Check drain tube.	Connect drain tube to evaporator drain pan as necessary. Remove drain tube obstructions as necessary.	Quarterly
9. Check self-contained water removal system (condensate drain pan).	Replace heater if amperage does not meet manufacturer's specifications.	Quarterly
10. Check for dirt, build-up, and foreign objects.	Clean with a brush or soapy water as necessary.	Quarterly
11. Check the integrity of fins.	Replace evaporator coil if necessary.	Quarterly
12. Check for obstructions to proper airflow.	Remove any obstructions that block air to the evaporator.	Quarterly
Controls		
13. Check operation defrost control set time.	Adjust the knob until the time matches the manufacturer's specification.	Quarterly
14. Check case temperature set point.	Adjust until it matches the manufacturer's specified set point.	Quarterly
Doors/Gaskets		
15. Check door slides or guides.	Replace broken guides as necessary.	Quarterly
16. Check door gaskets for cleanliness and presence of mold or mildew.	Clean with mild soap and water solution as necessary. Follow with fresh water rinse.	Quarterly

17. Check door gaskets for proper sealing.	Adjust or replace as necessary.	Quarterly
18. Check door hinges for looseness.	Tighten the screws that mount the hinge brackets to the unit frame as necessary. Replace broken hinges as necessary.	Quarterly
19. Check amperage of anti-sweat, frame, and door heaters.	Replace if amperage does not meet manufacturer's specifications.	Quarterly
Walls/Panel Interior		
20. Check refrigeration tubing is not rubbing or vibrating against other tubing or panel.	Correct as necessary.	Quarterly
21. Check cabinet exterior and interior for cleanliness.	Clean with mild soap and water solution as necessary. Follow with fresh water rinse.	Quarterly
22. Check casters for corrosion.	Wipe with damp cloth as necessary. Lubricate per manufacturer's specifications.	Quarterly
23. Check insulation and areas of moisture accumulation for biological growth.	Clean or disinfect as necessary.	Quarterly
24. Check condition of shelves.	Clean as necessary.	Quarterly
Surroundings		
25. Check for anything stacked on or around the machine.	Advise customer to remove as necessary.	Quarterly
26. Check area surrounding the machine for cleanliness.	Advise customer to clean as necessary.	Quarterly
Additional		
27. Check the pan chillers temperature and defrost.	Adjust to match manufacturer's specifications.	Quarterly
28. Check box fans to condiment pans for obstructions to proper airflow.	Remove any obstructions that block air to evaporator.	Quarterly
29. Check doors/drawers for proper fit.	Adjust as necessary or replace rollers as necessary.	Quarterly
30. Check refrigerant line insulation.	Repair or replace as necessary.	Quarterly
Notes:		
<ol style="list-style-type: none"> 1. <u>During the course of the regular maintenance inspection, the technician should notify the owner if they see an installation issue that could compromise food safety or equipment performance. These issues may include: equipment placed in direct sunlight, ambient air temperatures exceeding OEM thresholds, heat from other appliances affecting the condenser, impingement of minimum air inlet clearance for the condenser because equipment is placed too close to the wall.</u> 2. Disconnect electric power before cleaning. 		

Checklist 5.5 Frozen Carbonated Beverage Machines^{1,2}		
Inspection Task	Rec. Corrective Actions	Frequency
Exterior		
1. Check that the refrigeration tubing is not rubbing or vibrating against other tubing or panels.	Adjust as necessary.	Semi-annual
2. Check refrigeration tubing insulation.	Replace or repair as necessary.	Semi-annual
3. Check that nothing is stacked on or around the machine which impedes appropriate airflow through and around machine per OEM specifications.	Clear away as necessary.	Semi-annual (daily)
4. Check for dust and dirt on the outside of the machine.	Sponge off with mild soap and water, then dry with a soft, clean cloth. NSF approved commercial stainless steel cleaner may be used if applicable.	Semi-annual (daily)
5. Check the integrity of all panels and supports on equipment, as applicable.	Replace fasteners as needed to ensure proper integrity and fit/finish.	Semi-annual
Interior - Mechanical		
6. Check condenser for adequate airflow, and intake and ambient air temperature ³ for recirculation of discharge air, per OEM specifications.	Clear away or move the machine as necessary.	Monthly
7. Check the air filter for dust, grease, and grime.	Clean air filter as necessary.	Monthly
8. Disconnect electric power and check the outside of condenser and fins for dirt.	Clean in accordance with OEM specifications (e.g., with soft brush, coil cleaner, or vacuum with brush attachment. Brush from top to bottom, not side to side. Be careful in order to not bend fins).	Semi-annual
9. Check the condenser fan motor for worn bearings and secure mounting.	Lubricate, repair (e.g., tighten, weld, etc.), or replace as necessary.	Semi-annual
10. Check fan blades and fan housing for dirt, bending, missing shroud.	Clean, repair, or replace as necessary.	Semi-annual
11. With electric power on, check condenser fan motor for proper operation and integrity of bearings (heat, vibration, noise).	Repair or replace as necessary.	Semi-annual
12. Check air-cooled condenser surfaces for damage (e.g., bent fins) or evidence of leaks.	Straighten, repair, clean, or replace as necessary.	Semi-annual
Cleaning and Sanitizing		
13. Review operator's sanitation policies.	Notify them that sanitation must comply with federal, state, and local regulations and codes. Machine must be sanitized after service.	Quarterly
Storage (Winter or Extended)		
14. Check the condition of the equipment prior to storage.	Ensure that the equipment has been cleaned and shut down for extended	Annual

	storage in accordance with OEM specifications. Water must be removed from water-cooled condensers prior to storage.	
<p>Note:</p> <ol style="list-style-type: none">1. Ambient conditions of machine operation must comply with applicable codes, regulations, and OEM specifications.2. <u>The International Energy Conservation Code stipulates minimum insulation wall thickness for this type of equipment in order to prevent water and mold accumulation. The technician should notify the owner if newly-installed equipment does not comply with the requirements of the locally enforced code.</u>3. These two temperatures should be equal or near equal.		

Checklist 5.6 Heat Recovery		
Inspection Task	Rec. Corrective Actions	Frequency
1. Check for scaling, erosion, corrosion, algae or slime in heat recovery loop.	Treat the water as required.	Semi-annual
2. Check the water tube for scaling.	Clean water tube using mild scale removing compound following the de-scaler manufacturer's instructions.	Semi-annual
3. Check inlet and outlet piping for freeze protection measures.	Install heat tape or add freeze inhibit fluid to the partial heat recovery water loop as needed.	Semi-annual
4. Inspect anodes.	Replace as needed.	Every three years
Flat Plate Heat Exchangers		
5. Check the pressure drop across the heat exchanger on the refrigerant side.	Replace heat exchanger when pressure drop is 10 psi greater than baseline.	Semi-annual
6. Check the function of the check valve in the heat reclaim return line to ensure no back flow through the heat reclaim coil when heat reclaim not required.	Repair or replace as necessary.	Annually
7. Check the operation of the temperature sensor driving the heat reclaim valve (three way or motorized ball valve).	Repair or replace as necessary.	Annually
8. Check the operation of the heat reclaim valve (three way or motorized ball valve).	Repair or replace as necessary.	Annually
9. Check the water/glycol pumps on the secondary side for operation and proper flow.	Repair or replace as necessary.	Per OEM instructions
10. Check to see that the bypass switch is not initiated.	Repair as necessary.	Quarterly

