RS-20 (R-480A)

Performance comparison vs R-134a and R-456A in the Automotive A/C Sector

Test Objectives

The main objectives of this study are analyzing the RS-20 (R-480A) refrigerant gas performance in an automotive A/C system (cooling) and comparing it to R-134a and R-456A, acting as R-134a replacement.

This study has been conducted by Davasa Automoción in their facilities (Carril Penchos, 174, 30009 Murcia) using RS-20 (R-480A) in a vehicle with an engine propelled by gasoline. Davasa Automoción is an independent company, well renowned in the Automotive sector in Spain.

Statement of Work

The statement of work consists in analyzing the R-134a, R-456A and RS-20 (R-480A) refrigerant gases' performance under the following conditions:

1. Test 1 is conducted under air conditioning at the ambient temperature of 15-20ºC, considered spring or early-fall conditions.
2. Test 2 is conducted simulating summer conditions by partially covering the evaporator to reach 40ºC air input temperature:

Test	Temperature	Engine Revolutions
Test 1 - Spring	15-20ºC	750 rpm 2000 rpm 4000 rpm
Test 2 - Summer	40ºC	750 rpm 2000 rpm 4000 rpm

Both tests are carried out in a Volkswagen Polo 1.4 FSI model with ARR engine and DENSO cooling system.

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Methodology

In order to carry the out the test, this has been the employed methodology:

1. System preparation: vacuum the whole system and charging the refrigerant gas quantity recommended by the system manufacturer (550 gr). The same quantity has been used for all 3 refrigerants (R-134a, R-456A and RS-20).
2. System stabilization: during the test, the engine has been working at the different speeds (750, 2000 and 4000 rpm) at least for 5 minutes to ensure the system stability and so the data reliability.
3. Data collection: After the system stabilize, all the data was collected (air output temperature, ambient temperature and refrigerant gas pressures (high and low).

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Test Results

R-134a	Air Input 19,4°C			Air Input 40°C		
	Low Pressure (bar)	High Pressure (bar)	Air Output Temperature (°C)	Low Pressure (bar)	High Pressure (bar)	Air Output Temperature (°C)
750rpm	2.8	12.0	10.4	2.8	15.0	9.0
2000 rpm	3.8	10.0	6.0	2.8	14.0	6.0
4000 rpm	2.4	16.0	6,0	2.4	16.0	6.0

R-456A	Air Input 20,9°C			Air Input 40°C		
	Low Pressure (bar)	High Pressure (bar)	Air Output Temperature (°C)	Low Pressure (bar)	High Pressure (bar)	Air Output Temperature (°C)
750rpm	2.0	10.1	16.0	2.2	12.2	9.0
2000 rpm	2.0	10.2	7.0	2.2	13.0	7.0
4000 rpm	2.2	10.0	7.0	2.2	13.0	7.0

RS-20	Air Input 16,9°C			Air Input 40°C		
	Low Pressure (bar)	High Pressure (bar)	Air Output Temperature (°C)	Low Pressure (bar)	High Pressure (bar)	Air Output Temperature (°C)
750rpm	1.5	7.0	9.5	1.8	11.2	9.0
2000 rpm	1.6	9.0	7.0	1.8	14.0	8.0
4000 rpm	1.6	8.0	7.0	2.0	14.0	10.0

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Test Conclusions

After conducting the test and collecting all the data, it can be observed that the RS-20 refrigerant gas performs at similar conditions than R-134a in a cooling system that was initially designed for R-134a.

The RS-20 working pressures are lower than R-134a and R-456A ones. The low-pressure average is 1,5 bar for RS-20 and 3,0 bar for R-134a, while the high-pressure range is 7-14 bar for RS-20 and 10-16 bar for R-134a.

On Test 1, it may be observed that, at an ambient temperature of 16°C-20°C, the air output temperature of RS-20 is the same as the R-456A and similar to R-134a (1°C higher with the engine at 2000 and 4000 rpm), while at 750rpm the output temperature is 1°C lower vs R-134a.

On Test 2, simulating summer temperature conditions, it can be observed that there is a slightly loss of RS-20 cooling capacity of vs R-134a, reaching 8°C and 10°C at 2000 rpm and 4000 rpm vs 6°C for the R-134a on both cases.

More information

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