



R-470B (RS-51)

Characteristics and applications of RS-51

RS-51 is a blend of HFC+HFO refrigerant gases. It is non-azeotropic, **non-flammable** with a **zero ODP** and a **low global warming potential (GWP)** and was developed to comply with the requirements of the European F-Gas Regulation for reducing CO₂ emissions.

Some of its main properties are:

- It is a good alternative to R-404A, R-507, R-448A, R-449A for new medium and low temperature systems.
- It is a **direct drop-in** replacement for R-404A, R-507 and their replacements (R-407A/F/H, R-448A, R-449A) in existing systems.
- Its global warming potential (GWP) is:
 - ≈ 81% less than R-404A.
 - ≈ 46% less than R-448A and R-449A.
- It has a refrigeration capacity and energy efficiency (COP) similar to that of R-404A and R-507.
- It is an **indirect retrofit** replacement for R-22 (change the kind of lubricant) and its replacements (R-434A, R-438A, R-453A) in refrigeration.
- It is a blend that is compatible with POE synthetic oils.

Applications

With a GWP less than a quarter of that of R-404A and R-507, the R-51 refrigerant gas is an excellent replacement for R-404A and R-507, resulting in a reduced carbon footprint. RS-51 also has a GWP just slightly over half of that of R-448A and R-449A.

As the properties of RS-51 are similar to those of R-404A and R-507, it is suitable for any systems that use these particular refrigerants.

RS-51 could also be used as an alternative for many of these applications where R-22 has been used.

Working and service conditions

Since RS-51 is a blend, it should always be transferred in liquid phase or, if transferred in gas phase, in full loads.

As it is not necessary to change the existing lubricant, RS-51 is easy to use, just as described in the procedure.

There is no need to make any major changes in the R-404A or R-507 system to change to RS-51. It may be necessary to change the thermostatic expansion valve (TXV) to one for R-134a.



Lubricants

RS-51 is compatible with the same polyolester oils that are used with R-404A, R-507 and their replacements (R-407A/F/H, R-448A, R-449A), so there is no need to change the oil type when converting systems from R-404A, R-507, R-407A/F/H, R-448A, R-449A to RS-51. When replacing R-22 with RS-51, you will need to change the existing oil to a polyol-based oil.

Environmental data

None of the components of RS-51 contain chlorine, so the product has an ODP of zero (ozone depletion potential).

RS-51 has a **low** global warming potential (GWP), thus reducing CO₂ emissions if there is a direct leak.

RS-51 is a non-flammable direct replacement for R-404A and R-507, with the lowest GWP on the market.

Safety

RS-51 is not flammable under any blend fractionation situation, in accordance with the ASHRAE Standard 34.

The components of RS-51 have been subjected to toxicity testing by the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS), and was declared as having low toxicity.

The safety classification of RS-51 is **A1/group L1**.

Compatibility with materials

RS-51 is compatible with all materials commonly used in refrigeration systems that have previously worked with R-404A, R-507 and their replacements (R-407A/F/H, R-448A, R-449A).

Materials compatible with R-404A and R-507, and their replacements (R-407A/F/H, R-448A, R-449A), can generally be used with RS-51. It is recommended that you contact the equipment manufacturer to obtain precise information regarding the adaptation of said equipment in relation to the compatibility of the materials.

For old systems that have been using R-22, it may be necessary to replace some joints due to the different composition of RS-51.

Pressure / temperature tables

The pressure / temperature tables and graphics for the refrigerant indicate both the bubble point of the liquid and the dew point of the vapour.

Bubble point temperature: This is the temperature at which the liquid refrigerant begins to vaporise at the given pressure. When below this temperature, the liquid refrigerant will be subcooled.

Dew point of vapour: This is the temperature at which the refrigerant vapour begins to condense at the given pressure. When above this temperature, the refrigerant vapour is considered to be in a superheated state.

Superheated vapour: To determine the evaporator superheat, measure the temperature and pressure from the suction line in the evaporator outlet pipe. Use the P/T tables to determine the vapour dew point, with the pressure measured in the suction line. Subtract the current temperature from the dew point and the difference will be the evaporator superheat.

Subcooling in refrigeration liquid: To determine subcooling, measure the temperature and pressure from the suction line in the condenser outlet pipe. Use the P/T tables to determine the bubble point, with the pressure measured in the condenser.



Subtract the current temperature from the bubble point and the difference will be the condenser subcooling.

Note: with the RS range of refrigerants, the average evaporation and condensation temperatures will be the midpoint between the bubble point temperature and the dew point temperature.

Components

| Chemical Name | % By weight | CAS No. | EC No. |
|--|-------------|------------|-----------|
| rans-1,3,3,3- Tetrafluoroprop-1-ene (R-1234ze) | 56 | 29118-24-9 | 471-480-0 |
| Difluoromethane (R-32) | 11 | 75-10-5 | 200-839-4 |
| 1,1,1,2,2- Pentafluoroethane (R-125) | 11 | 354-33-6 | 206-557-8 |
| Carbon Dioxide (R-744) | 11 | 124-38-9 | 204-696-9 |
| 1,1,1,2,3,3,3-Heptafluoropropane (R-227ea) | 7 | 431-89-0 | 207-079-2 |
| 1,1,1,2- Tetrafluoroethane (R-134a) | 4 | 811-97-2 | 212-377-0 |