Checklist 5.7 Ice Makers / Ice Machines		
Inspection Task	Rec. Corrective Actions	Frequency
Exterior		
1. Check all water fittings and water supply lines and drains for leaks.	Replace and repair as necessary.	Semi-annual
2. Check that the refrigeration tubing is not rubbing or vibrating against other tubing or panels.	Adjust as necessary.	Semi-annual
3. Check refrigeration tubing insulation.	Replace or repair as necessary.	Semi-annual
4. Check that nothing is stacked on or around the ice machine which impedes appropriate airflow through and around ice machine per OEM specifications.	Clear away as necessary.	Semi-annual
5. Check for dust and dirt on the outside of the ice machine.	Sponge off with mild soap and water, then dry with a soft, clean cloth. Commercial stainless steel cleaner may be used if applicable.	Semi-annual
6. Check the integrity of all panels and supports on equipment, as applicable.	Replace fasteners as needed to ensure proper integrity, and fit/finish.	Semi-annual
7. Check water filters.	Replace per OEM specifications.	Annually, depending on water conditions
Interior - Mechanical		
8. Check condenser for adequate airflow and inadequate circulation of discharge air, per OEM specifications.	Clear away as necessary.	Semi-annual
9. Disconnect electric power and check the outside of condenser and fins for dirt.	Clean in accordance with OEM specifications (e.g., with soft brush, coil cleaner, or vacuum with brush attachment. Brush from top to bottom, not side to side. Be careful in order to not bend fins).	Semi-annual
10. Check the condenser fan motor for worn bearings and secure mounting.	Lubricate, repair (e.g., tighten, weld, etc.), or replace as necessary.	Semi-annual
11. Check fins for bending.	Straighten with a fin comb as necessary.	Semi-annual
12. Check evaporator and water distribution system for scale buildup.	Clean water distribution system (by hand) and evaporator (with nicklesafe per OEM specifications) as necessary.	Semi-annual, depending on water conditions
13. Check water reservoir(s) for ale solids or mineral buildup.	Remove solids and flush thoroughly, per OEM specifications.	Semi-annual
14. Check the pump motor for proper operation (e.g., broken impeller, pumping speed, leaking, sequence of operation).	Repair or replace as necessary, per OEM specifications.	Semi-annual
15. Check air filter, condenser fan blade, and coil for dust, grease, and grime.	Clean as necessary.	Semi-annual
16. For ice flaker machines, check auger and mechanical seals, and check	Replace as necessary.	Check with OEM requirements (hrs. of

auger bearings for water.		operation, time)
17. Check heat exchanger (evaporator) surfaces for evidence of buildup or fouling.	Restore as necessary.	Semi-annual
18. Check tubing for separation from evaporator.	Replace the evaporator.	Semi-annual
19. Check fan blades and fan housing for dirt, bending, missing shroud.	Clean, repair, or replace as necessary.	Semi-annual
20. With electric power on, check condenser fan motor for proper operation and integrity of bearings (heat, vibration, noise).	Repair or replace as necessary.	Semi-annual
21. Check air-cooled condenser surfaces for damage or evidence of leaks.	Repair, clean, or replace as necessary.	Semi-annual
Interior - Water		
22. Check the water-cooled condenser and water regulating valve for scale buildup.	Clean per OEM specifications.	Semi-annual
23. Check water distribution system and evaporator for scale buildup.	Clean per OEM specifications.	Semi-annual
24. Check water distribution system for restrictions and consistent water flow over the evaporator.	Clean as necessary.	Semi-annual
25. Check water flow through external water filter.	Remove and replace as necessary.	Semi-annual
26. Check strainer, inlet water valve screen for obstruction or scale.	Clean or replace as necessary.	Semi-annual
27. Check the float switch for scale.	Clean or replace as necessary.	Semi-annual
28. Check the float valve assembly adjustment and operation.	Clean, adjust, repair, or replace as necessary.	Semi-annual
29. Check for proper drainage or water backup in the bin.	Clean as necessary.	Semi-annual
30. Check for water overflow of the reservoir.	Identify cause of overflow, resolve, and Clean as necessary.	Semi-annual
31. Check drain pan, drain line, and coil for biological growth.	Clean and sanitize as necessary, per OEM specifications.	Semi-annual
32. Check interior panels and areas of moisture accumulation for biological growth.	Clean and sanitize as necessary.	Semi-annual
Other		
33. Check bins for contaminants.	Clean and sanitize the ice machine bins per OEM instructions.	Semi-annual
34. Check bin ice sensor for proper operation/location.	Adjust or replace as necessary.	Semi-annual
35. Determine ice production per 24 hours from OEM specifications and compare to actual production.	If production is low, perform system check per OEM specifications.	Semi-annual

Checklist 5.8 Industrial Refrigeration Built-Up Systems		
Inspection Task	* Rec. Corrective Actions	Frequency
Evaporative Condenser – Water Circuit		
1. Check spray distribution.	Clean and repair as necessary	Quarterly
2. Check spray pump and piping.	Clean and repair as necessary	Quarterly
3. Check the water treatment system.	Advise owner or representative if not operational	Quarterly
4. Check make-up water.	Clean strainer and repair as necessary	Quarterly
5. Check the bleed rate.	Clean strainer and adjust and repair as necessary	Quarterly
6. Check sump basin.	Clean, brush, and flush, must be free of dirt and debris	Annually (with proper water treatment)
Evaporative Condenser – Motor and Drive		
7. Check motor.	Lubricate and clean	Quarterly
8. Check motor mounting.	Replace as necessary	Quarterly
9. Check sheaves and pulleys.	Clean and repair or replace as necessary	Quarterly
10. Check gear drive unit (gear coupling/system).	Clean, repair and lubricate as necessary	Quarterly
11. Check belts condition.	Replace as necessary	Quarterly
12. Check belt tension and alignment.	Adjust or replace as necessary.	Quarterly
13. Check protective guards.	Ensure properly installed	Quarterly
14. Check connection wiring (electrical whips).	Tighten and secure	Quarterly
15. Check motor volts and amperages.	Record values, advise owner or representative if out of range	Quarterly
Evaporative Condenser - Other		
16. Check low ambient protection (basin heater).	Repair as necessary	Annually (before winter)
Open Drive, 100+ ton Compressor Package – Oil Circuit		
17. Check operating time of unit.	Replace oil, perform oil analysis, change oil filter and strainer per recommended service interval	Quarterly
18. Check the oil pump wiring and starter, as applicable.	Repair or replace as necessary	Annually
Compressor Package – Compressor Package		
19. Check operating time of unit.	Replace coalescing element, suction screen, liquid line strainers, and motor compressor coupling per recommended service interval	Quarterly
20. Check for oil and refrigerant leaks.	Repair as necessary	Quarterly
21. Check oil connections and LP/HP control piping for oil leaks.	If oil is found, check for refrigerant leaks or replace tubing as necessary following OEM instructions.	Annually
Compressor Package - Controls		
22. Check transducer calibration.	Re-calibrate as necessary	Quarterly
23. Check RTD sensors.	Re-calibrate as necessary	Quarterly
24. Check that the wiring properly	Support as needed	Quarterly

* All corrective actions should be performed in accordance with the applicable OEM's instructions. Corrective actions which involve health and safety should follow the applicable food safety codes.

