Guidelines for Using HCR188C in Refrigeration and Air Conditioning Systems

Introduction

HCR188C is a new hydrocarbon-based refrigerant that does not deplete our Earth's protective ozone layer like fluorocarbon refrigerants including R-12 and R-22.

It is now known that breathing these chlorofluorocarbon and hydrochlorofluorocarbon (CFC's and HCFC) refrigerants can cause oxygen deprivation, serious heart problems and possibly other health issues. For these and other technical reasons, ozone-safe HCR188C was developed to replace all of the legacy fluorocarbon refrigerants.

A direct replacement for fluorocarbon refrigerants, HCR188C is compatible with gaskets, seals, and most lubricants in existing refrigeration systems. HCR188C is also an economical replacement for the medium-pressure automotive refrigerant 134a.

HCR188C is flammable like other hydrocarbon products and must be used only by HVAC personnel trained and certified in the specific, safe handling procedures for HCR188C. Fully trained and EPA-certified HVAC personnel following these precautions will find that HCR188C is easily and safely charged into legacy HVAC systems.

Although HCR188C is flammable, very little is used to charge a refrigeration system; usually only one-fourth the charge of fluorocarbons!

Workplace safety is no accident! That is, it does take an effort to learn and to follow new safety procedures and to make them part of every refrigerant retrofit job. You alone have the responsibility to follow these HCR188C safe handling procedures to prevent accidents and injuries and to uphold the high safety standards of the HVAC industry.

Waiver of Liability Statement

This summary of safe handling procedures is intended for professional HVAC technicians servicing stationary home air condition systems, refrigeration, and automotive air condition systems containing HCR188C. Only trained, licensed and EPA-certified HVAC technicians have received specific safety training and are authorized to service equipment containing HCR188C.

This material is not approved for use by Do-it-Yourself amateurs, home owners and alley mechanics. The hobbyist and HVAC professional alike are strongly cautioned that all liability is entirely the end user's responsibility including equipment failure, personal injury, death, and loss of property. Standard disclaimers apply.

HCR188C Safe Handling Procedures

SECTION 1.

The following procedures apply to all users of HCR188C. Specific precautions and safe practices for automotive, light refrigeration, and air conditioning service are summarized in sections following these general precautions:

Personal Protective Equipment – PPE is always used for extra protection, just in case something goes wrong and energy is unexpectedly released. Anyone handling this refrigerant must use the following personal protective equipment (PPE):

Eye Protection - Refrigeration technicians and observers must wear Z87.1 approved mechanical safety glasses when

- moving, connecting, & installing HCR188C gas cylinders
- working on equipment, piping, & fittings containing HCR188C
- charging or recovering HCR188C from a refrigeration system
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Hand Protection - Wear gloves for thermal protection since

- operating compressors may exceed 120 F^o causing skin burns
- keep a first aid kit where you can reach it
- expanding HCR188C reaches subzero temperatures instantly causing frostbite on contact

Frostbite First Aid

- Immerse with water at 100 – 110^{o}F to warm rapidly. Use body heat or warm air if a water bath or shower are unavailable.
- Do not expose the wound to an open fire or flame.
- Do not rub or massage the affected parts of the body.
- Patients should not walk on frostbitten feet.
- Do not use medications. Do not apply dressings on intact skin.
- Keep the patient calm and at normal body temperature until medical help arrives.

Controlling Energy – Search for these hazards and eliminate them from the work area before working with HCR188C:

Ignition Sources - Eliminate open flames or other ignition sources like operating thermostats, relays, & open frame motors.

Do not light a halogen flame leak detector, candle, or strike a match.

