

C

R290

GREEN

ENERGY



MAINTENANCE GUIDE

cossiga

Making food look great globally

INTRODUCTION

Let's use clean, green energy!

Welcome. To make things easier for you, here are some simple guidelines on how to use, install and understand R290. Let's help the planet, one cabinet at a time.

Naturally Occurring

R290 is a hydrocarbon propane gas that is the simplest organic compound, just hydrogen and carbon. It is naturally occurring and can be found in crude oil where decomposed organic matter creates large quantities of carbon and hydrogen. **Since R290 occurs naturally, it is non-toxic to both the users and the ecosystem.**

Environmentally Friendly

Because R290 is a naturally occurring propane gas, the impact on the environment is minimal. Compared to CFS or HFC which are currently used as standard refrigerants, and have a Global Warming Potential (GPW) of 1,430, R290 and other hydrocarbons have a GPW of 3. **This means that R290 does not, in any way, contribute to the depletion of the ozone.**

Positive Energy

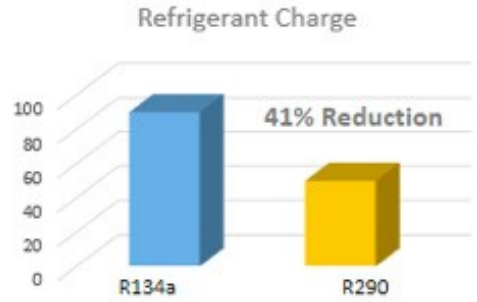
HFC and CFC refrigeration systems can use extraordinary amounts of energy to cool and have an irreversible hazardous effects on the environment. However, R290 with its thermodynamic properties and low condensing temperature maximizes energy efficiency, realizing up to 50% energy efficiency. Operators save green in every aspect of their business.



CHARACTERISTICS

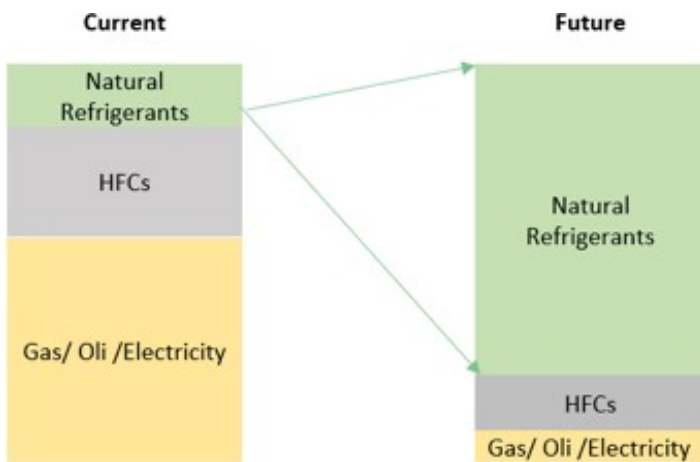
ECO-FRIENDLY

- Hydrocarbon (HC) Refrigerant: natural & non- toxic
- Ultra-low GWP (Global Warming Potential)
- Zero ODP (Ozone Depletion Potential)
- Commercial market acceptance



GWP	
R134a	1430
R290	3

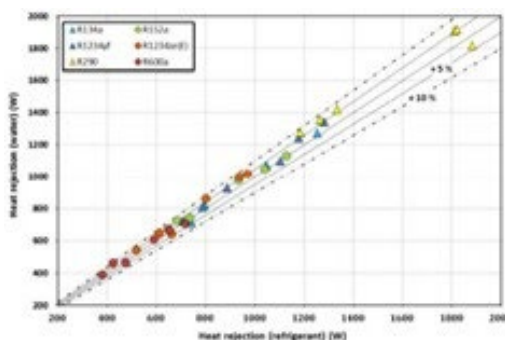
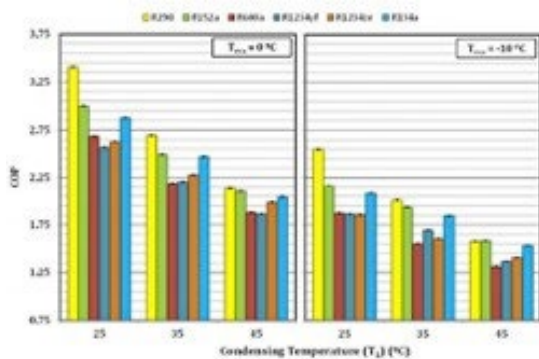
MARKET TRENDS



HIGHER REFRIGERANT PERFORMANCE

Higher thermal conductivity

Compares the heat rejected by the refrigerant at the condenser with the heat recovery by the secondary fluid, R290 has higher thermal conductivity than R134a. A higher value means better performance of transferring heat, improves efficiency and higher cooling capacity.