supported.		
25. Pull/download control data and alarms.	Log, advise, and take appropriate corrective action	Quarterly
26. Check for proper set points.	Correct settings	Annually
Compressor Package - Compressor		
27. Check seal drip count.	Replace when drip count exceeds OEMs drip count recommendation	Monthly
28. Check compressor bearings.	Adjust or replace as necessary	Quarterly
29. Check motor wiring.	Tighten connections as necessary	Quarterly
30. Inspect motor starter.	Tighten connections as necessary, replace contacts as necessary	Quarterly
31. Check compressor unloading.	Inspect and adjust	Quarterly
32. Check for loose compressor mounts.	Repair or replace motor mounts as necessary.	Annually
33. (On semi-hermetic only) Check the seals on all exposed gasket surfaces for oil.	If oil is found, check for refrigerant leaks or replace tubing as necessary following OEM instructions.	Annually
Various – Liquid Overfeed System		
34. Check pump and motor performance.	Check that it's operating within manufactures limits, if outside determine cause and remedy	Monthly
35. Check pump motor starter and wiring.	Repair as necessary	Monthly
36. Check pump safety cut-off.	Test and Adjust	Monthly
37. Check minimum flow device.	Test and Adjust	Quarterly
38. Check low side receiver fill valve.	Test proper cut in and cut out, adjust	Quarterly
39. Check evaporator feed valves.	Test for proper operation, repair or replace as necessary	Quarterly
40. Check general condition of piping and insulation.	Inspect, Repair, Replace as necessary	Quarterly
41. Check piping refrigerant leaks.	Inspect Repair, replace as necessary	Quarterly
Various Refrigerant Transfer Vessels		
42. Check vessel integrity and insulation.	Test and Repair	Quarterly
43. Check vessel transfer valves.	Test for proper operation, repair	Quarterly
44. Check valves operate in manual mode.	Test for proper operation, repair	Quarterly
45. Check vessel and piping for refrigerant leaks.	Test and Repair	Quarterly
Various - PLC		
46. Check refrigerant monitor	Test and Calibrate	Monthly
47. Check alarms	Test, Log, and Advise	Monthly
48. Check outside communications (alarm monitoring system, BMS)	Test and advise	Monthly
49. Check alarm annunciator	Test and repair	Quarterly
50. Check RTD Sensor calibration	Test and Calibrate	Annually
51. Check transducer calibration	Test and Calibrate	Annually
52. Check refrigerant monitor filter	Replace	Annually
53. Check defrost and space temperature set points	Test and Adjust	Annually
54. Check auxiliary power supply	Test within date and charging,	Annually

	repair or replace	
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Checklist 5.9 Parallel Rack Direct Expansion^{1,2}		
Inspection Task	Rec. Corrective Actions	Frequency
Condenser		
1. Check condenser for cleanliness.	Clean as needed.	Quarterly
2. Check power and control electrical connections.	Repair or replace as needed.	Quarterly
3. Check fans for proper rotation and operation.	Repair or replace as needed.	Annually
4. Check that refrigerant tubing supports are secure.	Secure and isolate as needed.	Annually
Rack – Power Off		
5. Check rack power and control electrical connections (e.g., look for frayed wire ends not fully under the screw connections).	Tighten (one connector at a time), repair, or replace as necessary.	Quarterly for aluminum wiring Annually for copper wiring
6. Check wiring for proper placement and support.	Isolate and secure as needed.	Quarterly
7. Check for oil and refrigerant leaks.	Repair as needed.	Quarterly
8. Check cooling fans for control cabinets and VFDs.	Clean, repair, and replace as needed.	Semi-Annually
9. Check head cooling fan for proper operation and cleanliness.	Clean, repair or replace as necessary.	Annually
10. Record mega ohm (MΩ) value for each compressor.	Report inconsistencies if applicable.	Annually
11. Check compressor mounting bolts for proper tightness.	Adjust tightness per manufacturer's recommendation.	Annually
12. Check that refrigerant tubing supports are secure.	Secure and isolate as needed.	Annually
Rack – Power On, System Running		
13. Check refrigerant level in the receiver or sight-glass, if system is so equipped.	Compare to baseline level.	Quarterly
14. Check lubricant level at the reservoir.	Record and compare to baseline level.	Quarterly
15. Check lubricant level in the compressor.	Record and compare to baseline level.	Quarterly
16. Check pressure drop across the lubricant filter.	Replace if pressure drop exceeds OEM limits.	Quarterly
17. Check lubricant supply pressure.	Record and compare to baseline level.	Quarterly
18. Verify lubricant separator operation and element pressure drop.	Clean and repair as necessary, record element pressure drop, replace the filter media if excessive.	Quarterly
19. Check for excessive vibration.	Repair and secure as needed.	Quarterly
20. Check compressor cooling devices (demand cooling and head fans).	Repair or replace as needed.	Quarterly
21. Check sub-cooler operation.	Adjust, repair or replace as needed.	Quarterly
22. Check de-superheater operation.	Adjust, repair or replace as needed.	Quarterly
23. Check defrost-pressure differential valve operation.	Adjust, repair or replace as needed.	Quarterly
24. Check outdoor ambient, discharge	Log results and compare to trends.	Quarterly

	and suction temperatures, and compressor amperage draw.	If critical, determine the cause and notify designated individual.	
25.	If existing, check BMS system's operation.	If any variation, notify the designated individual.	Quarterly
26.	Check that all on-board control devices are properly operating.	If not working or found in override position, notify designated individual.	Quarterly
27.	Check that rack controller is set for optimum operation.	If there have been any alarms, notify designated individual.	Quarterly
28.	Take and test lubricant sample.	Resolve noted findings.	Annually
29.	Check condenser flooding valves (during periods of low ambient temperatures).	Adjust, repair or replace as needed.	Annually
30.	Check split condenser controls and valves (during periods of low ambient temperatures).	Adjust, repair or replace as needed.	Annually
31.	Check compressor efficiency (use manufacturer's performance data).	Log results and compare to trends. If critical, determine the cause and notify designated individual.	Annually
32.	Check that on-board pressure transducers and temperature sensors read correct.	Log results and compare to trends. If critical, determine the cause and notify designated individual.	Annually
Additional			
33.	<u>Check crank case heaters for proper operation.</u>	<u>Notify the designated individual if the crank case heaters do not turn off when the compressor is on or the oil temperature is at OEM specifications.</u>	<u>Quarterly</u>
34.	<u>Verify oil system is operating as designed by checking oil separator float for improper seating and blow by, checking for excessive oil levels in off cycle compressors, and checking suction accumulators for improper oil return through plugged oil ports located in the internal piped riser of the accumulator.</u>	<u>Clean and repair the system as necessary.</u>	<u>Quarterly</u>
35.	<u>Check oil system return gas check valves.</u>	<u>Replace if the return rate does not meet OEM specifications.</u>	<u>Quarterly</u>
36.	<u>Check oil failure system deactivation control.</u>	<u>Notify the designated individual if the oil system safety switches are not operating properly.</u>	<u>Quarterly</u>
37.	<u>Check phase monitor settings, and record the supply voltages.</u>	<u>Notify the designated individual if the setting has been changed between inspections.</u>	<u>Semi-Annually</u>
38.	<u>Check the integrity of the fan blades; note blades that do not match OEM blades.</u>	<u>Replace as necessary. Notify the designated individual if non-OEM blades have been found.</u>	<u>Quarterly</u>
39.	<u>Check condenser control section for evidence of water infiltration.</u>	<u>If water infiltration is found, replace seals as necessary and notify the designated individual.</u>	<u>Quarterly</u>
<u>Notes:</u>			
1. <u>If, during the course of regular maintenance, the technician notices that the transducers are mounted incorrectly (horizontally), they should notify the owner of this incorrect installation.</u>			

2. During the course of regular maintenance inspection, the technician may notice unusual vibrations, which may be transmitted through the system piping. This type of vibration may be the result of improperly design/balanced piping systems, discharge restrictor plates that have been removed, or failed mufflers; the vibration can result in brazed joints being compromised. The technician should report these vibrations to the owner.