Remove or eliminate hot surfaces from the work area including bare light bulbs, hot plates, and other hot surfaces near the refrigerant or working area, for example, use a shielded fluorescent work light

Table of Ignition Sources*

Arc welding, plasma arc cutting	Open flame, burning candle, lantern
Cigarette or other burning material	Open frame motors
Condensate pump switch	On/off manual switches
Contactors	Oil differential switches
Defrost timers/switches	Pressure switches
Fan delay switches	Propane or MAPP gas soldering torch
Fan speed controllers	Potential relays
Flow switches	Start relays
Gas welding or cutting torch	Static electricity
Halogen flame leak detector	Striking a match
Hot automotive exhaust system	Thermostats
Hot plate or oven	Thermal overload relays
Humidity controllers	Time switches/relays
Incandescent light bulb	Universal relays
Isolator switches	Programmable controllers
Liquid level switch	* List is not exhaustive

Prevent live sparking of components and electrocution

- replace or install line shields over electrical contacts
- use solid state relays and controllers in equipment
- fix loose capacitors and other electrical ignition sources

Warning Labels - Replace any missing ignition source warnings on HCR188C equipment and gas lines.

No Open Flames

No Smoking

Lockout Tag out (LOTO) - Lockout and tag electrical disconnect switches to protect the worker from energized electrical controls and unexpected motor starts. The tag lists the name and tag out date.

- pull fuses or trip circuit breaker before working
- disconnect battery in automotive work
- test after de-energizing electrical lines

Energy Stored as Compressed Gas - Relieve system gas pressure before installing safety retrofit kit

- pump out and recover refrigerant
- pump out before breaking fittings

Job Hazard Review – It is the refrigeration technician's first duty to size up the work area and equipment to identify and mitigate hazards before starting work. A Hazard Review will assure that energy is controlled and adequate PPE is used.

First, list the sequence of steps or tasks for the job at hand. Then list what can go wrong at each step. Finally list the safety factors and PPE necessary to prevent accident or injury. This is a good opportunity for HVAC technicians and their supervisor to work the JHR together, developing safe work practices for routine jobs.

Job Hazard Review: Cutting the Refrigeration Line to Install a Retrofit Safety Valve

Task	Problem	Accident Prevention	PPE Required
1. pump out old refrigerant	Vacuum pump fittings leak Hose separates from quick connect	Inspect/Replace O-rings Push collar until fitting locks	Gloves, Safety Glasses Gloves, Safety Glasses
2. cut refrigeration tubing	Sharp edges on cut tubing	Use deburring tool	Gloves, Safety Glasses
3. install retrofit valve	Tight tubing fit, may leak	Sand off paint layer first	Safety Glasses

Checks for Electrical Hazards

- verify that electrical ignition sources are eliminated
- check that electrical equipment and lines are in good condition
- complete an electrical ground continuity check
- isolate electrical line voltages from the work area
- verify that lock out tag out is complete

Checks for Mechanical Hazards

- check that guards and shields are installed and in good condition
- inspect entrapment and pinch points around rotating equipment
- remove gloves before working around rotating equipment
- secure loose clothing, long hair, and jewelry
- do not work around rotating shafts, pulleys, and belts unless guards are complete and in place

Ask "what can go wrong" and what if…?

- Answer all questions raised before starting work
- Are eye protection and other PPE adequate if something goes wrong?

- If there is a fire, where is the fire extinguisher?
- Is there a clear exit route from the work area for evacuation?

Storing and Transporting HCR188C - We are all required to follow Federal, State and Local safety laws, and the consensus Standards; for example from the American National Standards Institute (ANSI), The National Fire Protection Association (NFPA), and the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Some of these standards and safety codes are summarized:

