



Refrigerant Solutions Ltd

RS-44 COMMERCIAL HEAT PUMP TRIAL

Tests were carried out on a roof top heat pump at the test site of Refrigerant Services Inc in Dartmouth, Halifax, Canada between August 2000 & October 2001 in which R22 was replaced by RS-44. The existing mineral oil in the system was retained for use with RS-44 and no changes were made to the hardware.

SYSTEM SPECIFICATIONS:

5 tonne roof top heat pump
Manufacturer: Comfort Aire
Model: PEHC-60-1A
Serial no. 4651F26900190
Number of months in service: 0 (new and unused)
Nominal cooling capacity: 56,000 BTU
Nominal heating capacity: 56,000 BTU
Voltage: 208/230/1/60
Compressor RLA 33.0/28.5 amps
Operating refrigerant charge: 4.28 kg R22
Oil type : mineral oil 150 viscosity
Expansion device: fixed orifice type

MODIFICATIONS TO SYSTEM:

Installed oil sight-glass on hermetic compressor for monitoring purposes only.

STAGE 1 OF COMMERCIAL HEAT PUMP SYSTEM TRIAL

The system was operated for several hours in both the cooling and the heating mode with the original R22 and oil charge as recommended by the manufacturer. Baseline data was recorded including :

Voltage, amperage, suction pressure, suction temperature, discharge pressure, discharge temperature, liquid line temperature, evaporator temperature, ambient temperature, oil level, return and supply air temperature.

STAGE 2 OF COMMERCIAL HEAT PUMP SYSTEM TRIAL

The R22 charge was recovered and the system evacuated. An equal amount by weight of RS-44 was charged into the system and the system was operated in both the cooling and heating mode. The same data as stage 1 was collected for comparison purposes.

RECORDED DATA

	Cooling mode		Heating mode	
	R22	RS-44	R22	RS-44
Suction pressure	4.48	3.26	4.82	4.02
Suction temperature	18	26.8	25	26
Discharge pressure	13.1	12.5	20.34	20.28
Discharge temperature	90	80	120	96
Liquid line temperature	31	30	2.2	31
Ambient temperature	22	25.6	24.2	23
Oil level	10.8	10.8	10.8	10.8
Amperage	22.27	18.87	28.97	24.14
Voltage	200	200	198	198
Evaporator temperature	7.2	7.9	41	36.2
Evaporator temperature difference	12.2	15.8	11.1	6.7
Superheat	9.1	15.4	N/A	N/A

Note:

Pressures in bars gauge

Temperatures in Celsius

Oil level in cm

All readings are averages over several hours of operation

Evaporator readings are the actual condenser readings when in the heating mode.

GENERAL OBSERVATIONS:

- (1) Oil return with RS-44 was similar to R22 operating levels
- (2) Suction pressures were lower with RS-44
- (3) Discharge pressures were similar to R22
- (4) Energy consumption was significantly lower with RS-44
- (5) Discharge temperatures were significantly lower with RS-44
- (6) Temperature difference across the evaporator was generally greater in the cooling mode and less in the heating mode

- (7) Superheat readings were higher with RS-44 indicating not as much of the evaporator was being utilized as with R22. Modifications to the fixed orifice expansion device could improve evaporator performance with RS-44.

CONCLUSIONS

- (1) Iso-pentane/butane components provide the necessary oil return.
- (2) Equivalent general operating performance was achieved on the conversion to RS-44 without the requirement of any system or oil modifications. (successful drop-in replacement).
- (3) There appeared to be improved energy efficiency with RS-44.
- (4) Modifications to the expansion device could further improve overall system performance and energy usage.
- (5) Significantly lower discharge temperatures could improve compressor reliability in high ambient conditions.