Checklist 5.10 Reach-In¹		
Inspection Task	Rec. Corrective Actions	Frequency
Condenser²		
1. Check condenser coil surface for dust, dirt, and lint.	Clean as necessary per manufacturer’s specifications.	Monthly
2. Check condenser intake air filter.	Clean or replace as necessary.	Monthly
3. Shine a light on the condenser surface to check for dirt inside the condenser.	Remove light build-up with a brush or a vacuum with a brush attachment. Remove moderate buildup with compressed air, followed by brushing as necessary. Remove heavy buildup per manufacturer’s specifications.	Quarterly
4. Check fan blades and motor for cleanliness.	Clean as necessary. If washing the fan blades is necessary, cover the fan motor to prevent moisture damage.	Quarterly
5. Check condenser for adequate airflow and no recirculation of discharge air.	Clean the louvers on the downstream side of the condenser and/or gravity dampers if applicable. Ensure sure that the fan shroud is present and intact.	Quarterly
6. Check condition of fins as applicable.	Straighten with fin comb as necessary.	Quarterly
Evaporator Coil		
7. Check drain trap.	Ensure it is level and trapping.	Quarterly
8. Check drain tube.	Connect drain tube to evaporator drain pan as necessary. Remove drain tube obstructions as necessary.	Quarterly
9. Check self-contained water removal system (condensate drain pan).	Replace heater if amperage does not meet manufacturer’s specifications.	Quarterly
10. Check for dirt, build-up, and foreign objects.	Clean with a brush or soapy water as necessary.	Quarterly
11. Check the integrity of fins.	Replace evaporator coil if necessary.	Quarterly
12. Check for obstructions to proper airflow.	Remove any obstructions that block air to the evaporator.	Quarterly
Controls		
13. Check operation defrost control set time.	Adjust the knob until the time matches the manufacturer’s specification.	Quarterly
14. Check case temperature set point.	Adjust until it matches the manufacturer’s specified set point.	Quarterly
Doors/Gaskets		
15. Check door slides or guides.	Replace broken guides as necessary.	Quarterly
16. Check door gaskets for cleanliness and presence of mold or mildew.	Clean with mild soap and water solution as necessary. Follow with fresh water rinse.	Quarterly

17. Check door gaskets for proper sealing.	Adjust or replace as necessary.	Quarterly
18. Check door hinges for looseness.	Tighten the screws that mount the hinge brackets to the unit frame as necessary. Replace broken hinges as necessary.	Quarterly
19. Check amperage of anti-sweat, frame, and door heaters.	Replace if amperage does not meet manufacturer's specifications.	Quarterly
Walls/Panels/Interior		
20. Check refrigeration tubing is not rubbing or vibrating against other tubing or panel.	Correct as necessary.	Quarterly
21. Check cabinet exterior and interior for cleanliness.	Clean with mild soap and water solution as necessary. Follow with fresh water rinse.	Quarterly
22. Check casters for corrosion.	Wipe with damp cloth as necessary. Lubricate per manufacturer's specifications.	Quarterly
23. Check insulation and areas of moisture accumulation for biological growth.	Clean or disinfect as necessary.	Quarterly
24. Check condition of shelves.	Clean as necessary.	Quarterly
Surroundings		
25. Check for anything stacked on or around the machine.	Advise customer to remove as necessary.	Quarterly
26. Check area surrounding the machine for cleanliness.	Advise customer to clean as necessary.	Quarterly
Notes:		
<ol style="list-style-type: none"> 1. Reach-ins can be self-contained, a part of a parallel rack or remote condenser. 2. Disconnect electric power before cleaning. 		

Checklist 5.11 Service Over Counter (Reach-In)		
Inspection Task	Rec. Corrective Actions	Frequency
Condenser¹		
1. Check condenser coil surface for dust, dirt, and lint.	Clean as necessary per manufacturer’s specifications.	Monthly
2. Check condenser intake air filter.	Clean or replace as necessary.	Monthly
3. Shine a light on the condenser surface to check for dirt inside the condenser.	Remove light build-up with a brush or a vacuum with a brush attachment. Remove moderate buildup with compressed air, followed by brushing as necessary. Remove heavy buildup per manufacturer’s specifications.	Quarterly
4. Check fan blades and motor for cleanliness.	Clean as necessary. If washing the fan blades is necessary, cover the fan motor to prevent moisture damage.	Quarterly
5. Check condenser for adequate airflow and no recirculation of discharge air.	Clean the louvers on the downstream side of the condenser and/or gravity dampers if applicable. Ensure sure that the fan shroud is present and intact.	Quarterly
6. Check condition of fins as applicable.	Straighten with fin comb as necessary.	Quarterly
Evaporator Coil		
7. Check the coil for pitting ² .	Replace if excessive.	Quarterly
8. Check drain trap.	Ensure it is level and trapping.	Quarterly
9. Check drain tube.	Connect drain tube to evaporator drain pan as necessary. Remove drain tube obstructions as necessary.	Quarterly
10. Check self-contained water removal system (condensate drain pan).	Replace heater if amperage does not meet manufacturer’s specifications.	Quarterly
11. Check for dirt, build-up, and foreign objects.	Clean with a brush or soapy water as necessary.	Quarterly
12. Check the integrity of fins.	Replace evaporator coil if necessary.	Quarterly
13. Check for obstructions to proper airflow.	Remove any obstructions that block air to the evaporator.	Quarterly
Controls		
14. Check operation defrost control set time.	Adjust the knob until the time matches the manufacturer’s specification.	Quarterly
15. Check case temperature set point.	Adjust until it matches the manufacturer’s specified set point.	Quarterly
Doors/Gaskets		
16. Check door slides or guides.	Replace broken guides as necessary.	Quarterly
17. Check door gaskets for cleanliness and presence of mold or mildew.	Clean with mild soap and water solution as necessary. Follow with	Quarterly

	fresh water rinse.	
18. Check door gaskets for proper sealing.	Adjust or replace as necessary.	Quarterly
19. Check door hinges for looseness.	Tighten the screws that mount the hinge brackets to the unit frame as necessary. Replace broken hinges as necessary.	Quarterly
20. Check amperage of anti-sweat, frame, and door heaters.	Replace if amperage does not meet manufacturer's specifications.	Quarterly
Walls/Panels/Interior		
21. Check refrigeration tubing is not rubbing or vibrating against other tubing or panel.	Correct as necessary.	Quarterly
22. Check cabinet exterior and interior for cleanliness.	Clean with mild soap and water solution as necessary. Follow with fresh water rinse.	Quarterly
23. Check casters for corrosion.	Wipe with damp cloth as necessary. Lubricate per manufacturer's specifications.	Quarterly
24. Check insulation and areas of moisture accumulation for biological growth.	Clean or disinfect as necessary.	Quarterly
25. Check condition of shelves.	Clean as necessary.	Quarterly
Surroundings		
26. Check for anything stacked on or around the machine.	Advise customer to remove as necessary.	Quarterly
27. Check area surrounding the machine for cleanliness.	Advise customer to clean as necessary.	Quarterly
Additional		
28. Check doors/drawers for proper fit.	Adjust as necessary.	Quarterly
29. Check refrigerant line insulation.	Repair or replace as necessary.	Quarterly
Notes:		
<ol style="list-style-type: none"> 1. Disconnect electric power before cleaning. 2. It is especially important if vinegar products are kept in the unit. 		

Checklist 5.12 Single Condensing Unit		
Inspection Task	Rec. Corrective Actions	Frequency
Condenser/Compressor Section¹		
1. Check condenser for cleanliness.	Clean as needed.	Quarterly
2. Check condenser fans for proper operation.	Repair or replace as necessary.	Quarterly
3. Check power and control electrical connections.	Repair or replace as necessary. Follow OEM's specifications for torque tolerances and tightening, as applicable.	Quarterly
4. Check that refrigerant tubing supports are secure.	Secure and isolate as necessary.	Quarterly
5. Check for indication of refrigerant leaks (i.e., oil spot, sight glass, etc.).	Repair as necessary.	Quarterly
6. Check refrigerant moisture indicator	Replace driers if moisture is indicated	Quarterly
7. Check compressor oil level, as applicable.	If low determine cause, correct and add oil	Quarterly
8. Check suction and discharge temperatures per OEM specification	Evaluate that temperatures are in proper range, if out determine cause and advise owner of needed repairs	Quarterly
9. Check compressor amperes, voltage, and voltage balance	Evaluate that amperes, voltage, and voltage balance are in proper range, if out determine cause and advise owner of needed repairs	Quarterly
10. Check all compressor operating controls (e.g., low-ambient control) and safety controls	Adjust or repair as necessary	Quarterly
11. Check defrost controls	Adjust or repair as necessary	Quarterly
12. Check that electrical covers and panels are in properly installed	Install covers and panels as necessary	Quarterly
Evaporator Section		
13. Check evaporator for cleanliness	Clean as necessary	Quarterly
14. Check evaporator drain pan and drain lines for cleanliness and proper draining	Clean as necessary with NSF approved cleaner.	Quarterly
15. Check evaporator fans for proper operation.	Repair or replace as necessary	Quarterly
16. Check for proper fan (e.g. fan delay control) and temperature control operation	Adjust or replace as necessary	Quarterly
17. Check power and control electrical connections	Repair or replace as necessary. Follow OEM's specifications for torque tolerances and tightening, as applicable.	Quarterly
18. Check evaporator defrost components for proper operation	Repair or replace as necessary	Quarterly
19. Check for indication of refrigerant leaks	Repair as necessary	Quarterly
20. Check expansion device for proper	Adjust or replace as necessary	Quarterly

operation		
21. Check that electrical covers, panels and trim are properly installed	Install covers and panels as necessary	Quarterly
Refrigerant Line Set		
22. Check the hangars and supports for proper and secure installation	Repair defective supports	Quarterly
23. Check for torn or missing insulation	Repair and/or replace insulation as necessary	Quarterly
Check for indication of refrigerant leaks	Repair as necessary	Quarterly
Notes:		
1. Any time the system is opened, replace the dryer or dryer cores.		