- Close the cylinder (canister) valve after each use and when in storage
  - Screw the shipping plug into the cylinder valve before shipping
- Strap or chain cylinders to secure in storage
  - Store the cylinder upright
  - Lock the cylinder to prevent tampering
  - 3-point contact with other cylinders in storage is permitted
- Keep oxygen cylinders away from cylinders of HCR188C or equipment containing HCR188C
  - Comply with local codes on flammable gases
  - Store with a 20 ft minimum separation or use a rated ½ hour fire wall between oxygen and HCR188C cylinders
- Take precautions against overfilling
  - The cylinder must have a working overpressure relief device
  - Never invert the HCR188C cylinder. The pressure relief device must relieve from the vapor phase, not the liquid phase
  - Fill recovery cylinders only to 80% capacity
  - The cylinder must have an overfill protection device
- Store HCR188C at an ambient air temperature less than 120^{o}F
  - Do not expose the cylinder to fire or strike an electric welding arc on the cylinder
  - Immediately return a cylinder to the vendor if damaged

Confined Space Warnings – You can die by asphyxiation if you store or use HCR188C in a confined space. HCR188C like other combustible and inert gases is an asphyxiate. These gases displace breathing air when released.

- Do not use HCR188C in an unventilated room or space
  - Especially do not use it below grade or ground level.
  - Do not enter any confined space together with a gas cylinder188C
  - For Example, do not ride in an elevator with any gas cylinder

Do Not Ride Elevator with
A Compressed Gas Cylinder

- If someone is unconscious in a confined space, do not enter to attempt a rescue. You will become a second victim. Immediately call 911 for help.

Retrofit Labeling and Color Code – Safety instructions are prominently labeled on the compressor and on the condenser coil. Alert others by replacing any missing pink stickers on compressors and systems containing or retrofitted with HCR188C. (Pink is the EPA-approved color code for HCR188C).

- The Certified Refrigeration Mechanic completes the required information details on the preprinted pink stickers:
    - The installer's name
    - The service company's address
    - Date of retrofit
    - HCR188C charge rate for the system, grams

NOTICE: Converted to HCR188C

Non-Ozone Depleting

This Refrigerant is FLAMMABLE - Take Appropriate Precautions

Service by Qualified Personnel Only

SERVICED BY: TECHNICIAN: _____

COMPANY: _____

ADDRESS: _____

_____

DATE: _____ REFRIGERANT: HCR188C

CHARGE AMOUNT: _____ LBS. _____ OZ. [_____ Grams]

DO NOT ADD LUBRICANT DO NOT REMOVE THIS LABEL

Leak Detection - Learn about and prepare equipment for portable leak detection of HCR188C. The manufacturer blends HCR-188C with a warning odor agent (mercaptan) smell.

- Warning Odor
  - Replace any missing warning labels on all appliances
  - Use a polymer-soap solution to find gross leaks
  - Use a battery powered gas sensor for detecting hydrocarbon refrigerant
  - check all connections and lines with a leak sensor after servicing any unit
  - DO NOT use a halogen flame leak detector

HCR188C Warning Odor - Light Refrigeration

- If warning odor is noticed, extinguish smoking materials, turn off burners and other open flames.
- Immediately open windows and doors for ventilation.
- Leave the room.

- The AC manufacturer has added fluorescent dye to the system before charging
  - Use an ultraviolet light to find the leak

- Tool and equipment Safety and Best Practices
  - Use only proper tools and servicing equipment approved for HCR188C
  - Never improvise tools and service equipment
  - Piping and fittings-Comply with all codes, standards, and best practices

SECTION 2

.Automotive Air Conditioning Precautions

Installation of the Retrofit Safety Check Valve (RSCV)* is mandatory on supply and return lines whenever performing an automotive or a split-system air conditioning retrofit to HCR188C. The RSCV includes the EPA-approved quick connect fittings for HCR188C in a tamper-proof design to prevent accidents and injuries.

The RSCV is a required safety device installed on the engine side of the firewall. It protects the passenger compartment from a slow evaporator coil leak and also prevents a refrigerant discharge into the passenger compartment from AC tubing severed in a font end collision. The EPA-approved pink color code dust cap seal and pink stripe identify the HCR188C Retrofit Safety Check Valve.

