

1. INTRODUCTION

During the development of an experimental evaluation of refrigeration systems, which is a part of the Embraco's HC's project, it has been observed some important characteristics related to the amount of refrigerant to be used in small appliances.

Due to the small refrigerating capacity involved with these appliances, their sensitivity to the amount of refrigerant is an inherent feature.

The purpose of this Technical Information is to share the experience obtained at the Embraco's Application Laboratory when R 600a replaces R 12 in a refrigeration system designed to run appropriately with R 12.

The methodology used to charge R 600a and the system's sensitivity when small amounts of refrigerant is involved will be reported.

2. METHODOLOGY USED TO CHARGE R 600a

Usually, small refrigerating capacity implies in small amount of refrigerant charge. When R 600a replaces R 12 the amount of refrigerant is smaller than the usual. For a system that works reasonably well with R 12, the amount of R 600a will be approximately 40% of the amount of R 12.

This is not a general rule but can give a preliminary estimative of the amount of R 600a to be charged.

One important point to be considered is the methodology used to determine the appropriate refrigerant charge. If a gas cylinder is used to add small amounts of refrigerant, until the appropriate refrigerant charge is determined, a special care should be taken into account in order to avoid infiltration of air in the system once R 600a refrigeration systems works with suction pressure lower than the atmospheric pressure. The tubulation that connects the gas cylinder and the process stub in the system must be evacuated each time a new portion of refrigerant is to be added.

When the refrigerant charge is determined, the system should be evacuated and the total amount of refrigerant should be charged at once. Then, the system is ready to perform the No-Load Pull-Down test.

3. TEST RESULTS

The table below presents some results obtained during the refrigerant charge determination for R 12 and R 600a in the same system.

REFRIGERATOR 120 LITERS						
Refrigerant		R 12			R 600a	
		Refrigerant Charge (g)	23	26	28	8
Evaporator Inlet (°C)		-21.4	-22.9	-24.6	-24.0	-26.3
Evaporator Outlet (°C)		5.3	-8.1	-23.7	-4.2	-24.4
Fresh Food Compartment (°C)		13.7	9.3	0.21	4.2	0.0
Condenser Outlet (°C)		46.1	49.2	50.2	46.9	49.5
Discharge Pressure (bar)		11.9	13.1	13.3	6.89	7.36
Suction Pressure (bar)		0.95	1.12	1.19	0.42	0.51
Input Power (W)		60.0	65.9	68.1	58.4	63.5

As can be seen, the system's sensitivity is a point to be considered when the refrigerant charge is being determined.

What should be emphasized is that the compressors used to perform the evaluation were not optimized in terms of energy efficiency ratio. Also, the system was not adjusted to be used with R 600a. The refrigerant charge was chosen to be evaluated due to the simplicity involved with the process, what is much easier to do than modify a specific component design. It does not mean that the system is able to run in other condition different of the No-Load Pull-Down test.

The tests results showed above represent a preliminary evaluation of a small domestic refrigerator and in order to generate them, Embraco used its best efforts to deliver a high quality result. These results should be used only as a reference and they are subject to change without previous notice. Embraco shall not be liable for any damage that may result from errors or omissions in this Technical Information.