Checklist 5.13 Soft Serve Machines¹		
Inspection Task	Rec. Corrective Actions	Frequency
Exterior		
1. Check that the refrigeration tubing is not rubbing or vibrating against other tubing or panels.	Adjust as necessary.	Semi-annual
2. Check refrigeration tubing insulation.	Replace or repair as necessary.	Semi-annual
3. Check that nothing is stacked on or around the machine which impedes appropriate airflow through and around machine per OEM specifications.	Clear away as necessary.	Semi-annual
4. Check for dust and dirt on the outside of the machine.	Sponge off with mild soap and water, then dry with a soft, clean cloth. Commercial stainless steel cleaner may be used if applicable.	Semi-annual (daily)
5. Check the integrity of all panels and supports on equipment, as applicable.	Replace fasteners as needed to ensure proper integrity and fit/finish.	Semi-annual
Interior - Mechanical		
6. Check the air filter for dust, grease, and grime.	Clean as necessary.	Monthly
7. Check drive belts for wear.	Replace belts as necessary.	Quarterly
8. Check condenser for adequate airflow, and intake and ambient air temperature ² for recirculation of discharge air, per OEM specifications.	Clear away or move the machine as necessary.	Semi-annual
9. Disconnect electric power and check the outside of condenser and fins for dirt.	Clean in accordance with OEM specifications (e.g., with soft brush, coil cleaner, or vacuum with brush attachment. Brush from top to bottom, not side to side. Be careful in order to not bend fins).	Semi-annual
10. Check the condenser fan motor for worn bearings and secure mounting.	Lubricate, repair (e.g., tighten, weld, etc.), or replace as necessary.	Semi-annual
11. Check condenser fan blade and coil for dust, grease, and grime.	Clean as necessary.	Semi-annual
12. Check fan blades and fan housing for dirt, bending, missing shroud.	Clean, repair, or replace as necessary.	Semi-annual
13. With electric power on, check condenser fan motor for proper operation and integrity of bearings (heat, vibration, noise).	Repair or replace as necessary.	Semi-annual
14. Check air-cooled condenser surfaces for damage (e.g., bent fins) or evidence of leaks.	Straighten, repair, clean, or replace as necessary.	Semi-annual
15. Check O-rings for wear, tear, and loose fit.	Replace with new ones as necessary.	Semi-annual
16. Check the scraper blades for damage.	Replace scraper blades that are nicked or damaged.	Semi-annual
17. Check the shell bearing for signs of	Clean and lubricate following all	Semi-annual

wear (excessive mix leakage in drip pan) and be certain it is properly cleaned.	lubricating procedures as outlined in OEM manual.	
18. Check drive belt tension.	Adjust, as necessary, following the steps in the operator's manual.	Semi-annual
19. Check the type of lubricant being used.	Verify that the lubricant used is in accordance with US Department of Agriculture, FDA, and OEM requirements. Notify equipment owner if not.	Semi-annual
Cleaning and Sanitizing		
20. Review operator's sanitation policies.	Notify them that sanitation must comply with federal, state, and local regulations and codes. Machine must be sanitized after service.	Quarterly
Notes:		
<ol style="list-style-type: none"> 1. Ambient conditions of machine operation must comply with applicable codes, regulations, and OEM specifications. 2. These two temperatures should be equal or near equal. 		

Checklist 5.14 Walk-In		
Inspection Task¹	Rec. Corrective Actions	Frequency
Condensing Unit		
1. Check air-cooled condenser surfaces for damage or evidence of leaks (oil spots).	Repair or clean as needed.	Quarterly
2. Check for signs of oil stains on interconnection piping and condenser coil, paying close attention to areas around solder joints, building penetrations, and pipe clamps. If a suspect area is found, check with an electronic leak detector.	Repair any leaks found and add refrigerant as needed.	Quarterly
3. Check condition of outdoor condensing units.	Clear away weeds and debris as necessary.	Quarterly
4. Check any suspect areas with an electronic leak detector.	Repair as necessary	Quarterly
5. Check the condition of the condenser, looking for accumulation of dirt and debris.	Clean as required.	Quarterly
6. Check for corrosion issues.	Apply anti-corrosion primer and paint as required.	Quarterly
7. Check all mechanical and flare connections.	Tighten as necessary.	Quarterly
8. Check compressor oil levels and oil safeties.	Repair, replace, or adjust as needed to ensure proper operation.	Quarterly
9. Check compressor sight glass (if equipped) for proper oil level.	Adjust oil levels as needed.	Quarterly
10. Check net oil pressure, operating at manufacturer's design.	Repair, replace, or adjust as needed to ensure proper operation.	Quarterly
11. Measure compressor superheat to verify that it conforms to specification.	Adjust as needed.	Quarterly
12. Check low ambient head pressure control sequence for proper operation.	Repair or replace components or modify software/set points to ensure proper operation.	Quarterly
13. Check motors for proper lubrication, if applicable.	Lubricate as necessary. Do not lubricate permanently sealed, ball bearing motors.	Quarterly
14. Check for proper operation of cooling coil and for damage or evidence of leaks.	Clean, restore, or replace as required.	Quarterly
15. Check condenser coil and blades cleanliness	Clean as necessary.	Quarterly
16. Check operation of demand cooling, liquid injection, or unloaders if so equipped.	Repair, replace or adjust as necessary.	Quarterly
17. Check high and low pressure refrigerant control settings and verify proper operation.	Replace or adjust as necessary.	Quarterly
18. Check pressure drop across all refrigerant filters and driers.	Replace as required.	Quarterly

19. Check refrigerant levels in the sight glass and inspect for leaks.	Adjust as necessary and document for future visits.	Quarterly
20. Check refrigerant system temperatures.	If outside of recommended levels, find cause, repair as necessary, to achieve optimal operating levels.	Quarterly
21. Check suction lines for insulation decay between condensing unit and evaporator coil.	Replace as necessary.	Quarterly
22. Check the amperage of motors and compressors.	Document for future visits, find cause for difference from manufacturer's design.	Quarterly
23. If the accumulator is insulated, check for damage.	Clean, restore, seal, or replace as necessary.	Quarterly
24. Check the refrigerant piping penetrations for air or water leaks or rubbing against other piping.	Repair as needed.	Quarterly
25. Measure crankcase heater amp draw to verify operation.	Repair or replace as needed.	Quarterly
26. Check condition of moisture indicator/sight glass if so equipped.	If there is indication of moisture (out of range), replace driers.	Quarterly
27. Check moisture indicator/sight glass for flash gas. If found, check entire system for refrigerant leaks.	Repair any leaks and add refrigerant as needed.	Quarterly
Evaporator Fan Coil/Unit Cooler		
28. Check condensate line.	Ensure drain line has no blockage.	Quarterly
29. Check drain line heat tape for proper operation.	Repair or replace as necessary.	Quarterly
30. Check drain pan to ensure that drain is clear of debris, obstructions, or ice buildup and is free draining.	Clear as necessary.	Quarterly
31. Check for condensate water dripping on the walk-in floor or moisture carryover beyond the drain pan from the cooling coils	Find the source and correct the problem.	Quarterly
32. Check drain pan, drain line, and coil for biological growth.	Clean as needed.	Quarterly
33. Check motors for proper lubrication, if applicable.	Lubricate as necessary. Do not lubricate permanently sealed, ball bearing motors.	Quarterly
34. Check all fan blade set screws and all fan guards are in place.	Tighten as required or replace as necessary.	Quarterly
35. Check all fan blades and motor housing/rail for signs of cracks, wear, or stress. Pay close attention to the hub and spider.	Replace blades or housing as required.	Quarterly
36. Check for unusual noise or vibration.	Take corrective action as required.	Quarterly
37. Check operation of all fans to ensure airflow is unobstructed.	Remove obstruction.	Quarterly
38. Check all flare connections.	Tighten as necessary.	Quarterly
39. Check evaporator coil fins surfaces.	Clean as necessary.	Quarterly
40. Check for proper defrosting of evaporator. Check operation / calibration of all fan cycle and defrost controls when used.	Determine the cause and correct.	Quarterly

