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ABSTRACT

This paper will focus on the experimental evaluation of zero ODP alternative refrigerants in unitary air conditioning equipment. Tests were run on a nominal 10 SEER 2.5 ton split-system air conditioner using both a scroll and a reciprocating compressor. Refrigerants evaluated include: R-22, an azeotrope of HFC-32 & HFC-125, HFC-134a, and a blend of HFC-32, HFC-125, and HFC-134a. When testing with the 32/125 azeotrope or HFC-134a, special compressors were used with either reduced or increased displacement. This normalized the capacity of the air conditioner to R-22. The only other change for the first series of tests was to replace the expansion valve with one designed for the pressure of the alternative refrigerant. A second series of tests involved "soft-optimized" heat exchangers and evaluation of liquid-suction heat exchangers. The heat exchanger optimization process was limited to re-circuiting the heat exchangers for the particular refrigerant under test.

INTRODUCTION

Despite the fact that HCFCs are considered interim solution to the ozone depletion problem caused by CFCs, these fluids still contain chlorine and contribute to some ozone depletion as well (albeit to a much smaller extent). As a result of this environmental concern, HCFCs have been included in recent revisions of the Montreal Protocol and the U.S. Clean Air Act. The consumption of HCFCs will be restricted beginning in 1996 and will be completed phased-out by 2030.

The air conditioning industry is currently evaluating alternative refrigerants for HCFC-22. Under the auspices of the Air-Conditioning & Refrigeration Institute (ARI), a program (the Alternative Refrigerant Evaluation Program or AREP) involving major equipment manufacturers around the world, was formed to conduct an evaluation of the performance of HCFC-22 (6 R-502) alternatives in representative equipment. As a result of early tests, three leading candidates were identified. These candidates are: HFC-134a, an azeotrope of HFC-32 & HFC-125 (termed AZ-20 by AlliedSignal), and a zepotrope of HFC-32, HFC-125, & HFC-134a (termed AC9000 by DuPont and Klea 66 by ICI).

In order to determine the performance of a representative air conditioner operating with these alternative refrigerants, a test program was initiated at an independent test laboratory where industry standard tests could be run.
Figure 3

Figure 4

Figure 5

Figure 6