# R-407C

## Field Reference Guide

Updated September 2023

Johnson Controls

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# 01

# Introduction

## What is R-407C

R-407C (HFC-32/HFC-125/HFC-134a 23/25/52 %) is a zeotropic mixture with a significant temperature glide. R-407C is recognized as a suitable alternative refrigerant in medium and high-temperature applications, such as residential and light commercial air conditioning. R-407C is **NOT** a “drop-in” replacement for R-22. In addition to slight capacity losses, there are differences between R-407C and other refrigerants that must be considered when handling, processing, or applying it.

# R-407 Color Coding

R-407C cylinders are colored burnt orange. This coding is not only used on refrigerant cylinders, but also equipment informaitonal labels, expansion valves, and other system components. It is important for the technician to reconzie R-407C systems, as there are specific service practices that MUST be adheared to in order to promote system efficiency, longevity, and customer comfort.


**R-407C Refrigerant Cylinder**

# Primary Differences – R-407C vs. R-22

The primary differences between R-407C and R-22 systems relate to the oil type and refrigerant characteristics.

## POE (Polyol Ester) Oil

The Polyol Ester oil (POE) is used with R-407C systems. In the past, R-22 systems used mineral oil (MO) or alkylbenzene oil (AE) as the system lubricant. POE is **NOT compatible** with mineral (MO) or alkylbenzene (AE) oils. Proper service practices must be performed during installation and service, particularly in retrofit applications, to ensure there is NO intermixing of the oils. Mineral and alkylbenzene oils are not miscible with R-407C refrigerant and will be pushed through the system as a liquid blob, which can create a restriction at metering devices, causing pressure fluctuations. POE is very hygroscopic, meaning that it readily absorbs moisture (about 15 times faster than mineral oil). This emphasizes the importance of proper system evacuation to 500 microns or less after system installation or after opening the system for service. Under no circumstances should an R-407C system be open to the atmosphere any longer than necessary. If left open, the POE oil in the system will absorb moisture from the surrounding air and become trapped in the oil. Once absorbed, the moisture cannot be removed through system evacuation, even at vacuum pressures of 500 microns. Over time, this moisture can lead to the formation of sludge in the system, leading to poor system performance, and eventual system failure. Therefore, it is important to prevent moisture from getting in the oil in the first place. The general recommendations for handling POE oil are to keep it in a metal container, transfer it with an oil pump, and keep the container sealed.

POE oil will irritate the skin (it removes moisture from the skin rapidly) and is a serious medical concern if it encounters the eyes. Gloves and safety glasses or goggles are essential items.

POE lubricants are a form of a mild organic acid, which will scrub oxides and contaminants from the interior of refrigerant tubing walls. If present, the oxides will be removed from the copper tubing walls and will circulate through the system. These oxides are likely to end up in the metering device and create performance issues. A low-pressure flow of dry nitrogen is recommended when brazing line connections in the field. This prevents oxide formation.

## Refrigerant Characteristics (Fractionation)

As a zeotrope, R-407C refrigerant is susceptible to fractionation should a system leak exist. The individual refrigerant components will leak at different rates, thereby changing the operational characteristics of the system refrigerant. Should a leak occur, maintenance of system performance indicates recovery of the system charge, leak repair, and complete system charging through the recommended charging methods as described in Section 2.

# Component Considerations

## Compressors

Only a compressor designed for R-407C should be used in R-407C systems.

## Metering Devices

It is imperative that only a metering device designed and properly sized for R-407C is used on an R-407C system. A capillary tube and fixed orifice metering devices may be acceptable but verify that the equipment selected allows it. With higher SEER ratings and utility rebate program requirements, extremely specific equipment and metering device matches are required to attain the stated system SEER. Fixed orifice metering devices are limited in their use with high-efficiency equipment.

## Refrigerant Lines

Refrigerant lines used for R-407C must be properly sized for R-407C systems. On retrofit applications, the lineset should be replaced if possible. This prevents cross contamination of mineral / AB oils from an old lineset into the R-407C system. It is possible to use existing refrigerant lines from an R-22 system in an R-407C system installation if they are of the correct size; however, they must be cleaned of all debris and oil. The cleaning process is further described in Chapter 2.

## Filter Driers

Only use filter driers rated for use with R- 407C. Proper drier selection and usage is critical in an R-407C installation. When removing a filter-drier from a system, it must be cut out with a tubing cutter, not a torch flame. If the desiccant is heated, moisture may be driven out of the desiccant and into the system. This is of greater concern to R-407C systems because of the hygroscopic qualities of POE oil. When moisture is absorbed in POE oil, it is difficult to remove.