41. Check for abnormal accumulation of ice patterns.	Adjust defrost cycles or operation of expansion valve/superheat accordingly.	Quarterly
42. Compare actual defrost heater voltage and amp draw against unit data plate.	Repair or replace.	Quarterly
43. Check condensate drain P-trap if present.	Prime as needed to ensure proper operation.	Quarterly
44. Check for oil stains on heaters, return bend, and coil fins.	Repair or clean as needed.	Quarterly
45. Check for signs of corrosion on fins, cabinet, copper tubing, and solder joints.	Repair as necessary.	Quarterly
46. Visually inspect heaters to ensure even surface contact with the coil.	If heaters have warped. Re-align or replace heaters as needed.	Quarterly
Electrical Controls		
47. Check all wiring and connections for overheating, bare spots, kinks.	Repair or replace as necessary.	Quarterly
48. Check condition of compressor and defrost contactors. Look for discoloration and pitting.	Replace as required.	Quarterly
49. Check control box for dirt, debris, insects and/or loose terminations.	Clean and tighten as needed.	Quarterly
50. Check operation and calibration of all timers, relays, pressure controls, temperature controls, and safety controls.	Adjust or replace as necessary.	Quarterly
51. Check electrical covers on the walk-in's evaporator coils blower unit.	Replace if missing.	Quarterly
Doors/Gaskets		
52. Check for frost or condensation around the door jamb or heated pressure relief vent.	Replace heaters as necessary.	Quarterly
53. Check hinges and door closers for proper opening.	Lubricate as necessary.	Quarterly
54. Check to make sure that the doors are sealing tightly. Check sweeps.	Adjust as necessary.	Quarterly
55. Check condition and operation of strip curtains.	Inform owner if missing or damaged.	Quarterly
56. Check the door gaskets.	Replace as necessary. Clean them with a soft cloth, soap, and water.	Quarterly
Walls/Panels/Interior		
57. Check all electrical connection.	Tighten as necessary.	Quarterly
58. Check integrity of all panels and curbs on equipment.	Replace fasteners as needed to ensure proper integrity and fit/finish of equipment.	Quarterly
59. Check interior for cleanliness.	Clean the interior of the walk-in cooler as necessary; avoid using harsh cleaners.	Quarterly
60. Inspect the condition of anti-skid strips on ramps and thresholds.	Replace as necessary.	Quarterly
61. Check caulk seals in wall joints.	Repair as necessary.	Quarterly
Notes:		
1. <u>During the course of regular maintenance inspection, the technician may notice that the outdoor condenser</u>		

was not installed at the proper, minimum height above grade (or roof, as applicable) with regard to local building code requirements. The technician should report this installation fault to the owner.

APPENDIX A – DEFINITIONS

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ACCA or ANSI.]

Absorption System: A refrigeration system in which the refrigerant gas evolved in the evaporator is taken up in an absorber and released in a generator upon the application of heat.

Accumulator: A tank installed in the suction line on or near the compressor unit, designed to intercept liquid refrigerant before it can reach the compressor crankcase. Liquid trapped in the accumulator is then returned at a safe rate back to the compressor. On parallel compressor systems, the suction manifold is designed to serve this function. It also meters lubricant to the compressor on start-up.

Air Curtain: A moving blanket of air blown across the opening of a refrigerated merchandiser which allows reach-in customer access while reducing the exchange of refrigerated air with ambient air.

Air Defrost: Suitable for all medium temperature display cases and walk-ins with room temperatures above 34°F. Defrost is accomplished either by leaving fans on and stopping refrigeration for a specified length of time, or as a natural result of cycling the refrigeration by means of a thermostat or low pressure control. See "off time" defrost.

Ambient Air: The air surrounding an object. The air around a refrigeration system condenser is typically considered "ambient air."

Ambient Sub-cooling: Sub-cooling in the condenser by the use of the ambient air to cool the refrigerant lower than the saturated condensing temperature.

Anti-sweat Heater: A self-regulating low amp draw electric heater, installed to prevent condensation where metal surfaces are cooled below expected dew point by the refrigeration process. Anti-sweat heaters are most used on low temperature merchandisers. Types of anti-sweat heaters: door, frame, discharge nosing, return nosing, rear cap, rear overhang.

Automatic Water Regulating Valve: A form of winter condensing pressure control for water cooled condensers. It restricts the flow of water if discharge pressure drops below a pre-set minimum.

Ball Valve: A manually operated valve to stop the flow of refrigerant or isolate a section of the system. Allows for ease in servicing, and provides no pressure drop if full port valves are used. A minimal pressure drop will be realized if non-full port valves are used. Standard on Hussmann parallel rack suction, liquid and defrost branches.

Cascade System: A refrigeration system with two or more refrigerant circuits, each with the evaporator of one cooling the condenser of the next, in series, to achieve very low temperatures.

Check Valve: Permits flow in one direction only. Used when possible backflow would be detrimental to the system.

Circuit System: A supermarket refrigeration system design type that includes a separate liquid line and suction line for each case or line-up of cases. When contrasted with the loop system, it is more difficult to install but more convenient to service. Contrasts with Loop System.

Coil: The finned copper or aluminum tube assembly used for heat transfer in refrigerators (evaporator coil), in condensers (condenser coil), and for heat reclaim (heat reclaim coil).

Compressor: In refrigeration, the machine that compresses the cool refrigerant into a hot, high pressure gas so it can give off heat to the air or water being passed through condenser.

Compressor Burn-Out: Catastrophic compressor failure due to excessive heat and/or lubrication failure which results in motor winding insulation failure.

Condensation: The process of changing vapor into liquid by extracting heat.

Condenser: The device that exhausts the heat from a refrigeration system. The refrigerant turns from a gas into a liquid in the condenser, and is ready to begin the refrigeration cycle again. Condensers can be air cooled, water cooled or a combination of both, called evaporative condensers or fluid coolers. Condensers may also be single circuited, multi circuited, or split circuited.