Lower running costs

The COP of a refrigerating plant is defined as the ratio between the cooling capacity (Q_{ev}) and the power consumed by the plant (P_c).

$$COP = \frac{\dot{Q}_{ev}}{P_{comp}} = \frac{\dot{m}_{ref} \cdot \Delta h_{ev}}{\dot{m}_{ref} \cdot \frac{w_s}{\eta_G}} = \frac{\eta_G \cdot \Delta h_{ev}}{w_s}$$

It can be highlighted that the use of R290 to replace R134a will improve the COP of the refrigeration facility whatever the evaporating level is, which results in lower running costs.

Flammable

The main disadvantage with the use of R290 is the risk of flammability.

Accidents must have two essential preconditions:

- A. The flammable mixture of gas and air
- B. The ignition source of a certain energy level

R290 isn't explosive on its own, requiring external ignition sources to ignite the gas. The minimum ignition temperature of R290 is 470 degrees, makes it both an effective and stable fuel for home, industrial, and commercial use.

Although there was initially fear that these propane-operated refrigerators could pose an explosion risk, investigations show that there is a little chance of this occurring. Most R290 units contain less propane than common products like lighters, air fresheners, and spray paint.



SYSTEM DESIGN

Compressor Selection

We selected SECOP compressors for different models with different refrigerant quantities.

	COMPRESSOR	REFRIGERANT
BTGRF-R	SECOP-SC15MNX	R290/175g
	SECOP-SC15MNX	R290/235g
	SECOP-SC18MNX	R290/300g
BTGOR-R	SECOP-SC18MNX	R290/250g
	SECOP-SCE21MNX	R290/330g
TTGOR-R	SECOP-SCE21MNX	R290/300g
STGRF-R	SECOP-SC15MNX	R290/175g
	SECOP-SC15MNX	R290/225g
	SECOP-SC15MNX	R290/235g
GOGRF-R	SECOP-SC15MNX	R290/135g
	SECOP-SC15MNX	R290/175g
	SECOP-SC15MNX	R290/200g
LSRF-R	SECOP-SC15MNX	R290/235g
	SECOP-SC18MNX	R290/290g



Capillary tube selection

R290 has about 150 % of R134a volumetric capacity at 45 °C condensing temperature. Therefore, the R290 system needs different capillary tube diameters and lengths because of different volume flows needed for the same refrigeration.



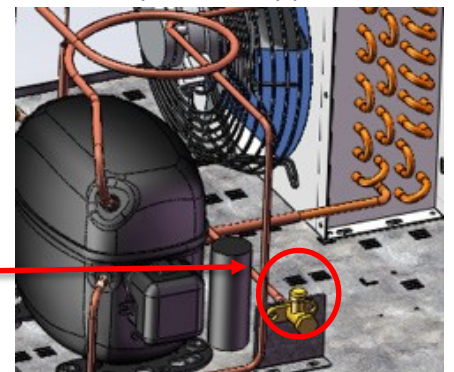
The choice of capillary diameter and length is based on the below factors:

- Compressor capacity
- Evaporating temperature
- Condensing temperature
- Return gas temperature
- Sub-cooling

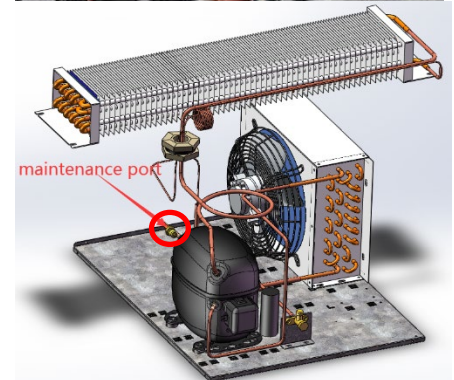
The input data are limited per refrigerant according to experience and compressor application areas.