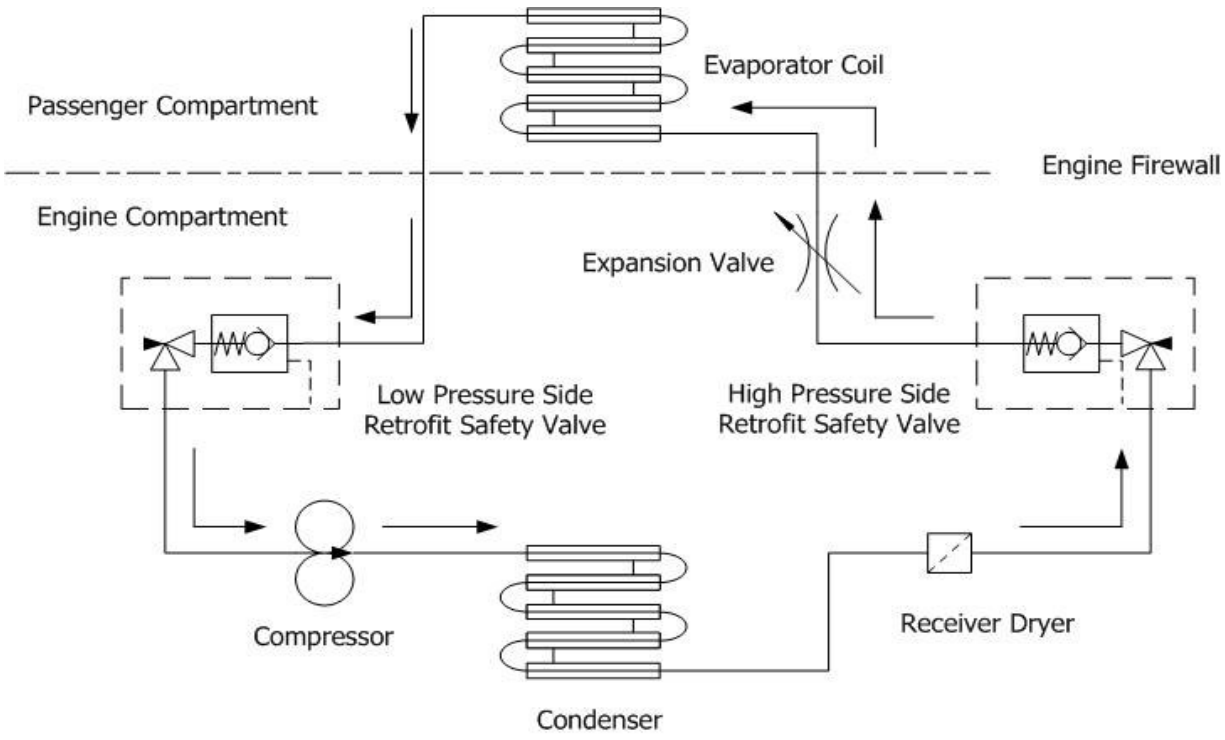
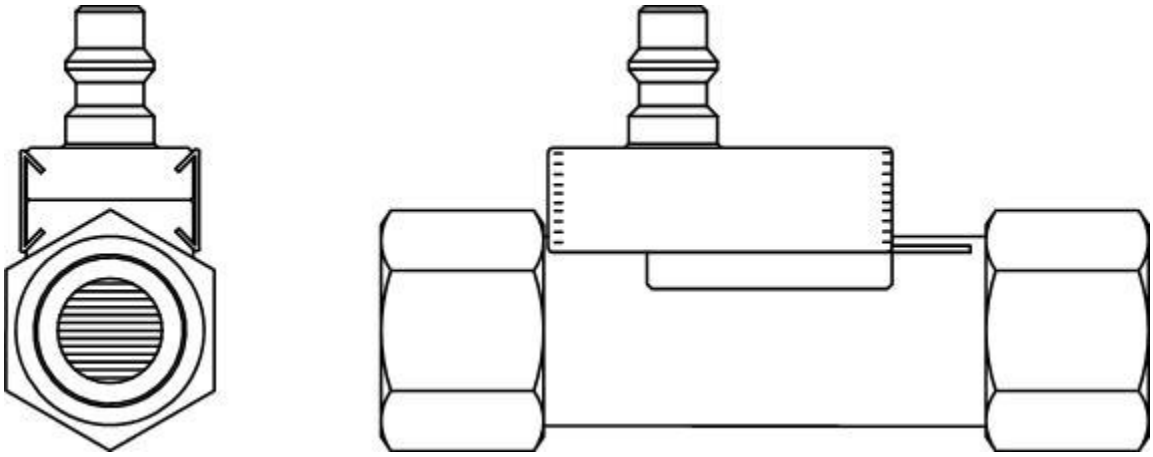