- Condenser, Air Cooled:** A condenser cooled by natural convection air currents or by forced air circulation.
- Condenser, Evaporative:** A condenser cooled by the evaporation of water.
- Condenser, Water Cooled:** A condenser cooled by water circulated through it.
- Condensing Temperature:** Temperature at which refrigerant vapor gives up its latent heat of vaporization and becomes a liquid. May also refer to the temperature used in sizing a condenser. See saturated condensing temperature.
- Contact:** An electrically controlled switch used for switching a power circuit, similar to a relay except with higher current ratings.
- Copper Plating:** An undesirable film of copper deposited on compressor walls, pistons, discharge valves, motor shaft, or seals. This condition is not normal and may occur when excessive temperatures are seen.
- Crankcase Heater:** A device that inserts into, mounts under, or wraps around the compressor crankcase and warms it to prevent liquid refrigerant from accumulating in the compressor when the off cycle compressor is exposed to cold temperatures. On Hussmann compressor units, the crankcase heaters turn on when the compressor turns off. Crankcase heaters are standard on some compressors, but, if not, are recommended options for compressor units subjected to environments of 45°F and below.
- Defrost:** Any method of removing frost or ice from an evaporator.
- Demand Cooling:** A compressor head cooling system which injects saturated refrigerant into the suction cavity when the head temperature exceeds a safe operating level.
- Differential Check Valve:** A spring loaded check valve that permits flow only when the outlet pressure is a pre-determined amount lower than the inlet pressure.
- Differential Pressure Regulator:** A regulating valve that maintains a constant differential used in reverse flow defrost and head pressure bypass.
- Discharge Air Temperature:** The temperature of the air immediately after it leaves the evaporator or condenser coil.
- Discharge Pressure:** The pressure of the refrigerant measured in pounds per inch, gauge (psig), as it leaves the discharge valve of the compressor; the pressure of the refrigerant anywhere between the compressor and condenser.
- Discharge Pressure Control:** Winter condensing, or high pressure cut-out control.
- Evaporative Cooling:** A device designed to cool a space by passing air through a water spray or wetted surface and using the cooling effect of evaporation to reduce the air temperature. This device works well when relative humidity is low.
- Evaporator:** The device that extracts heat from a refrigerator. When refrigerant enters the evaporator through the expansion valve, its pressure is reduced to the point where the heat in the refrigerator is sufficient to make the refrigerant boil. As the refrigerant boils (evaporates rapidly) it draws heat from the refrigerator in much the same way as perspiration does from the body.
- Evaporator (Evaporation) Temperature:** A common term for the saturated suction temperature. Also, saturated suction temperature usually refers to the temperature equivalent of the pressure measured at the suction valve of the compressor rather than at the evaporator.
- Evaporator Pressure Regulator:** A modulating temperature control valve installed in the suction line of a compressor unit that can be set to maintain a fixed evaporator pressure (hence temperature). EPR's are used extensively on parallel compressor units to raise the evaporator temperature in the warmer refrigerators connected to the compressor unit.
- Fan-Cycling Control:** A form of winter condensing pressure control in which condenser fans are turned off as ambient temperature decreases. Either thermostats (sensing ambient air) or pressure controls (sensing condensing pressure) can be used to make and break the fan circuit. Also used in some meat cases while on gas defrost.
- Floating Head:** To allow head pressure to “float” in low ambient conditions to save energy.
- Flooded Coil:** A condition caused by passing more refrigerant through an evaporator coil than can be vaporized at the immediate temperature and pressure. See Frost Back.

Flooding Valve: A form of winter condensing pressure control consisting of an upstream regulator in the liquid return line from the condenser. If condensing pressure decreases in response to colder weather, the valve throttles, causing liquid refrigerant to back up in the condenser until condenser capacity decreases enough to return condensing pressure to the setting of the valve.

Frost Back: The condition of frost (frozen moisture) on the outside of the evaporator outlet and suction line as a result of incomplete vaporization of refrigerant in a "flooded" evaporator. See Flooded Coil.

Head Cooling Fan: A fan mounted on low temperature compressors which cycles with the compressor. The fan provides air flow over the head to remove excessive heat of compression which would damage the head or cause oil breakdown.

Head Pressure: The pressure on the high side of a refrigeration system, measured in the discharge line at the outlet of the compressor.

Head Pressure Control: Winter condensing pressure control accomplished by various methods to include: 1) cycling of condenser fans; 2) air damper controls; 3) flooding valve; 4) split condenser.

Heat Exchanger: Device used to transfer heat from a warm or hot surface to a cold or cooler surface.

Heat of Compression: Mechanical energy expelled as heat energy when a vapor is compressed.

Heat of Condensation: Latent heat released when a vapor changes to a liquid due to a change in temperature or pressure.

Heat Reclaim: The heat normally rejected into the outside air by the condenser is used inside the store for heating purposes. The heat may be prioritized for hot water, or hot air for the store, or backroom.

Heat, Latent: Heat characterized by a change of state of the substance concerned, for a given pressure and always at a constant temperature of a pure substance, i.e., heat of vaporization or of fusion.

Heat, Sensible: Heat which is associated with a change in temperature as contrasted to heat interchange in which a change of state occurs.

High Pressure Control or Cutout: A pressure sensitive device (usually an electric switch), actuated directly by the refrigerant vapor pressure on the high side (usually head pressure).

Liquid Injection: Used on compound systems to maintain proper superheat levels entering the second stage compressors.

Liquid Level Indicator: Device located in the liquid line and having a sight port by which liquid flow may be observed for the presence of bubbles.

Liquid Solenoid Valve: A solenoid valve used to control the flow of refrigerant in a liquid line.

Loop System: A supermarket refrigeration system design type that includes a single liquid line and suction line serving many cases, each case having its own liquid line solenoid (LLS) and evaporator pressure regulator (EPR). When contrasted with the circuit system, it is easier to install but more difficult to service. Contrasts with Circuit System.

Main Liquid Line Solenoid: On parallel compressor units this valve restricts liquid refrigerant flow, reducing pressure to all branch liquid line solenoids when any system goes on gas Defrost. This allows backflow of liquid refrigerant from the evaporator(s) being defrosted into the liquid manifold for use in systems still in refrigeration mode.

Motorized Ball Valve: A motor-driven shut-off valve that can be remotely controlled by a microprocessor control or other means.

Off Time Defrost: Defrost occurring when the defrost time clock closes the system liquid line valve in order to stop refrigerant flow. The resultant lack of refrigerant defrosts the merchandiser. Off time will vary per merchandiser.

Oil Failure Safety Control: On compressors equipped with an oil pump for lubrication, this safety control senses the difference in pressure between the intake and discharge of the pump. If this difference falls and remains below the setting of the control for a minute or two, the control will trip, de energizing the compressor motor contactor. The control must be manually reset.

Oil Float: The device used to meter oil into compressor crankcases on parallel compressor units and their satellites. Also called "oil regulators," or "oil level regulators."

Oil Reservoir: A tank that supplies oil to the oil floats on parallel compressor units.

Oil Separator: A device located in the discharge line of compressor units, that captures much of the oil pumped out of the compressors to minimize the quantity of oil circulating through the refrigerant lines. Oil separators are standard on parallel compressor units, and return the oil to the oil reservoir. They are available for Conventional units, and return the oil to the suction side of the compressor.

Preparation Area (Prep Room): Often called a "prep room". A large, refrigerated work area where vegetables or meats are processed and packaged for display and sales purposes.

Pressure Relief Device: A valve or rupture device designed to automatically relieve excessive pressure.

Receiver Pressure Regulating Valve: Used with a flooding valve, this valve permits discharge gas to flow to the receiver to ensure sufficient receiver pressure.

Refrigerant Recovery: To remove refrigerant from a system and transfer it to an approved refrigerant container.

Relay: An electrically operated switch. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Satellite: A separate compressor unit that uses the same source of refrigerant as the parallel compressor unit it is applied to. Satellites can be remote or installed on a parallel compressor unit and are available for both medium and low temperature applications. Applied to the lowest temperature refrigerators, (low end Satellite), the Satellite permits the parallel compressors to operate at a higher, more efficient suction pressure. Satellites are often applied to preparation areas (high end Satellites) to decrease the required capacity of the parallel compressor unit.

Saturated Suction Pressure: The suction pressure at which liquid refrigerant will boil at a specified temperature. The lower the saturated suction pressure, the colder this boiling point becomes, and the colder the evaporator will be.

Saturated Suction Temperature: The evaporator temperature that corresponds to the saturated suction pressure. Evaporator temperature.

Secondary Fluid: A heat transfer fluid that is used to transfer heat from a space or product that does not change state (liquid-gas or gas-liquid). Usually a mixture of glycol and water but may be other fluids.

Self-Contained: A fully charged merchandiser equipped with its own condenser unit, which can operate independently of another refrigeration system.