The practice of replacing the filter drier every time the system is opened is particularly important on R-407C systems because of the hygroscopic nature of POE oil.

**Filter Drier Cutaway**

## Tool and Test Instruments

Due to the POE oil used in R-407C systems, any tool or test instrument that encounters refrigerant and/or oil in the system should be dedicated to R-407C systems, including the manifold gauge set.

A dedicated manifold gauge set should be used with R-407C equipment. There are manifold gauge sets on the market today that can handle both R-407C and R-22. If you own one of the "dual refrigerant" sets, it is recommended it is used for only one. The primary concern is the intermixing of oils. If a gauge set is connected to an R-22 system, mineral or alkylbenzene oils will remain in the manifold. Connecting the same gauge set to an R-407C system will allow the mineral/AB oils to enter the R-407C system, which could lead to system performance issues.

Recovery machines should be dedicated to one refrigerant or the other, but not both, to avoid possible cross contamination of oils. If you use a single recovery machine for multiple refrigerants, make sure that you use it for refrigerant recovery only (not recycling). Follow the recovery machine manufacturer instructions regarding filter and oil maintenance for the machine being used.

## Pressure Controls

R-407C systems operate at pressures slightly above R-22 systems. Pressure controls, if used, shall be checked for proper function, and setting following installation of an R-407C outdoor unit.

# 02

# R-407C Service Considerations

# R-407C Service Considerations

The service techniques discussed in this manual include many that have been used successfully throughout the years and are considered "industry standard" practices. The transition to R-407C is not difficult with a firm foundation and understanding of these fundamental practices. The practices are presented in a logical order - from equipment to selection to final refrigerant charge adjustment.

Also note that this guide does **NOT** replace the Installation Instructions supplied with Unitary Products R-407C units. Do not attempt installation or service without fully reading and understanding the documentation provided with the unit being installed. Questions should be directed to your local distributor or Johnson Controls Unitary Products Technical Services.

## Safety

Personal safety is always of utmost importance when working on any job or piece of equipment. Always wear gloves when connecting and disconnecting service hoses, or in any instance where refrigerant and/or refrigerant oil may encounter the skin. Safety glasses are also a requirement for air conditioning service.

Additionally, caution must be taken not to spill POE oil as it may damage synthetic roofing materials, PVC, and other materials. When exposed to high temperatures (such as a torch flame), R-407C will decompose and a pungent odor will result. Ensure that R-407C refrigerant is not present or leaking from joints to be brazed.

Do not allow R-407C cylinders to exceed 125°F, and always secure cylinders during transport to avoid puncture and burst. If it is necessary to heat a cylinder of R-407C to raise its pressure in cooler weather, heat the cylinder with water no more than 90°F and never heat a cylinder with flame. Do not allow the cylinder to reach a temperature of more than 125°F during transport or storage. Never exceed 80% of the capacity of a recovery cylinder. Doing so may cause the cylinder to rupture, causing possible physical injury or property damage.

Recovery cylinders must be rated for R-407C use. These cylinders meet the Department of Transportation DOT 4BA 400 or DOT 4BW 400 standards. Cylinders must be properly secured during transport to avoid physical damage and cylinder burst.

Always use caution with nitrogen and use an appropriate pressure regulator. Never exceed the maximum pressure rating of low-side system components.

## Equipment Selection

Always perform a heat loss/gain load calculation to ensure the correct sized components are used. For residential/light commercial, the ACCA Manual J provides reliable and accurate results. Computer software for load calculations, based on Manual J, is available through a local distributor. Refer to the Tech Guide for help in selecting the correct equipment match ups.

For duct sizing, follow the principles outlined in ACCA Manual D to assure adequate air delivery to each room. Computer software for duct sizing, based on Manual D, is available through a local distributor.

# Retrofit Applications

## Existing Evaporator Coils - SEER and Oil Concerns

Depending on the age of the system being retrofitted, the indoor coil and outdoor unit combination efficiency may have provided 10 SEER, 8 SEER, or lower. The evaporator coil should be changed to provide a properly matched SEER rated system. A 15 SEER outdoor unit matched with a 10 SEER indoor coil will not provide 15 SEER. For the latest ARI rated coil and condensing unit combinations, go to www.ahridirectory.org.