Figure 1. Required Locations of the HCR188C Retrofit Safety Check Valves (RSCV)



Front View Side View

Figure 2. HCR188C Retrofit Safety Check Valve * (pink dust cap not shown)

*patent pending

Retrofit Safety Check Valve Installation Instructions

- Recover pre-existing fluorohydrocarbon refrigerant by pumping into an evacuated and labeled refrigerant canister
  - cut out the legacy high and low pressure ports
  - deburr the tubing ID and OD to remove any metal chips
  - remove paint or powder coat layer from tubing OD
    using stoppers to keep tubing clean inside
  - insert RSCV into appropriate high and low pressure lines
  - apply sealant onto the compression ferrule sleeves
  - orient the quick connect fittings vertically upwards
  - use two opposing wrenches to properly tighten compression fittings
- Use only piping with the required HCR188C pink label
- Use only the dedicated pink-labeled HCR188C refrigerant recovery tanks
  - Use an oil filter when recovering HCR188C
  - Do not recharge recovered HCR188C back into refrigeration system since HCR188C composition changes during recovery and precludes reuse
  - Reclaimed HCR188C can be used as gas BBQ grill fuel

Warning and Precautions

HCR188C Warning Odor - Automotive

- If warning odor is noticed, extinguish smoking materials
- Roll down windows
- Pull off the road when safe to do so
- Turn off ignition, step away from the vehicle

SECTION 3.

Automotive Air Conditioning and Split Unit Air Conditioning

CHARGING – This section describes the approved procedures for charging evacuated CFC or HCFC System with up to HCR188C. This work is to be performed only by a Certified Air Conditioning Technician. First inspect the work site and remove or fix hazards before starting. Always charge the system with fresh HCR188C to assure the correct charge rate; do not reuse recovered HCR188C. Please see Appendix II for maximum allowable refrigerant charge based on occupancy category and room size.

- **Hookup** – Connect the HCR188C charging canister to a gauge set
  - check the vacuum pump capacity, HCR188C cylinders, and fittings
  - Inspect condition of hoses, fittings, gaskets and O-ring seals
  - use the EPA-approved HCR188C adapter connectors on a standard low pressure gauge set
  - use the EPA-approved HCR188C cylinder connection

- **Preparation** – Charge the system with HCR188C
  - Unlock both Retrofit Safety Check Valves (RSCV)
    - insert a splined Allen wrench through the quick connect stem
    - engage and turn clockwise until the screw stops turning
    - attach gauge set hoses with HCR188C adapter fittings to both RSCVs and to vacuum pump before opening slider valve
  - Open slider valve
    - Slide stem horizontally over the pedestal until cleat stops, aligning the internal valve service ports
  - Pump down the system
    - evacuate the system to remove moisture and air
    - close the vacuum port valve

- **Charging the System** – Calculate HCR188C charge rate (0.25 x CFC charge).
  - attach HCR188C canister
    - set on digital scale and tare scale
    - open canister valve until calculated charge flows into system.
    -

- **Sealing the System** – Close the HCR188C canister valve.
    - slide retrofit safety check valves (RSCVs) closed
    - disconnect gage set hoses and fittings
    - set anti-tamper lock screw in RSCVs
    - install pink cap and tamper seal

RECOVERY – This process describes the approved procedures for recovering and recycling HRC188C refrigerant by a Certified Motor Vehicle Air Conditioning

(MVAC) Technician. First inspect the work site and remove or fix hazards before starting the recovery and making repairs.