Split Condenser: A doublewide condenser with each side operating independently of the other, and each having its own fan controls. Used to reduce the amount of refrigerant required for operation in low ambient conditions.

Split Suction: Two suction groups on one compressor rack.

Sub-cooling: Heat rejection by refrigerant liquid. Sub-cooling can be viewed as the temperature of the refrigerant below its condensing point at its immediate pressure. A small amount of sub-cooling is necessary to prevent flash gas or bubbles in the liquid line which results in poor refrigerator performance.

Suction Filter: A filter used in the suction line between the evaporator pressure regulating valve and the compressor.

Suction Manifold: The inlet to the compressor from the low (suction) side designed to trap liquid refrigerant before it can reach the compressor.

Superheat: Heat absorbed by refrigerant vapor. Superheat can be viewed as the temperature of the refrigerant above its boiling point at its immediate pressure.

Thermostatic Expansion Valve (TEV or TXV): Valve that allows expansion and boiling of refrigerant from liquid to vapor.

Three Way Valve: A solenoid valve with an inlet which is common to either of two opposite outlets, or with a common outlet and two opposite inlets. Three way valves control refrigerant direction.

Unit Cooler: The evaporator and fan assembly that provides the refrigeration for a walk in or preparation area. Often called a blower coil, it consists of an evaporator coil, expansion valve, and fan(s).

Unloader (external): A solenoid which holds open one intake valve of a multi piston compressor. This reduces the load the compressor can pump unloads reducing refrigeration capacity.

Unloader (internal): A hydraulic mechanism which holds open the intake valve(s) until oil pressure reaches a set point. This assures oil is circulating before the compressor starts pumping.

VFD: Variable Frequency Drive.

Winter Condensing Pressure Control: During cold weather, heat reclaim, or gas defrost, the condenser of a refrigeration system will work too well. Unchecked, its capacity can increase to the point where liquid line pressures are too low to operate the thermostatic expansion valves, and the refrigerators will warm up. To prevent this, several forms of condensing pressure control can be used to maintain a minimum condensing pressure.

APPENDIX B – REFRIGERATION BIBLIOGRAPHY & RESOURCES

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ACCA or ANSI.]

The following documents are offered for informational purposes only and are not considered part of the requirements of this standard. The editions/versions/dates of the documents indicated here are current as of the date of this ACCA standard.

- ACCA** **Air Conditioning Contractors of America (2800 Shirlington Road, Suite 300, Arlington, VA, 22206; tel: 703/575-4477; www.acca.org)**
- EPA Refrigerant Certification (Section 608)
 - Understanding Section 608 DVDs
 - Refrigeration for HVAC Technicians DVDS
 - HVACR 201 (focus: refrigeration)
 - Understanding Basic Electricity in the Real World DVDs
 - Videos Refrigeration Piping
 - Video: 24-hour Refrigeration
- AHRI** **Air Conditioning, Heating and Refrigeration Institute (2111 Wilson Boulevard, Suite 510, Arlington, VA, 22201; tel: 703/524-8800; www.ari.org)**
- Standards and Guidelines
- | | |
|--------------------|--|
| Standard 700-2004 | Specification for Fluorocarbon Refrigerants |
| Standard 740-1998 | Refrigerant Recovery/Recycling Equipment |
| Standard 810-2012 | Performance Rating of Automatic Commercial Ice-Makers |
| Standard 820-2012 | Performance Rating of Ice Storage Bins |
| Standard 1200-2013 | Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets |
| Guideline K-2009 | Containers for Recovered Fluorocarbon Refrigerants |
| Guideline N-2012 | Assignment of Refrigerant Color Containers |
| Guideline Q-2010 | Content Recovery and Proper Recycling of Refrigerant Cylinders |
| Guideline T-2013 | Specifying the Thermal Performance of Cool Storage Equipment |
- Other
- ARI Product Certification directory/database: ARI certification consists of manufacturers who voluntarily participate in independent testing to ensure that their product will perform according to published claims at specified controlled testing conditions.
 - Industry Recycling Guide (IRG-2), Handling and Reuse of Refrigerants in the US, 1994
- ASHRAE** **American Society of Heating, Refrigerating and Air-Conditioning Engineers (1791 Tullie Circle, NE, Atlanta, GA 30329; tel: 404/636-8400; www.ashrae.org)**
- Standards and Guidelines
- | | |
|------------------|---|
| Standard 15-2013 | Safety Standard for Refrigeration Systems |
| Standard 34-2013 | Designation and Safety Classification of Refrigerants |
- Other Documents
- ASHRAE Handbook – Refrigeration, 2014

- EPA** **Environmental Protection Agency (6601 J, 1200 Pennsylvania Avenue, NW, Washington, DC 20004, tel: 202/272-0167; www.epa.gov)**
 – §608, Clean Air Act, Stationary Refrigeration and Air-Conditioning, Halon Blends & Handling
 – Significant New Alternatives Policy (SNAP) program: www.epa.gov/ozone/snap
- IAPMO** **International Association of Plumbing and Mechanical Officials (4755 E. Philadelphia Street, Ontario, CA, 91761; tel: 909/472-4100; www.iapmo.org)**
 – Uniform Mechanical Code, 2015
- IIAR** **International Association of Plumbing and Mechanical Officials (1001 N. Fairfax Street, Suite 503, Alexandria, VA 22314; tel: 703/312-4200; www.iiar.org)**
 – ANSI/IIAR Standard 1-2012 American National Standard for Definitions and Terminology Used in IIAR Standards
 – ANSI/IIAR Standard 2-2008 American National Standard for Equipment, Design and Installation of Closed-Circuit Ammonia Mechanical Refrigerating Systems
 – ANSI/IIAR Standard 3-2012 American National Standard for Ammonia Refrigeration Valves
 – BSR/IIAR Standard 4-201X Installation of Closed-Circuit Ammonia Refrigerating Systems
 – ANSI/IIAR Standard 5-2013 Start-up and Commissioning of Closed-Circuit Ammonia Refrigeration Systems
 – BSR/IIAR Standard 6-201x Maintenance and Inspection of Closed-Circuit Ammonia Refrigeration Systems
 – ANSI/IIAR Standard 7-2013 Developing Operating Procedures for Closed-Circuit Ammonia Mechanical Refrigerating Systems
 – BSR/IIAR Standard 8-201x Decommissioning of Closed-Circuit Ammonia Refrigerating Systems
- Other
 Process Safety Management & Risk Management Program Guidelines
 Ammonia Refrigeration Library
 Ammonia Data Book – 2nd Edition
 Ammonia Refrigeration Management (ARM) Program
 Ammonia Refrigeration Piping Handbook
 The CO2 Handbook – 2014 Edition
 Engineering Safety Relief Systems Guidebook
 Industrial Refrigeration Energy Efficiency Guidebook
- ICC** **International Code Council (500 New Jersey Avenue, NW 6th Floor, Washington, DC 20001; tel: 888/422-7233; www.iccsafe.org)**
 – International Mechanical Code, 2015
- NATE** **North American Technician Excellence (2111 Wilson Boulevard, Suite 510, Arlington, VA, 22201; tel: 703/276-7247; www.natex.org)**
 NATE offers certifications tests for service and installation technicians to highlight relevant applied knowledge. Separate ‘service’ and ‘installation’ tests are given in the following specialty categories: Light Commercial Refrigeration (LC), and Commercial Refrigeration (RC).
- RSES** **Refrigeration Service Engineers Society (1911 Rohlwing Road, Suite A, Rolling Meadows, IL, 60008; tel: 847/297-6464; www.rses.org)**
 Various training manuals, self-study courses, classes and CDs to enhance the professional development of practitioners within the refrigeration sector.

UL **Underwriters Laboratories Inc., (333 Pfingsten Road, Northbrook, IL 60062; tel: 847/272-8800; www.ul.com)**
Standards
UL 471 Standard for Commercial Refrigerators and Freezer
UL 984 Hermetic Refrigerant Motor-Compressors