

#### CARE IN THE REOPERATION OF DOMESTIC SYSTEMS

The substitution of R 12, due to problems of attacking and destroying the ozone layer, accelerated the development of environmentally acceptable alternatives with the purpose of substituting the R 12 found in products in the field today.

The R 134a and the R 600a are already being widely used by refrigeration system manufacturers. For the replacement, the chemical industry and the compressor manufacturers developed another option for blends which is recommended for systems which had already been operating with R 12.

The maintenance of domestic refrigeration systems which already use some of these alternatives, caused a dilemma for the refrigeration technician in choosing the best option as, the majority of the time, he was ignorant of the impacts on the system and the care during the reoperation process.

#### HOW DO YOU PROCEED IN THE REOPERATION OF A REFRIGERATION SYSTEM?

##### 1<sup>st</sup> Step - Identify the refrigerant which is being used.

Normally the refrigeration system identification is shown together with the gas load or on the compressor identification label.

##### 2<sup>nd</sup> Step - Remove the refrigerant load.

- R 12  
Use a perforated valve to collect the refrigerant gas in a storage cylinder and send for recycling. Do not release it into the atmosphere.
- R 600a  
The seal should be broken in a ventilated room, far from gutters, flames and/or sparks.
- R 134a  
Use a perforated valve to collect the refrigerant gas in a storage cylinder and send for recycling. Do not release it into the atmosphere.

##### 3<sup>rd</sup> Step - Choose a refrigerant fluid.

Always try to use the original refrigerant. However, due to market supply and technical handling problems with R 134a and R 600a, the following options could be possible:

SYSTEM WITH	1 <sup>st</sup> OPTION	OTHER ALTERNATIVES	IMPACT
R 12	New R 12	R 12 - recycled from a good source	Not recommended due to ecological issues.
		blends	Alteration to dryer filter, refrigerant load and eventually to the system performance.

SYSTEM WITH	1 <sup>st</sup> OPTION	OTHER ALTERNATIVES	IMPACT
R 600a	R 600a	R 12	Not recommended due to ecological issues.
		blends	Alteration to dryer filter, compressor, refrigerant load and eventually to the system performance.
R 134a	R 134a	Non-existent	Reoperation only with R 134a and in workshops with specific equipment.

Note 1 - **The use of other refrigerants such as R 12 and blends in systems which have already been operating with the R 134a is not approved by Embraco.** The risks of contamination caused by ester oil residues, even in small quantities, are increased and can seriously damage system performance.

Note 2 - The use of R 134a in systems which use R 12 or R 600a is only possible with a sealed unit suitable for R 134a substitution. However, it is not recommended as it is economically unfeasible.

##### 4<sup>th</sup> Step - Dryer filter substitution.

The standard procedure must be followed when installing the dryer filter, as for each type of refrigerant there are appropriate dryer filters. See table below:

REFRIGERANT	RECOMMENDED DRYER FILTER
R 12	XH5 , XH6 , Universal (MS594)
R 134a	XH7 , XH9 , Universal (MS594)
R 600a	XH5 , XH6 , Universal (MS594)
blends	XH9 , Universal (MS594)

##### 5<sup>th</sup> Step - Compressor Installation.

The compressor must be suitable for working with the chosen refrigerant and have the same refrigeration capacity as the original compressor, and installation must follow the recommended procedures for each type of refrigerant.

The Embraco compressors for retail distribution starting in September'97, will be suitable for use with blends or R 12. These compressors will be supplied with alkylbenzene added synthetic oil, exclusively developed for use with the following blends:

REFRIGERANT		MANUFACTURER
# ASHRAE	COMMERCIAL NAME	
R 401a	SUVA MP39	DuPont
R 401b	SUVA MP66	DuPont
R 409a	FX56	Elf Atochem
R 413a	ISCEON - 49	Rhône Poulenc

#### 6<sup>th</sup> Step - Vacuum Process.

A high vacuum pump must be used, and two vacuum cycles are necessary, one of up to 1000  $\mu\text{m}$  mercury (29.88"Hg) necessary followed by a new vacuum application of up to 500  $\mu\text{m}$  mercury (29.90"Hg).

#### 7<sup>th</sup> Step - Gas Load.

Before turning on the compressor, check that all the electrical components (relay and thermal protector) are correct and connected. Introduce the refrigerant gas load recommended by the manufacturer (when using the system's original refrigerant gas). If one of the alternatives has been opted for, it will be necessary to adjust this load. Check the following table:

REFRIGERANT		CORRECTION FACTOR MULTIPLIED BY	OBSERVATION
ORIGINAL	ALTERNATIVE		
R 12	blends	0,80	Load reduction
R 600a	R 12	1,60	Load increase
R 600a	blends	1,30	Load increase

Example: If blend is used on a 280 l refrigerator with an original load of 120 gr R 12 the correction factor will be 0.80, thus:

$$\text{Load}_{\text{blend}} = 0.80 \times \text{load}_{\text{R 12}} = 120 \times 0.8 = 96 \text{ gr}$$

This value serves as a reference to speed up the loading process.

The values given for the load correction factors are guides as they depend on the operating conditions and the system size. The correct gas load is obtained when:

- The evaporator shows ice formation over all its surface (if this is not the case, add more refrigerant gas);
- Absence of gas formation on the return line (if this does occur remove refrigerant gas).

**When using blends, remember that these blends should only be removed from the cylinder in liquid form to guarantee that the refrigerant is introduced with the correct composition, since it is made up by refrigerants of different ebullition points.**

**When introducing refrigerant gas in liquid form keep the compressor disconnected.**

#### 8<sup>th</sup> Step - Gas leakage test.

Perform gas leakage test using the specified leakage detectors for the gas used and, if everything is in order, seal the process tube.

With the objective of facilitating future services, after having concluded system maintenance, it is important to identify the refrigerant fluid and the load used.

The above described procedures, seek to clear up doubts concerning the alternative available on the market and are based on experiments carried out at Embraco. The use of another refrigerant gas or procedure not included in this article should not be used, and neither will it be recognized by Embraco, without a previous criterial evaluation.