Filling valve selection

A filling valve is added for charging the system in production, Controlling the flowing speed and reducing the risk of fire.

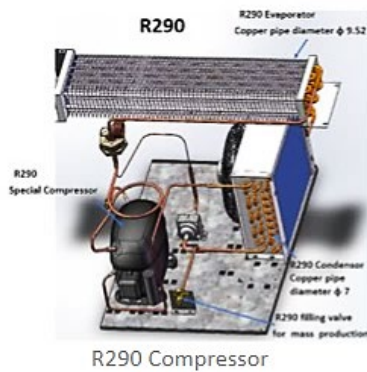


Please notice that this valve is not used for maintenance, the maintenance port is set up on another side.



R290 structure VS R134a structure

R290 Structure

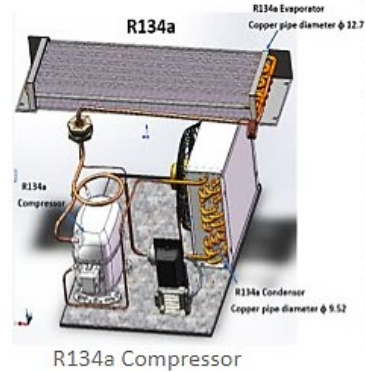


R290 filling valve for mass production

R290 Condenser: Capillary tube diameter $\Phi 7$

R290 Evaporator: Capillary tube diameter $\Phi 9.52$

R134a Structure



No filling valve for mass production

R134a Condenser: Capillary tube diameter $\Phi 9.52$

R134a Evaporator: Capillary tube diameter $\Phi 12.7$

SERVICE AND REPAIR

Maintenance personnel must receive professional and strict R290 pre-job training, understand the characteristics of refrigerants, how to operate scientifically, improve safety awareness, and pass the operation examination.

MAINTENANCE SITE

Check the site: A safety inspection must be carried out to ensure that the risk of ignition is minimized before maintenance.

Requirements for maintenance operation area:

- A) The maintenance area must be ventilated.
- B) Fire extinguishing equipment shall be provided at the maintenance site.
- C) There should be enough space at the maintenance site. Open fire, electric spark, and ≥ 470 °C heat source is prohibited within 2m. Warning signs should be set up at the maintenance site.
- D) No smoking during on-site maintenance.

Monitor the site: A portable R290 leak detector



SERVICE AND REPAIR

MAINTENANCE TOOLS

Most maintenance tools used on the R134a system are still required.

Extra tools used on R290

- Hydrocarbon leak detector
- Thermocouples or an infrared thermometer
- No Smoking or Open Flames sign
- Propane fittings and a bottle of Refrigeration grade propane
- Approved fire extinguisher
- Standard vacuum pump
- Standard gauge manifold



Leak testing

Before maintenance and installation, the portable R290 leak detector should be used to detect the concentration, and it can only be operated within the safe range.

For systems containing R290 refrigerant, the following leak detection methods are applicable:

- Electronic leak detector can be used to detect R290 refrigerant.
- Ensure that the leak detector will not become a potential ignition source and is suitable for the measured refrigerant.
- The leak detector should set the minimum combustible concentration of refrigerant (expressed in percentage) and calibrate and adjust it to the appropriate gas concentration test range (up to 25%).
- Chlorine-containing solvents should not be used in the liquid used for leakage detection to prevent corrosion.

R290 REFRIGERANT CHARGE

The filled refrigerant pipeline should be as short as possible to reduce the residual amount of refrigerant in it.

Ensure that the refrigeration system is earthed before filling refrigerant.

Fill refrigerant from the maintenance port carefully.

Be careful not to overcharge refrigerant. Leak detection should be carried out after refrigerant charging is completed.

