



RS-20 (R480A) BROCHURE

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Replacement for R-134A



GWP (Global Warming Potential) of 291



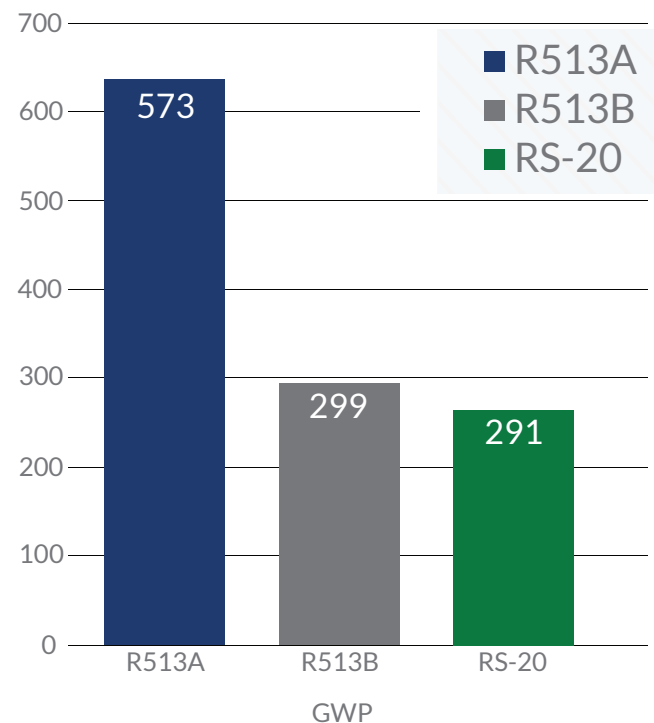
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RS- INTRODUCTION AND MOBILE AIR CONDITIONING

Many millions of vehicles still use R-134A as the air conditioning fluid, although it has been banned in several jurisdictions (eg European Union) in new vehicles.

Refrigerant leaks are common, leading to a continuing global demand for service gas to maintain the operation of existing vehicles. However, the authorities in several territories have introduced quotas for HFCs based on their GWP thus progressively restricting the lawful use of R-134A and creating a refrigerant shortage with an obvious potential for smuggling. RS-20 has a GWP which is 80% lower than R-134A, and less than half that of alternatives such as R513A & R513B. RS-20 can be charged into existing system operating on R-134A without modifications or change of lubricant. RS-20 will enable owners to maintain their air conditioning systems until they sell their vehicles or junk them.

GLOBAL WARMING POTENTIAL



OTHER APPLICATIONS

In addition to mobile air conditioning, RS-20 is suitable to replace R-134A across the board of applications including, but not restricted to, refrigerant transport, cold stores, supermarkets, cellar cooling, dairy cooling, dairy chillers, vending machines. etc.

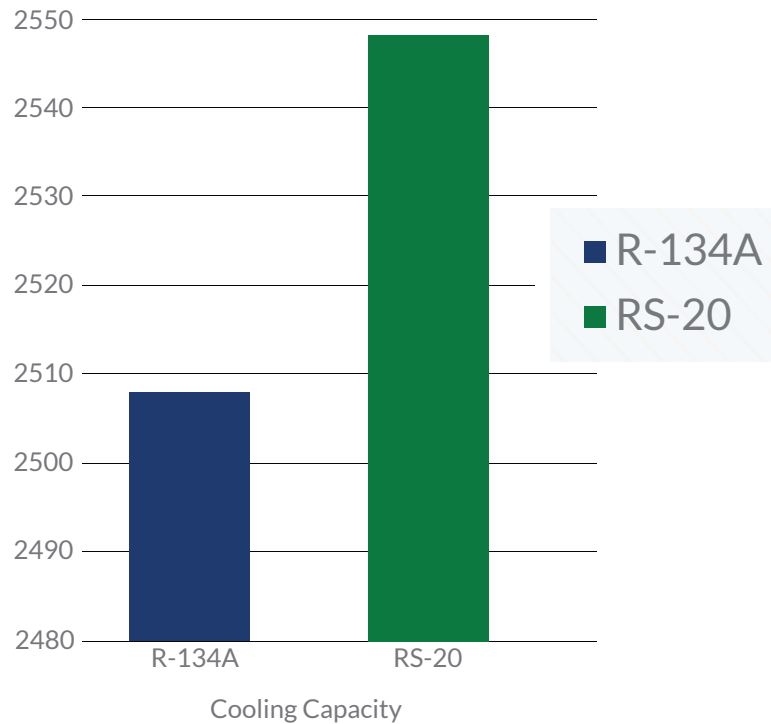
PERFORMANCE CHARACTERISTICS

- Designed specifically to replace R-134A in vehicle air conditioning
- Also suitable for other R-134A applications
- No hardware changes needed
- Non-flammable
- Easy to recycle
- Similar discharge pressure & temperature
- Equivalent cooling capacity
- Uses same lubricant as R-134A
- Zero ozone depletion



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COOLING CAPACITY



SAFETY

RS-20 has been independently tested and meets the ASTM 681 test of being non-flammable as formulated. The components of RS-20 have an ASHRAE 'A' toxicity safety classification.

THE ENVIRONMENT

None of the components of RS-20 contains chlorine so that the refrigerant has no ability to deplete the ozone layer. While RS-20 does have a direct GWP (less than 300), this is substantially lower than R-134A and all known alternatives.