- **Hookup** – Connect the empty HCR188C recovery canister to a gauge set
  - inspect condition of hoses, fittings, gaskets and O-ring seals
    - use the EPA-approved HCR188C adapter connectors on standard low pressure gauge set
    - use the EPA-approved HCR188C cylinder connection
    - install an oil separator when recovering HCR188C
  - connect the hose between the vacuum pump and recovery cylinder
    - evacuate the recovery cylinder
    - repeat to evacuate additional recovery cylinders

- **Evacuating the System –**unlock the Retrofit Safety Check Valves
    - insert splined Allen wrench through the quick connect stems
    - engage and turn counterclockwise to back out lock screw
    - do not slide valve to open until hoses are attached
  - attach gauge set hoses with HCR188C adapter fittings
    - connect to a refrigerant recovery machine (pending EPA clearance)
    - if not available, set evacuated canister onto top-loading digital scale; tare to monitor recovery
  - open slider valve sliding horizontally over the pedestal until cleat stops travel
  - pump down system
    - evacuate the system to remove moisture and air
    - when fully evacuated, close the vacuum port valve

- **Recovering into an evacuated recovery canister**
  - open the refrigerant canister valve to recover HCR188C from AC system
  - after recovery, look for a pressure increase on the gauge
    - this shows that some refrigerant remains dissolved in oil and that additional recovery is needed
    - continue recovery with another evacuated recovery canister until the system holds vacuum
  - disconnect recovery setup when pressure is constant
    - close both HRC188C RSCVs
    - close recovery canister valve
    - disconnect gage set hoses and fittings

- **Sealing the System** – Close the HCR188C canister valve.
  - lock RSCVs
    - set anti-tamper screw in RSCVs
    - install pink cap and tamper seal
  - label recovery cylinder contents

- **<u>Recovered HCR188C</u>** is not recharged back into refrigeration system

    - Note that composition changes during recovery preclude reuse of recovered HCR188C
    - Reclaimed HCR188C can be used as gas BBQ grill fuel

        - recharge repaired system with fresh HCR188C to assure the correct charge rate

Section 4,

Window Air Conditioner, Refrigerator, Freezer

This section describes how to recover HCR188C from appliances at the end-of-appliance life. Applicable precautionary measures from Section 1 are required when recovering HCR188C. The refrigerant recharging process for light refrigeration is also reviewed.

- The HVAC Technician recovers the refrigerant using either a recovery machine or following the recovery process described above in Section 3. In both processes an oil separator is required to isolate clean HCR into the recovery canister.

- A vampire connection is used to recover all HCR188C from the system under repair, e.g.: removing the compressor or removing evaporator. Old refrigerant is recycled as described in Section 3.

- Following the HCR188C recovery, a hand tubing cutter can part the tubing, then compressed air or flushing fluid is used to clear the system of any remaining oil/refrigerant mixture. Clean and degrease all tubing surfaces to prepare for joining the new component.

- The system is evacuated and recharged * through the vampire fitting. The Certified Refrigeration Mechanic completes the required information details on the preprinted pink sticker shown in Section 1:

    - The installer's name
    - The service company's address
    - Date of retrofit
    - HCR188C charge rate for the system, grams

- Legacy appliances may also require updating to sparkless electrical wiring and solid state or potted components to prevent ignition.

    * The EU and British standards for hydrocarbon refrigerants permit a maximum1.5 Kg. (3.3. lb) charge for sealed domestic appliances.