In addition to properly matching the evaporator coil to the condensing unit, existing evaporator coils should be replaced. This prevents residual mineral or AB oil from moving from the coil into the new system.

If the existing indoor coil and line set cannot be changed due to space or other constraints, the coil should be flushed in a comparable manner as described in the line set section of this manual. Please refer to the technical literature shipped with the equipment to ensure the system is properly evacuated and charged.

## Lineset Considerations

Line sets should always be replaced in retrofit applications to prevent intermixing of the mineral or alkylbenzene oils with POE oil used in R-407C systems. If replacing the line set is not practical, then the following precautions should be taken:

- Inspect the line set for kinks, corrosion, sharp bends, or other restrictions.
- Determine if there are any low spots which might be serving as oil traps.
- Flush the line set with a commercially available flush kit to remove as much of the existing oil and contaminants as possible. Nu-Calgon Rx11-Flush is available through Source One Parts.
- Install a suction line filter-drier to trap any remaining contaminants and remove the drier after 50 hours of operation.

Rx11 Flush

**Be sure to read, understand, and follow the flushing instructions included with the unit installation instructions.**

Sizing of line sets should always be verified with the Tabular Data Sheet provided and/or the Unitary Products Comfort Cooling Piping software available on Solutions Navigator. The software allows the user to input job data including line lengths, number of elbows, etc., and will calculate the refrigerant pressure drops and velocities automatically.

When calculating line sizes manually, size the suction lines to prevent the pressure drop from exceeding 5 pounds. Size the liquid lines to prevent the pressure drop from exceeding 60 pounds. To assist in oil return during the off-cycle, horizontal runs on suction lines must be sloped back to the compressor.

Recommended minimum suction line velocity for R-407C systems is 800 fpm for horizontal lines and 1000 fpm for vertical lines, with a maximum of 3000 fpm. Because of the excellent miscibility of R-407C and POE oils, the customary practice of providing oil traps for suction risers greater than three feet is not required on R-407C systems.

Never leave refrigeration lines open to the atmosphere to prevent moisture and other non-condensable contaminants from entering the system. Always seal refrigerant lines by crimping or capping if it will be exposed to the atmosphere for any length of time.

## Lineset Connections

Soft solder is not to be used. A brazing alloy with a minimum 5% silver content is recommended. A low-pressure flow of dry nitrogen is recommended when brazing line connections in the field. This will prevent oxide formation on the walls of the copper tubing. POE lubricants used in R-407C systems are a form of a mild organic acid, which will scrub oxides and contaminants from the interior of refrigerant tubing walls. If present, the oxides will be removed from the copper tubing walls and will circulate through the system. These oxides are likely to end up in the metering device and create performance issues.

**Copper Oxidation**

**First generation** Unitary Products R-407C systems were shipped with a nitrogen holding charge which must be released following the connection and brazing of the lineset. Production as of August 1st, 2017, changes to the new model numbers and will no longer have a nitrogen holding charge. Units will be shipped from the factory with R-407C charge. Refer to Tabular Data Sheet for refrigerant charge quantities.

Generation numbers and August 2017 serial numbers are the only identification of R-407C. Example: GAW14L60C21S (1st generation, shipped with nitrogen holding charge), GAW14L60C22S (second generation, shipped with R-407C charge). **Be sure to consult the installation instructions provided with the equipment for system-specific direction.**

## Leak Testing

While the dry nitrogen used during brazing is still connected to the system, pressurize the lineset and evaporator coil to 250 PSI to check for leaks. Use soap solution to test the field joints for leaks. Repairing leaking field joints is much less time consuming at this point than after refrigerant and oil is in the system.

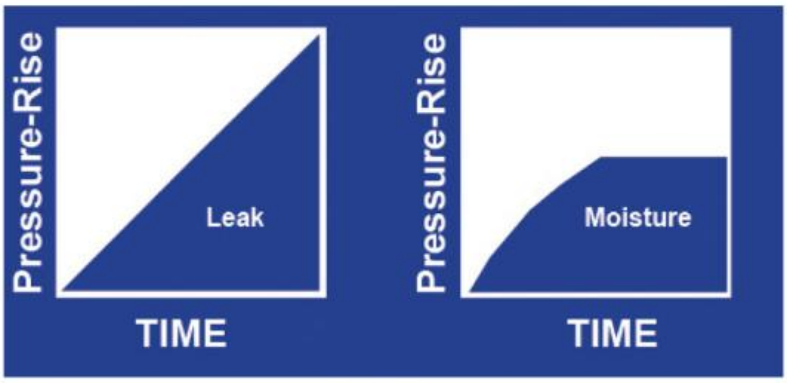
Leak detection with an installed system is often conducted with an electronic leak detector. Be sure to use an electronic leak detector designed for use with R-407C. A trace amount of R-407C used with nitrogen for the sole purpose of leak detection with an R-407C electronic leak detector may be released as a "de minimus release".