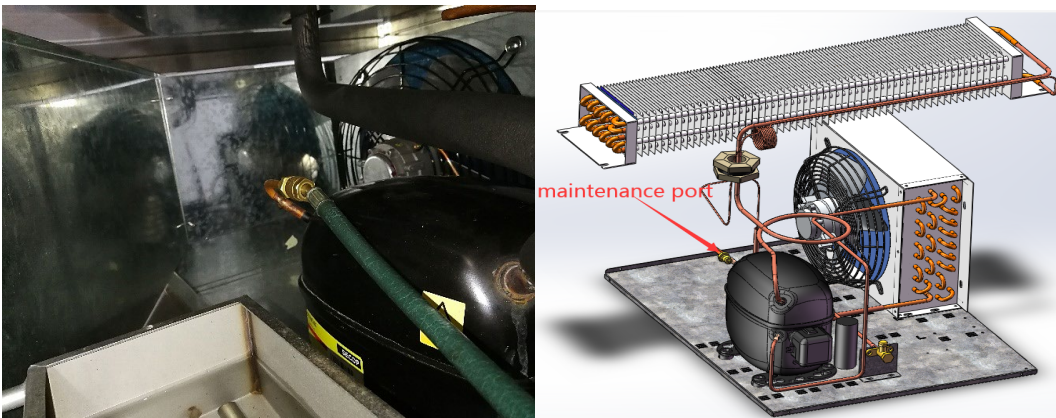
SAFETY MAINTENANCE

Open The System:

When repairing electrical components, disconnect the power supply before maintenance. If the power supply is required during maintenance, uninterrupted leak detection is required at the most dangerous locations to prevent potential hazards. All improper operations such as metal collisions that may produce sparks shall be avoided during replacement.

Release a Charge:

When welding or cutting the pipeline of R290 refrigeration system, the refrigerant should be discharged first. The refrigerant should be discharged to an open place without the risk of open fire, electric spark and any 470 °C heat source. Or discharged into the refrigerant recovery tank. (Please select the emission mode according to local regulations.) Assemble the copper lines and fittings from the maintenance port on the compressor for discharge, as shown in the figure below:



Pressure Test:

When the refrigerant is discharged, the flow rate of the refrigerant should be appropriate, so a large amount of compressor oil cannot be brought out. Perform the pressure test and ensure the dry nitrogen pressure is down to 1 – 2 psig before starting the vacuuming process.

Evacuation:

Discharge R290 until no refrigerant flows out, add high purity (oxygen free) nitrogen, discharge it, and then vacuumize it with a vacuum pump for 15-20min before welding the pipeline. The outlet of the vacuum pump should be free from any ignition source and spark and be well vacuumed. **Vacuum degree requirement: less than 40 Pa.**

Leak Test:

After welding replacement parts on the R290 refrigeration system, leak detection test must be carried out. Nitrogen can be used to pressurize, and then soapy water can be used for leak detection. It is forbidden to use compressed air or oxygen for leak detection.