SECTION 5. Commercial Refrigeration Compressor Room Precautions

- **Room Design** - Ensure that non-combustible materials are used for room construction
    - Design the room with pressure-relief blowout panels if a release of refrigerant will exceed the Lower Explosive Level (LEL)
    - Provide ventilation for the compressor room
        - Vent room to outside air
        - place the air inlet at floor level sized match the air discharge fan
        - Maintain a negative air pressure balance
            - this prevents entrainment into occupied building areas
            - else, natural ventilation is acceptable if six to ten air exchanges per hour are maintained
            - avoid stratification that could occur in dead air areas, pits, confined spaces; install local ventilation to evacuate these spaces
        - Ensure free air movement around all components containing HCR188C
        - Run forced ventilation continuously, or
            - instead use an exhaust fan activated by fixed combustible gas sensor
            - instead use a fan relay set to ensure concentrations no more than 0.5%, which is 25% of the lower explosive level (LEL)
        - Use the following type of fan system
            - maintains a negative air balance
                - prevents leak flowing to other areas
            - has non-sparking fan system components
            - has an emergency fan control outside equipment room

- **Use HCR188C fixed leak detection in compressor rooms**
    - Install permanent combustibles sensor if a release can reach the LEL
    - The combustibles detector activates exhaust fan system and alarm
        - A/V in mechanical room and at facilities trouble desk
        - mount heavier-than-air combustibles detector at floor level
        - the manufacturer must calibrate the detector for HCR188C, set below one-fourth of LEL=0.5% (as stated in OSHA 29 CFR 1910.94)
        - service sensors at manufacturer's recommended intervals

- **Administrative Controls**
    - Have a response plan if the detector signals a trouble alarm and practice the response action
    - Provide for compressor room security

        - The facility owner must provide access key access only to HCR188C-certified technicians
    - Post flammable gas warning signs at all entrances
        - The signs must warn <<No Open Flames, No Smoking>>
    - Eliminate Ignition Sources
        - No bare light bulbs, hot plates, other hot surfaces
            - use a shielded fluorescent work light
        - No open flames or other ignition sources
            - use only brushless motors
            - Boilers, welding torches, and other open-flame devices must not share this space
        - Insulate electrical contacts
            - use solid state relays and controllers in equipment
        - Enclose the ignition source and use an inert gas purge
            - if ignition sources cannot be removed
    - Provide fire extinguishers to meet local code requirements

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Appendix I.

HCR188C replaces most of these medium-pressure refrigerants :

Ozone-depleting substances - Chlorofluorocarbons ("CFCs")

(1) CFC-11, also known as fluorotrichloromethane
(2) CFC-12, also known as diclorodifluoromethane
(3) CFC-13, also known as chlorotrifluoromethane
(4) CFC-111, also known as pentachlorofluoroethane
(5) CFC-112, also known as tetrachlorofluoroethane
(6) CFC-113, also known as 1,1,2-trichloro-1,2,2, trifluoroethane
(7) CFC-114, also known as 1,2-dichloro-1,1,2,2-tetrafluoroethane
(8) CFC-115, also known as 1-chloro-1,1,2,2,2-pentafluoroethane
(9) CFC-211, also known as heptachlorofluoropropane
(10) CFC-212, also known as hexachlorodifluoropropane
(11) CFC-213, also known as pentachlorotrifluoropropane
(12) CFC-214, also known as tetrachlorotetrafluoropropane
(13) CFC-215, also known as trichloropentafluoropropane
(14) CFC-216, also known as dichlorohexafluoropropane
(15) CFC-217, also known as chloroheptafluoropropane

