



# RS-51

DESCRIPTION	
Type	HFO blend
HFC replacement	R404A and R507
Drop-in or long term	Both
Lubricant	POE
ODP	Zero
GWP 100 year ITH	717
500 year ITH	208

## RS-51: PHYSICAL PROPERTIES

		RS-51 <sup>(2)</sup>	R404A <sup>(2)</sup>
Molecular Mass		89.73	97.60
Boiling point (1 atm) <sup>(1)</sup>	°C	-61.45	-46.23
	°F	-78.6	-51.2
Temperature glide	K	4.1 <sup>(4)</sup>	0.5
Critical Temperature	°C	94.29	72.12
	°F	201.7	161.8
Critical Pressure	bara	54.66	37.35
	psia	792.8	541.7
Liquid Density (25 °C) <sup>(1)</sup>	kg/m <sup>3</sup>	1107	1044
Density of saturated vapour (25 °C) <sup>(1)</sup>	kg/m <sup>3</sup>	56.74	66.41
Latent Heat of Vaporisation at boiling point <sup>(3)</sup>	kJ/kg	259.9	200.9
Heat capacity constant volume Cv (25 °C & 1bara)	kJ/kg.K	0.762	0.784
Heat capacity constant pressure Cp (25 °C & 1bara)	kJ/kg.K	0.862	0.877
Cp/Cv (25 °C & 1 bara)		1.131	1.118
Vapour Pressure (25 °C) <sup>(1)</sup>	bara	17.07	12.55
	psia	247.7	182.0
Vapour Viscosity (25 °C & 1 bara)	cP	0.0129	0.0121
Liquid Viscosity (25 °C) <sup>(1)</sup>	cP	0.143	0.128
Liquid Thermal Conductivity (25 °C)	W/m.K	0.0812	0.0627
Surface Tension (25 °C) <sup>(1)</sup>	N/m	0.00642	0.00446
Specific heat of liquid (25 °C) <sup>(1)</sup>	kJ/kg.K	1.54	1.54
Ozone Depletion Potential	ODP	0	0
Global warming potential AR5	GWP	717	3943
Flammability limit in air (1 atm)	vol%	none	none
Inhalation exposure (8 hour day & 40 hour week)	ppm	1000	1000

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- (1) Bubble point
- (2) RS-51 refrigerant properties obtained from NIST's REFPROP v10 program.
- (3) Difference between bubble point liquid enthalpy and dew point vapour enthalpy at 1 atm.
- (4) Pressure drop in the evaporator of 0.5 bar.

## **TYPE AND DESCRIPTION**

RS-51 is a non-flammable, non-toxic, zero ODP blend which is a low GWP replacement for R404A and R507.

## **APPLICATIONS**

With a GWP less than a quarter that of R404A and R507, RS-51 is an excellent replacement for R404A and R507 which results in a lower carbon footprint. RS-51 also has a GWP which is just over half that of R448A or R449A.

## **SERVICE WORK**

Because it is a blend, it is essential that RS-51 be charged into systems in the *liquid* as opposed to the gaseous phase.

Since there is no need to change the existing lubricant, RS-51 is straightforward to use as the procedure below outlines.

## **LUBRICANTS**

RS-51 is fully compatible with polyol ester (POE) lubricants which are commonly used with R404A and R507.

## **MATERIALS COMPATIBILITY**

RS-51 is compatible with all materials commonly used in systems that were designed and charged with R404A and R507.

In general, materials which are compatible with R404A can be used with RS-51. It is recommended to check equipment manufacturer's retrofit literature and obtain recommendations from equipment manufacturers with regard to materials' compatibility.

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## **ENVIRONMENTAL DATA**

None of the components of RS-51 contains chlorine so that it has no ability to deplete the ozone layer.

RS-51 does have a direct global warming potential (GWP) but at 717 (AR5) its GWP is the lowest of any non-flammable alternatives for R404A and R507 on the market.

## **RETROFIT PROCEDURE**

Replacing R404A or R507 with RS-51 essentially will follow the procedure specified by the equipment manufacturer for a refrigerant change. Since RS-51 is zeotropic it is very important that liquid, not vapour, refrigerant be added to the system.

1. Ensure the right equipment is available, eg recovery unit and cylinders, container for recovered lubricant, vacuum pump, weighing scales, replacement drier etc.
2. Before removing the R404A or R507A, operate the unit under standard operating conditions and record the pressures, temperatures and any other relevant measurable data to establish unit performance. Typically, the appropriate standard conditions for setting up the unit will have already been specified by the equipment supplier.
3. Recover and weigh the R404A or R507A from the unit. The weight should be within the range specified by equipment manufacturer.
4. Replace the filter/drier and evacuate the system.
5. As in the case of R404A and R507, RS-51 should be used with a polyol ester lubricant.
6. Before operating the unit, charge the unit with **liquid** RS-51. The weight added at this stage should be approximately 10% lower than the R404A or R507 charge specified by the equipment manufacturer.
7. Operate the unit under conditions similar to those used in Step 2, closely watching the liquid line sight glass, the compressor oil level sight glass and the suction superheat.
8. For optimum performance it is recommended to change the expansive valve to one commonly used with R134a. If the system has an electronic expansive device, select the parameters applicable to R134a.
9. The evaporator superheat should be checked and changed as necessary by adjusting the TX valve.

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10. Check system thoroughly for leaks.

11. Remove all R404A or R507A labels and clearly label system RS-51.