## Evacuation

When the field joints have been verified as leak-free, it is time to evacuate the lineset and evaporator coil. A vacuum pump and micron gauge must be used together to ensure the proper vacuum level is reached. All installations must be evacuated to 500 microns or less. At 500 microns of vacuum, the boiling point of water is reduced to -12°F, causing moisture in the lineset and evaporator coil to boil off and exit the system through the exhaust port of the vacuum pump. Here are some ways to reduce the amount of time it takes to evacuate an air conditioning system:

- Use a properly sized vacuum pump and follow the pump manufacturer's recommendations based on system tonnage.
- Use short, large diameter hoses.
- Remove the Schraeder cores from the service valves with core removal tools (the cores add a lot of restriction and slow down the evacuation process).
- Maintain the oil pump with regular oil changes.
- Make sure all fittings are tight, including those made at the vacuum pump and the micron gage.
- Evacuate from both the high and low sides of the system simultaneously.




**Pressure Increases Indicating Leaks and Moisture**

After a vacuum of 500 microns or less has been reached, the vacuum pump is shut off and the valve on the pump is closed. This allows the micron gauge to monitor the vacuum in the system. If the micron level rises to atmospheric pressure, a leak is present and must be repaired. If the micron level rises to an intermediate micron level (such as 1500 microns) and stops, moisture is still present, and the evacuation process should be continued.

## Total System Charge

Total required system refrigerant quantity of R-407C is stamped on the unit rating plate to include 15' of lineset and an evaporator coil. A charge adder is indicated on the unit Tabular Data Sheet for line sets over 15: The total calculated system refrigerant charge based on the line length of the application shall be indicated on the unit rating plate for future reference.

R-407C refrigerant must be removed from the cylinder in liquid form. Use a liquid charge adapter on the manifold gauge set to flash the liquid R-407C to vapor before allowing the refrigerant into the system's suction side. Do not put liquid refrigerant directly into the suction line as compressor damage may result. Systems with no refrigerant are charged in the liquid form into the liquid line after proper system evacuation. When the pressure in the system equals the pressure in the refrigerant cylinder and refrigerant is no longer flowing into the system, start the system and continue refrigerant charging into the suction line with the liquid charging adapter.

## Leak/Recharge Concerns

Due to the zeotropic nature of R-407C, if a system leak is present, the refrigerant components present in R-407C (HFC-32/HFC-125/HFC-134a) leak out at different rates. HFC-32, as the highest-pressure refrigerant component, tends to escape first. Should 50% of the system charge leak followed by 'topping off' the charge to the estimated required value, system capacity is degraded up to four percent with a five percent decrease in efficiency [2].

Additionally, charging by superheat on an R-407C system following a leak becomes a difficult target due to the unknown refrigerant composition and could lead to an overcharge condition [2]. **Therefore, following location and repair of a system leak, evacuation to 500 microns is required and the system charged with virgin R-407C refrigerant.**

When charging R-407C, always use refrigerant from the R-407C cylinder in liquid form only. This will minimize the potential for fractionation of the refrigerants present in R-407C. Use a liquid charge adapter on the manifold gauge set to flash the liquid R-407C to vapor before allowing the refrigerant into the system's suction side. Do not put liquid refrigerant directly into the suction line as compressor damage may result.

## Cooling Mode Airflow Setup

Prior to verifying the system refrigerant charge, the system airflow must be properly set up. It is a common misconception that the cooling blower speed on a residential air conditioning system should always be set to "high." In many cases, high speed cooling will not provide the best possible performance and customer comfort. For optimum performance, most manufacturers recommend 400 cfm (cubic feet per minute) per ton of air conditioning. For example, a 2-ton system should have 800 cfm of air moving through the evaporator coil.

If the blower speed is set too high for the application, the evaporator coil will not be able to do an adequate job of dehumidification and may result in a customer complaint (i.e., "clammy" or muggy" living space). If the blower speed is set too low, there will be inadequate heat transfer between the warm return air and the evaporator coil. Frost (and eventually ice) will form on the coil, resulting in inadequate performance and compressor failure due to liquid refrigerant flood-back.

