



DuPont Fluoroproducts

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Mr. Steve Johnson
ThermoKing Corporation
Bus Air Conditioning
314 West 90th Street
Minneapolis, MN 55420

Dear Mr. Johnson,

Based on your request to Eric Youngdale, I am providing two data tables that summarize the performance impact of leakage (fractionation) on R-404A and R-407C. The tables were developed based on five 50% vapor leaks from a static system. This is obviously an extreme situation and would be considered a "worst case". Composition change is minimal for R-404A. For R-407C, leakage from an operating system would result in much less composition change due to vapor/liquid mixing.

I have also enclosed two technical papers on R-407C. Both have sections that discuss system leaks, composition change and impact on performance. The first is an ASHRAE paper written by DuPont after the initial development of R-407C. The second is an article from York International that was published in "HVAC&R Engineering". Although it discusses R-22 alternatives for chillers, I thought it might be of some use as background information.

Please feel free to call me at 302-999-3474 if you have any questions or need any additional information.

Best regards,

Dave Bateman
Sr. Technical Service Consultant

The information contained herein is based on technical data and tests which we believe to be reliable and is intended for use by persons having technical skill, at their own discretion and risk. Since conditions of use are outside of DuPont's control, we can assume no liability for results obtained or damages incurred through the application of the data presented.

Sheet1

R-404A: COMPOSITION CHANGE DUE TO VAPOR LEAK;
IMPACT ON PERFORMANCE

ASSUMED FIVE 50% VAPOR LEAKS FROM A STATIC SYSTEM
THEN RE-CHARGED WITH VIRGIN R-404A

TEST CONDITIONS: 120 F CONDENSING; -10 F EVAPORATOR

PERFORMANCE COMPARISON

	R-404A INITIAL	1ST LEAK/ RECHARGE	2ND LEAK/ RECHARGE	3RD LEAK/ RECHARGE	4TH LEAK/ RECHARGE	5TH LEAK/ RECHARGE
COOLING CAPACITY (RELATIVE TO R-404A)	1	1	1	1	0.99	0.99
ENERGY EFFICIENCY (RELATIVE TO R-404A)	1	0.99	1	1	1	1
DISCH. TEMPERATURE (F)	174	174	174	174	174	173
DISCH. PRESSURE (PSIA)	326	325	324	323	324	324
COMPOSITION CHANGE (WT.%)						
HFC-125	44	43.4	43	42.9	42.8	42.8
HFC-143a	52	52.1	52.1	52	52	52
HFC-134a	4	4.5	4.9	5.1	5.2	5.2

TALKING POINTS:
COMPOSITION CHANGE IS MINIMAL

IMPACT ON PERFORMANCE IS INSIGNIFICANT

RESULTS CONFIRMED BY LAB TESTS AND EXTENSIVE
FIELD EXPERIENCE

Sheet1

R-407C: COMPOSITION CHANGE DUE TO VAPOR LEAK;
IMPACT ON PERFORMANCE

ASSUMED FIVE 50% VAPOR LEAKS FROM A STATIC SYSTEM
THEN RE-CHARGED WITH VIRGIN R-407C

TEST CONDITIONS: 110 F CONDENSING; 40 F EVAPORATOR

PERFORMANCE COMPARISON

	R-407C INITIAL	1ST LEAK/ RECHARGE	2ND LEAK/ RECHARGE	3RD LEAK/ RECHARGE	4TH LEAK/ RECHARGE	5TH LEAK/ RECHARGE
COOLING CAPACITY (RELATIVE TO R-407C)	1	0.95	0.93	0.92	0.91	0.91
ENERGY EFFICIENCY (RELATIVE TO R-407C)	1	1	1.01	1.01	1.01	1.01
DISCH. TEMPERATURE (F)	166	164	163	162	162	162
DISCH. PRESSURE (PSIA)	257	244	238	235	234	234
COMPOSITION CHANGE (WT.%)						
HFC-32	23	19.6	18.2	17.5	17.3	17.2
HFC-125	25	22.5	21.2	20.5	20.1	20
HFC-134a	52	57.9	60.6	62	62.7	62.8

TALKING POINTS:
SCENARIO OF FIVE 50% VAPOR LEAKS WITHOUT SYSTEM
REPAIR IS EXTREME

UNDER THIS "WORST CASE SCENARIO" COOLING CAPACITY
WILL BE REDUCED ABOUT 9% AFTER 5 LEAK/RE-CHARGES

IF A 15% LEAK IS ASSUMED, CAPACITY WILL BE REDUCED BY
ONLY 5% AFTER THREE LEAKS

COMPOSITION CHANGE IN AN OPERATING SYSTEM WILL BE
MUCH LOWER DUE TO LIQUID/VAPOR MIXING

MUCH LESS COMPOSITION CHANGE WILL OCCUR IF THE LEAK
IS FROM THE LIQUID PHASE

SINCE THE HFC-32 CONCENTRATION BECOMES LOWER, THE
REFRIGERANT DOES NOT BECOME FLAMMABLE