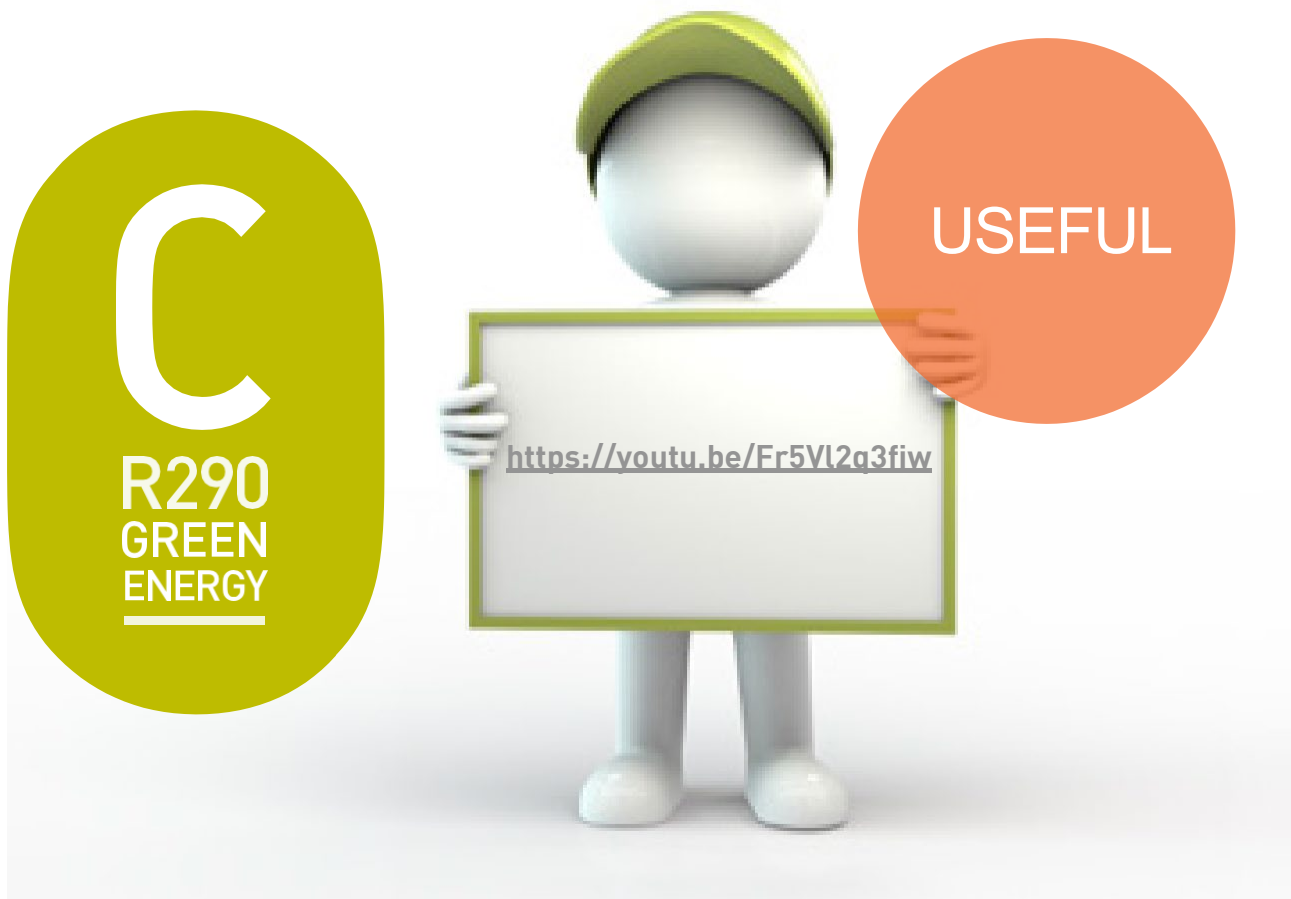
Charge the System:

Install access valve onto R290 tank 3 and insert R290 tank into a shipping box. Top up the required filling weight by opening the ball valve slightly.

Confirm the Charge:

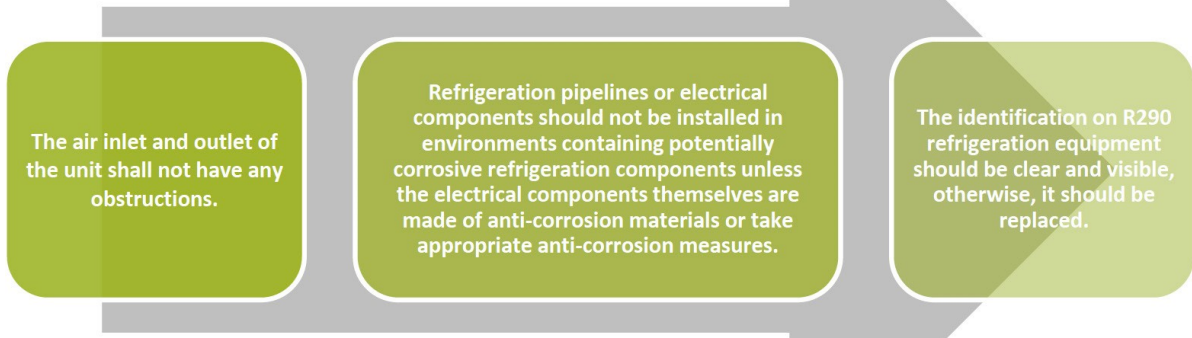
Confirm the refrigerant charge via system operating pressures and amperage draw.