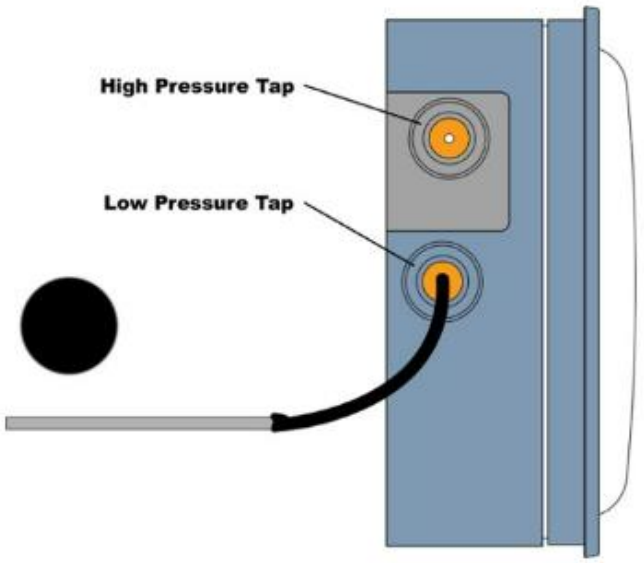
In addition to the blower speed selection, improperly sized duct and other system restrictions can affect system airflow. Therefore, it is important to evaluate the air distribution system by measuring the total system external static pressure (ESP) and applying the ESP value to the furnace or air handler blower performance chart.

## External Static Pressure (ESP)

External static pressure (ESP) is a force imposed by the system blower pushing in all directions on the duct system. On the supply (positive) side of the blower, this pressure is pushing out in all directions on the interior of the supply system. On the return (negative) side of the blower, this pressure is pulling inward on the interior of the return system. This pressure is measured in inches of water column (wc).

Restrictions in the duct system, such as an undersized duct, dirty filters, dirty evaporator coil or closed or blocked registers or grilles, will cause the external static pressure to increase. As the external static pressure increases, the furnace or air handler blower's ability to move air decreases. Most residential furnaces and air handlers are designed to deliver their rated airflow up to .5" wc total external static pressure. This means that a furnace capable of moving 1200 cfm (3 tons) of airflow can do so on its highest speed and the total ESP is .5" wc or less. Higher ESP values can result in greatly reduced blower performance.

A common tool of choice for measuring ESP is the Magnehelic© gauge. The Magnehelic© gauge has two ports, labeled "high" and "low". The "high" port causes the value shown by the needle to increase if a positive pressure is being put into the port. This port is connected to the supply side of the system. The port marked "low" causes the value shown by the needle to increase if there is a negative pressure on the port. This port is connected to the return side of the system.



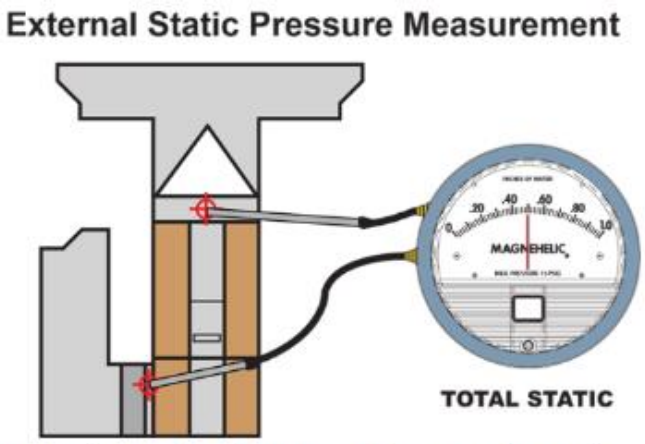

Magnehelic© Side View

# External Static Pressure Measurement

The Magnehelic© gauge can measure supply static, return static and both added together (representing the total system static).

The supply system, when properly sized, should be near .1" wc (without the evaporator coil). A clean, dry evaporator coil will add about .2" wc static, bringing the supply static to a total of .3" wc (.1"+.2" = .3"). To measure the supply static pressure, the technician should connect the Magnehelic© gauge probe to the port marked "high." The probe should be inserted perpendicular to airflow immediately off the supply duct connection, under the evaporator coil, if possible. This will measure supply static and resistance to airflow, imposed by the evaporator coil, supply duct, fittings, and registers.