SERVICING

Because RS-20 is a blend, the recommendation is to charge the refrigerant into the system in liquid form. A full service and conversation guide is available on request.



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RS-20 (480A) PHYSICAL PROPERTIES

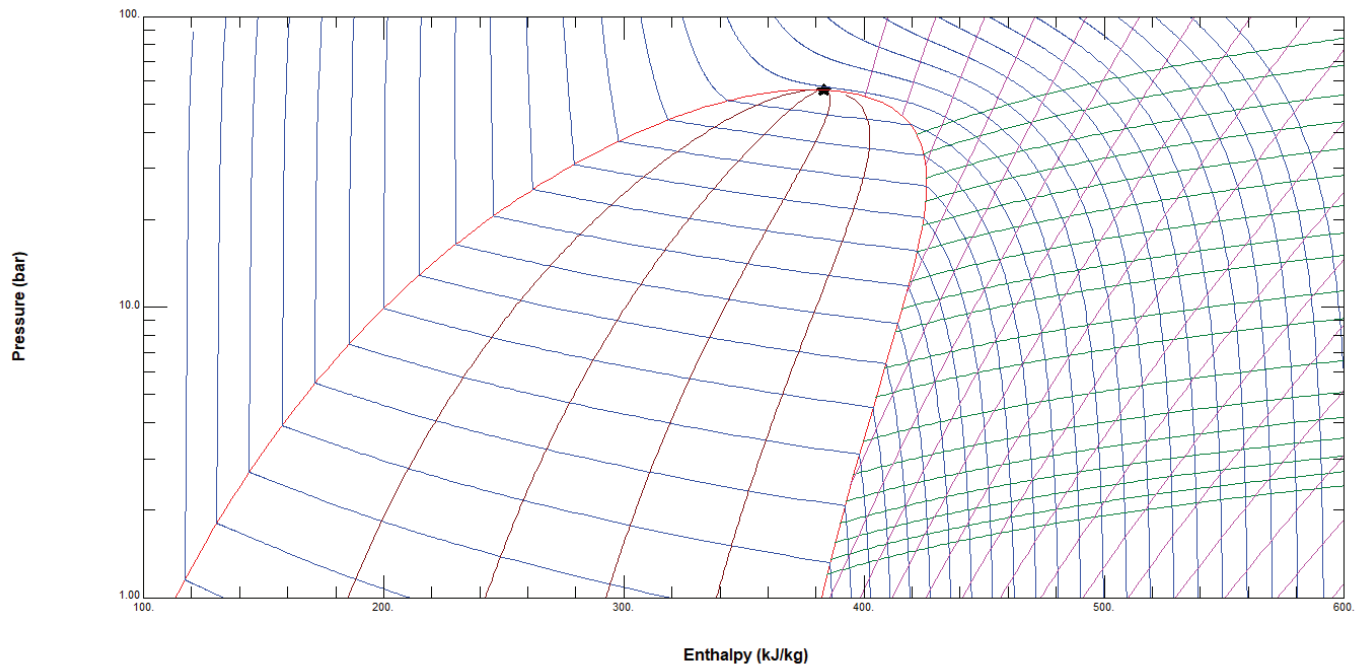
| Physical Properties | | RS-20 ¹ | R-134A |
|---|--------------|--------------------|------------------|
| Molecular Weight | | 108.2 | 102.0 |
| Boiling Point (1atm) ² | °C °F | -34.09 -29.37 | -26.07 -14.93 |
| Temperature Glide ³ | °C | 4.5 | 0 |
| Critical Temperature | °C °F | 107.4 225.3 | 101.1 213.9 |
| Critical Pressure | bara psia | 43.51 631.1 | 40.059 581 |
| Liquid Density at 25 °C ⁴ | kg/m3 | 1175 | 1207 |
| Density of Saturated Vapour at 25°C ⁵ | kg/m3 | 28.27 | 32.35 |
| Specific Heat of Liquid at 25°C ⁴ | kJ/kg°C | 1.391 | 1.425 |
| Specific Heat of Vapour at 1 atm & 25°C | kJ/kg°C | 0.863 | 0.606 |
| Vapour Pressure at 25°C ⁴ | bara psia | 7.517 109 | 6.654 96.5 |
| Latent Heat of Vaporisation at Boiling Point ⁵ | kJ/kg | 229.4 | 217 |
| Global Warming Potential (GWP) AR4 | GWP | 291 | 1430 |
| Flammability Limit in Air (1 atm) | vol% | None | None |
| Inhalation Exposure (8 hr Day & 40 hi Week) | ppm | 1000 | 1000 |

1. RS-20 refrigerant properties obtained from NIST's REFPROP program.
2. Boiling point at 1 atm (mean of bubbles and dew points).
3. Typical evaporator temperature glide from Rankine cycle calculations. Midpoints: 45°C condensing, 7°C evaporating with 0.5 bar pressure drop; compressor isentropic efficiency: 0.7.
4. Mean of bubble and dew points at 25°C. Property calculations on the midpoint liquid and vapor compositions as appropriate.
5. Difference between bubble point liquid enthalpy and dew points vapor enthalpy at 1 atm.



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RS-20 (480A) PRESSURE ENTHALPY



Key

| | |
|-----------------|--|
| Saturation Line | |
| Isotherm | |
| Isochore | |
| Isentrope | |
| Quality | |