For more information, please check out the below video link:

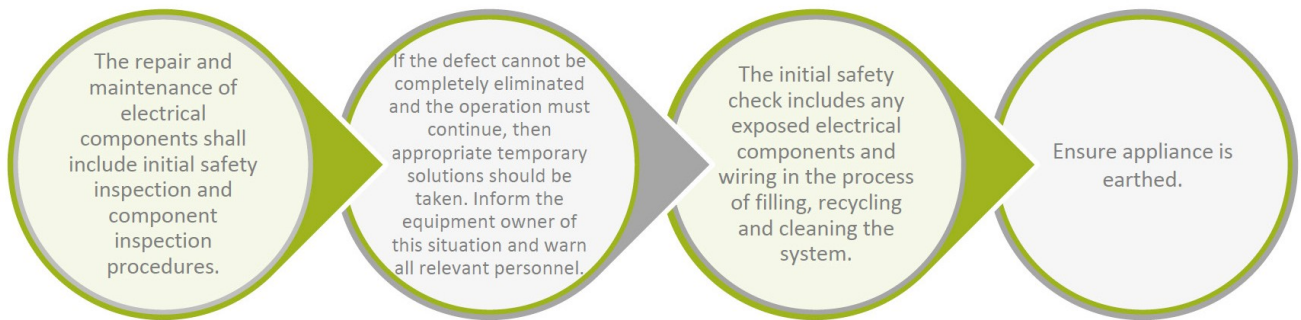


EQUIPMENT INSPECTION

R290 refrigeration equipment inspection



Electrical equipment inspection



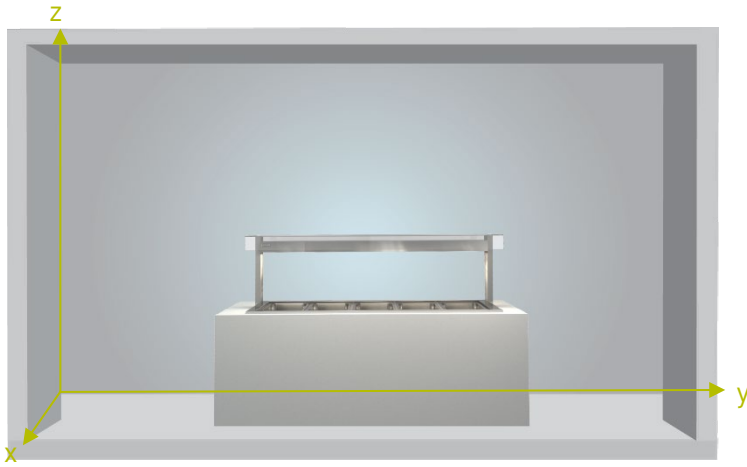
Cable or power cord inspection.

Check whether the cable or power cord will be affected by wear, corrosion, overvoltage, vibration, sharp edges or the other adverse environment.

ATTENTION

- Each product has a corresponding climate type. Please use it under the appropriate climate conditions.
- When the equipment is scrapped, the R290 refrigerant in the system must be recovered. After the R290 refrigerant in the scrapped equipment is drained, it should be marked with date and signature.
- The power supply voltage and frequency used by users must be consistent with the requirements of refrigeration products.
- Note that R290 refrigeration products have space requirements, which are related to the refrigerant charge of R290. We recommend that the indoor space meets this standard: 7g/m³ for safe operation (every 7g of refrigerant must provide no less than 1m³ of usable space).
Please see more details below.

The space requirements are not minimum volume restrictions. The room volume can still be slightly larger than the suggested space.



Series	Series	Recommended Space (m3)
BTGRF-R	BTGRF9R/BTGRF9 (SD)	25.00
	BTGRF12R/BTGRF12R (SD)	33.57
	BTGRF15R/BTGRF15R(SD)	42.86
BTGOR-R	BTGOR9R	35.71
	BTGOR12R	47.14
TTGOR-R	TTGOR12	42.86
STGRF-R	STGRF9R(SD)	25.00
	STGRF12R(SD)	32.14
	STGRF15R(SD)	33.57
GOGRF-R	GOGRF9R	19.29
	GOGRF12R	25.00
	GOGRF15R	28.57
LSRF-R	LSRF5R-D690	33.57
	LSRF6R-D690	41.43

Calculation Formula: Length x Width x Height = $x*y*z$



REFERENCE

Energy performance evaluation of R1234yf, R1234ze(E), R600a, R290 and R152a as low-GWP R134a alternatives:

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