**Measuring Supply and Return Static to Determine Total Static**

To measure the return static pressure, the technician should connect the Magnehelic© probe to the port marked "low." The probe should be inserted between the filter and the furnace. This will allow the measurement of return static imposed by the filter, return drop, return duct, fittings, and grilles. If probe access cannot be obtained between the furnace and the filter, the blower deck provides a noninvasive place to measure return static.

The total external static pressure can be determined by taking the supply and return static pressures, individually, and adding them, or simply by using two probes and noting the reading on the gauge.

## Using Static Pressure Data

After the total external static pressure has been measured, the furnace or air handler blower performance chart is used to determine the system airflow. To determine the airflow, start by locating the furnace or air handler model that you are working with. Next, locate the measured static and the blower speed that is being used for cooling. The resulting value is the airflow in cfm. Remember that 400 cfm per ton of air conditioning is recommended. If the system airflow is in excess of 400 cfm per ton, select a lower blower speed to reduce the cfm. If the system airflow is below 400 cfm per ton, select a higher blower speed to increase the cfm. After changing the cooling blower speed, measure the system's total external static pressure once again, as this value will change with the new blower speed. Recheck the cfm on the blower performance chart to ensure the system airflow is near the 400 cfm per ton goal.

## An Alternate Formula for Gas Furnaces

If the blower performance charts are not available for the furnace that the air conditioning system is being added to (or for belt drive equipment), use the following procedure to determine an approximate cfm.

- Make sure the furnace is firing at 100 percent of its nameplate input.
- Set the blower speed with the appropriate speed tap for cooling operation.
- After 15 minutes of furnace operation, measure the temperature rise across the furnace.
- The temp rise should be placed into this formula: Btu Output / 1.085 x Temp Rise.
- The resulting value is the cfm being delivered.
- 400 cfm/ton is the desired target value.

Once the proper cooling blower speed has been selected, verify the system refrigerant charge.

## Refrigerant Charge Verification

The method of refrigerant charge verification with R-407C systems differs from Unitary Products using other refrigerants. **The general steps are outlined here but be sure to consult the Installation Instructions for unit-specific direction.**

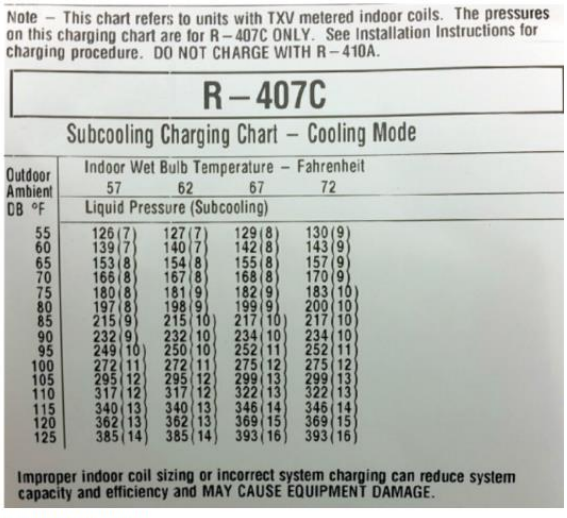
A manifold gauge set is required to read the system discharge pressure. A sling psychrometer (or digital psychrometer) is required to measure the indoor wet bulb (WB) temperature, and a thermometer is required to measure outdoor dry bulb (DB) temperature.

The recommended method considers indoor web bulb, outdoor dry bulb, and discharge pressure, with refrigerant charge modifications made if the discharge pressure is higher or lower than the required value for the prescribed conditions. **The proper system airflow (400 cfm/ton) must be established PRIOR to evaluating system charge.**

| Note |
| --- |
| This method should not be used to 'top off' a system that had leaked refrigerant. In the case of a leak, the remaining system charge should be recovered, the leak repaired, and recharged to the Total System Charge value required for the application. |

Set the system running in cooling mode by setting the thermostat at least 6° F below the room temperature and operate system for at least 10 - 15 minutes.

1. Refer to the technical guide for the recommended indoor airflow, and verify it is correct (it should be 350-400 CFM per ton).
2. Measure and record the indoor wet bulb (WB) and the outdoor ambient dry bulb (DB) temperature.
3. Charge the system to the initial charge value listed on the Tabular Data Sheet.
4. Using the charging chart located on the unit (sample below), find the intersection of the indoor wet bulb and the outdoor dry bulb temperatures. This is the recommended liquid pressure.
5. Measure and record the pressure at the liquid valve pressure port and compare it to the value obtained in step 4.
6. Add refrigerant if the measured liquid pressure value is lower than the recommended value. R-407C refrigerant must be drawn from the cylinder in liquid form only as discussed elsewhere in this document. Recover refrigerant if the measured liquid pressure value is above the recommended value.