Azeotropic Mixtures
(16) CFC-500 (CFC-12/HFC-132a, 73.8/26.2 wt. %)
(17) CFC-501 (CFC-12/HCFC-22, 25.0/75.0 wt. %)
(18) CFC-502 (HCFC-22/CFC-115, 48.8/51.2 wt. %)
(19) CFC-503 (CFC-13/HCFC-23, 59.9/40.1 wt. %)
(20) CFC-504 (HFC-32/CFC-115, 48.2/51.8 wt. %)
(21) CFC-505 (CFC-12/HCFC-31, 78/22 wt. %)
(22) CFC-506 (HCFC-31/CFC-114, 55.1/44.9 wt. %)

Ozone-depleting substances - Hydrochlorofluorocarbons ("HCFCs")
(1) HCFC-21, also known as dichlorofluoromethane
(2) HCFC-22, also known as chlorodifluoromethane
(3) HCFC-31, also known as chlorofluoromethane
(4) HCFC-121, also known as tetrachlorofluoroethane
(5) HCFC-122, also known as trichlorodifluoroethane
(6) HCFC-123, also known as dichlorotrifluoroethane
(7) HCFC-124, also known as chlorotetrafluoroethane
(8) HCFC-131, also known as trichlorofluoroethane
(9) HCFC-132, also known as dichlorodifluoroethane
(10) HCFC-133, also known as chlorotrifluoroethane
(11) HCFC-141, also known as dichlorofluoroethane
(12) HCFC-142, also known as chlorodifluoroethane
(13) HCFC-221, also known as hexachlorofluoropropane
(14) HCFC-222, also known as pentachlorodifluoropropane

(15) HCFC-223, also known as tetrachlorotrifluoropropane

Ozone-depleting substances, continued - Hydrochlorofluorocarbons ("HCFCs")

(16) HCFC-224, also known as trichlorotetrafluoropropane
(17) HCFC-225, also known as dichloropentafluoropropane
(18) HCFC-226, also known as chlorohexafluoropropane
(19) HCFC-231, also known as pentachlorofluoropropane
(20) HCFC-232, also known as tetrachlorodifluoropropane
(21) HCFC-233, also known as trichlorotrifluoropropane
(22) HCFC-234, also known as dichlorotetrafluoropropane
(23) HCFC-235, also known as chloropentafluoropropane
(24) HCFC-241, also known as tetrachlorofluoropropane
(25) HCFC-242, also known as trichlorofdifluoropropane
(26) HCFC-243, also known as dichlorotrifluoropropane
(27) HCFC-244, also known as chlorotetrafluoropropane
(28) HCFC-251, also known as trichlorofluoropropane
(29) HCFC-252, also known as dichlorodifluoropropane
(30) HCFC-253, also known as chlorotrifluoropropane
(31) HCFC-261, also known as dichlorofluoropropane
(32) HCFC-262, also known as chlorodifluoropropane
(33) HCFC-271, also known as chlorofluoropropane

Appendix II. Permitted HCR 188C Charge Based on Room Size and Occupancy Type

Occupancy Type	**Charge Size***	**System Category**	**Example**
Domestic	1.5 Kg (3.3 lb)	sealed systems	Homes, apartments
Public	5.0 Kg (11.0 lb)	open air or machinery rooms	Public places, institutions, businesses
Commercial	2.5 Kg (5.5 lb)	per system	Offices, manufacturing
Private	10 Kg (22.0 lb)	open air or machinery rooms	Offices, manufacturing
Industrial	10 Kg (22.0 lb)	occupied spaces	Non-public areas
Restricted Access	25 Kg (55.0 lb)	open air or machinery rooms	Cold rooms, food processing, plants

* not to exceed, providing ignition sources are not normally present

These limits were established by the European Union (EN 378 annex C of Part 1) to maintain the room air concentration below 25% of the lower explosive limit or 0.008 Kg/m^3 (0.0005 lb/ft^3). The British Flammable Refrigerant Standard (BS4434:1995) also allows up to a 1.5 Kg maximum charge, with systems using up to 0.25 Kg located anywhere. The maximum charge for systems below ground level is 1.0 Kg.

Please Visit our Website for the Latest Updates: http://www.hcr188c.com/