Note – This chart refers to units with TXV metered indoor coils. The pressures on this charging chart are for R–407C ONLY. See Installation Instructions for charging procedure. DO NOT CHARGE WITH R–410A.

**R–407C**

Subcooling Charging Chart – Cooling Mode

| Outdoor Ambient DB °F | Indoor Wet Bulb Temperature – Fahrenheit 57 | 62 | 67 | 72 |
| --- | --- | --- | --- | --- |
| | Liquid Pressure (Subcooling) | | | |
| 55 | 126 (7) | 127 (7) | 129 (8) | 130 (9) |
| 60 | 139 (7) | 140 (7) | 142 (8) | 143 (9) |
| 65 | 153 (8) | 154 (8) | 155 (8) | 157 (9) |
| 70 | 166 (8) | 167 (8) | 168 (8) | 170 (9) |
| 75 | 180 (8) | 181 (9) | 182 (9) | 183 (10) |
| 80 | 197 (8) | 198 (9) | 199 (9) | 200 (10) |
| 85 | 215 (9) | 215 (10) | 217 (10) | 217 (10) |
| 90 | 232 (9) | 232 (10) | 234 (10) | 234 (10) |
| 95 | 249 (10) | 250 (10) | 252 (11) | 252 (11) |
| 100 | 272 (11) | 272 (11) | 275 (12) | 275 (12) |
| 105 | 295 (12) | 295 (12) | 299 (13) | 299 (13) |
| 110 | 317 (12) | 317 (12) | 322 (13) | 322 (13) |
| 115 | 340 (13) | 340 (13) | 346 (14) | 346 (14) |
| 120 | 362 (13) | 362 (13) | 369 (15) | 369 (15) |
| 125 | 385 (14) | 385 (14) | 393 (16) | 393 (16) |

Improper indoor coil sizing or incorrect system charging can reduce system capacity and efficiency and MAY CAUSE EQUIPMENT DAMAGE.

R-407C Charging Chart

## Allow the System to Stabilize

After adding or removing refrigerant, allow 10-15 minutes of run-time before re- evaluating system charge. This will allow the system to stabilize and provide the most accurate information regarding the refrigerant charge status.

## Completion of Setup

The dry bulb temperature drop across an evaporator coil varies widely depending on the load placed on the coil. A 20° dry bulb drop across the coil is a value which might be found in many situations, though it will vary according to conditions. Higher humidity conditions tend to result in a lower temperature drop across the coil.

# 03

# Frequently Asked Questions

# FAQs

## Can R-407C outdoor unit be applied in an existing R-22 AC?

Johnson Controls recommends the installation of matched systems whenever possible. In application where space or other limitations prevent the installation of matched system components, Johnson Controls recommends that the installation procedures supplied with the equipment and within the R-407C Technical Service Guide be followed. As an outdoor unit is defined as a replacement "component," an AHRI/DOE/EPA certified outdoor unit can be installed into an existing R-22 system. The supplied with the equipment and per the guidance provided in the R-407C Technical Service Guide.

## Could the use of alternate refrigerants besides R-407C result in the denial of a warranty claim?

Yes, it could. While it is possible that refrigerants with similar performance characteristics to R-407C will operate reliably, JCI does not approve or condone the use of alternate refrigerants (i.e., MO-99, NU-22, R-410a, R22, etc.). Installers should refer to the application and technical literature supplied with the equipment and per the guidance provided in the R-407C Technical Service Guide.

## Is R-22 still legal to be used as a "service refrigerant"?

Yes, until January 1, 2024, per the latest EPA mandates. JCI does not approve or condone the use of R22 or other "drop-ins" in these new R-407C systems which were designed specifically for use with R-407C only. Performance data, application data, AHRI data, etc. is limited to R-407C. R-407C offers a non-ozone depleting alternative to HCFCs such as R-22, is lower cost and is readily available in the market.

## R-407C has no chlorine. Does it need to be recovered?

Federal law mandates that refrigerants may not be vented into the atmosphere. R-407C must be recovered. Make sure the recovery machine and cylinder used is compatible with R-407C.

## What precautions must be taken with R-407C?

When handling any refrigerant, care must be taken to ensure the technician's safety. Toxicity levels of R-407C are comparable to several other refrigerants currently on the market. R-407C is non-flammable at atmospheric pressure and is considered non- flammable by the Department Of Transportation (DOT). It is also considered non- combustible under normal usage. However, mixtures of air and R-407C at elevated pressures can become flammable in the presence of an ignition source. Because of that possibility, never use a mixture of air or oxygen and R-407C to check for leaks. When leak checking with dry nitrogen, keep all ignition sources away as a precaution.

The thermal stability of R-407C is such that when exposed to high temperatures, its vapor will decompose, resulting in toxic and irritating compounds. The lack of chlorine in R-407C prevents phosgene gas from forming when exposed to high temperatures, but the gases that form are nonetheless very toxic. Avoid inhalation and use only in well- ventilated areas as mentioned above.

## Will installation practice change?

Johnson Controls stresses the importance of proper installation and start up procedures. The extremely hygroscopic nature of POE oil and incompatibility with mineral and alkylbenzene oils requires careful attention to installation and service in the field.

System charging procedures with Unitary Products R-407C systems differ from systems utilizing other refrigerants. **This guide does NOT replace the Installation Instructions supplied with Unitary Products R-407C units. Do not attempt installation or service without fully reading and understanding the documentation provided with the unit being installed.**

## Will the filter/driers change?

Liquid line driers and suction line filter driers (when needed) must be rated for use with R-407C. The desiccant used in driers designed for R-407C is significantly different than those designed for R-22 as well as other refrigerants. The driers may also contain more desiccant than used in their R-22 counterparts, to offset the higher moisture content expected of POE oils. Once a drier absorbs its capacity of moisture, any additional moisture in the system simply passes through the drier. Left unchecked, the moisture reacts with the oil, refrigerant and heat in the compressor to form acid and in extreme cases, sludge.

## How should R-407C be charged into the system?

To avoid fractionation, R-407C should be removed from the cylinder as a liquid and charged into the suction line during equipment operation. This can be done with a liquid charging adapter, which causes the liquid refrigerant to flash to a vapor prior to entering the system.

Systems with no refrigerant (such as after a compressor replacement) are charged in the liquid form into the liquid line after proper system evacuation. When the pressure in the system equals the pressure in the refrigerant cylinder and refrigerant is no longer flowing into the system, start the system and continue refrigerant charging into the suction line with the liquid charging adapter.

## What are the refrigerant names & numbers all about?

With the large number of new refrigerants comes a confusing assortment of new refrigerant names and numbers. Most refrigerants have an official number assigned under ASHRAE Standard 34, e.g., R-12, R-407C, R-410a, R-22. Many new refrigerants have a trade name in addition to the ASHRAE number. These names and numbers are often used interchangeably, so be careful and stick to the ASHRAE R#.

## Is R407C a blend refrigerant?

Yes. It is a mixture of HFC-32, HFC-125, and HFC-134a. It is a zeotrope, and special care must be taken when dealing with system leaks and refrigerant charging as noted in this manual.

## Why are so many of the new refrigerant's "blends"?

Manufacturers combine refrigerant components into blends to develop safe and cost- effective alternatives that match CFC performance and properties. Blends are not new; R-502 is a blend of R-22 and R-115 developed in the 1950s to improve on R-22's low- temperature performance. Blends have 400 or 500 series ASHRAE numbers, e.g., R-407C.

## Can R-407C systems be "topped off" after a leak?

This is not recommended. There is still some confusion in the marketplace concerning separation of the blend components (also known as fractionation) during a leak and resultant system performance loss. All blends can fractionate under certain conditions.

When a system leak is found and repaired, the system should be recharged with the calculated Total System Charge with virgin R-407C refrigerant. This will ensure optimal capacity and efficiency.

## Are oil traps required with R-407C?

With the excellent miscibility of R-407C with POE oils, the common practice of installing oil traps if the condenser is more than three feet above the evaporator is no longer required.

## Is there a true “drop-in” refrigerant to replace R-22?

No. There are no exact "drop-ins" which perfectly match R-22 performance. Major compressor manufacturers recommend/require converting to POE to maximize compressor life and retain warranty coverage. R-407C units come factory supplied with POE oil to ensure proper miscibility with R-40, C.

## What type of material is used to connect linesets on R-407C systems?

Soft solder is not to be used. A brazing alloy with a minimum 5% silver content is recommended.

## Are pressures higher with R-407C vs. R-22?

System pressures with R-407C are similar, but slightly higher (5-10%), than their R-22 counterparts.