Physical properties

| PHYSICAL PROPERTIES | UNITS | R-470B (RS-51) ⁽²⁾ | R404A ⁽²⁾ |
|--|----------------------|-------------------------------|----------------------|
| Peso molecular | (kg/kmol) | 89,73 | 97,6 |
| Boiling point (at 1,013 bar) ⁽¹⁾ | (°C) | -61,45 | -46,23 |
| Critical temperature | (°C) | 94,29 | 72,12 |
| Critical pressure | (bara) | 54,66 | 37,35 |
| Liquid density at 25°C ⁽¹⁾ | (kg/m ³) | 1107 | 1044 |
| Saturated vapour density at 25°C ⁽¹⁾ | (kg/m ³) | 56,74 | 66,41 |
| Cv (25°C y 1 bara) Specific heat a V const. | (kJ/kg.K) | 0,762 | 0,784 |
| Cp (25°C y 1 bara) Specific heat a P const. | (kJ/kg.K) | 0,862 | 0,877 |
| Cp/Cv (25°C y 1bara) | | 1,131 | 1,118 |
| Vapour pressure 25°C ⁽¹⁾ | (bara) | 17,07 | 12,55 |
| Latent heat of vaporization at boiling point. ⁽³⁾ | (kJ/kg) | 259,9 | 200,9 |
| Vapour viscosity (25°C y 1 bara) ⁽¹⁾ | cP | 0,0129 | 0,0121 |
| Liquid viscosity (25°C) ⁽¹⁾ | cP | 0,143 | 0,128 |
| Thermal conductivity of liquid (25°C) | W/m.K | 0,0812 | 0,0627 |
| Surface tension (25°C) ⁽¹⁾ | N/m | 0,00642 | 0,00446 |
| Specific heat of liquid at (25°C) ⁽¹⁾ | kJ/kg.K | 1,54 | 1,54 |
| Flammability in air at 1 atm | %vol. | No | No |
| ODP | | 0 | 0 |
| GWP* | | 746 | 3922 |
| Exposición por inhalación (8h/día y 40 h/semana) | (ppm) | 1000 | 1000 |

(1) Bubble point

(2) Properties of the RS-51 refrigerant obtained from the REFPROP v10 program from NIST.

(3) Difference between the enthalpy of the liquid bubble point and the enthalpy of the vapour dew point at 1 atm.

* According to IPPCC-AR4/CIE (Fourth Assessment Report of the Intergovernmental Panel of Experts on Climate Change)-2007.

Remember to consult the guidelines for conversion from RS-51.

R-470B (RS-51) Absolute Saturation Properties

| T [°C] | Pressure Liquid [bar] | Pressure Vapour [bar] | Density Liquid [kg/m ³] | Density Vapour [kg/m ³] | Enthalpy Liquid [kJ/kg] | Enthalpy Vapour [kJ/kg] | Entropy Liquid [kJ/K·kg] | Entropy Vapour [kJ/K·kg] |
|-----------|-----------------------------|-----------------------------|---|---|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| -60 | 1.0977 | 0.20337 | 1406.6 | 1.0403 | 118.69 | 358.67 | 0.66705 | 1.8574 |
| -59 | 1.1502 | 0.21704 | 1403.6 | 1.1056 | 120 | 359.35 | 0.67314 | 1.8546 |
| -58 | 1.2047 | 0.23146 | 1400.7 | 1.1742 | 121.3 | 360.02 | 0.67921 | 1.8518 |
| -57 | 1.2611 | 0.24666 | 1397.8 | 1.2462 | 122.61 | 360.69 | 0.68525 | 1.8491 |
| -56 | 1.3195 | 0.26267 | 1394.9 | 1.3217 | 123.92 | 361.37 | 0.69126 | 1.8465 |
| -55 | 1.3799 | 0.27952 | 1391.9 | 1.4008 | 125.23 | 362.04 | 0.69726 | 1.8439 |
| -54 | 1.4425 | 0.29724 | 1389 | 1.4838 | 126.54 | 362.71 | 0.70323 | 1.8413 |
| -53 | 1.5071 | 0.31587 | 1386.1 | 1.5706 | 127.85 | 363.39 | 0.70918 | 1.8388 |
| -52 | 1.574 | 0.33545 | 1383.1 | 1.6615 | 129.16 | 364.06 | 0.71511 | 1.8364 |
| -51 | 1.6431 | 0.35601 | 1380.1 | 1.7565 | 130.48 | 364.73 | 0.72102 | 1.834 |
| -50 | 1.7145 | 0.37758 | 1377.2 | 1.8559 | 131.79 | 365.41 | 0.7269 | 1.8317 |
| -49 | 1.7882 | 0.40021 | 1374.2 | 1.9597 | 133.11 | 366.08 | 0.73277 | 1.8294 |
| -48 | 1.8643 | 0.42392 | 1371.2 | 2.0681 | 134.43 | 366.75 | 0.73861 | 1.8271 |
| -47 | 1.9427 | 0.44877 | 1368.2 | 2.1812 | 135.75 | 367.42 | 0.74444 | 1.8249 |
| -46 | 2.0237 | 0.47478 | 1365.2 | 2.2992 | 137.07 | 368.09 | 0.75024 | 1.8228 |
| -45 | 2.1072 | 0.502 | 1362.2 | 2.4223 | 138.39 | 368.77 | 0.75603 | 1.8206 |
| -44 | 2.1932 | 0.53047 | 1359.2 | 2.5506 | 139.72 | 369.44 | 0.76179 | 1.8186 |
| -43 | 2.2819 | 0.56023 | 1356.2 | 2.6842 | 141.04 | 370.11 | 0.76754 | 1.8165 |
| -42 | 2.3732 | 0.59132 | 1353.2 | 2.8234 | 142.37 | 370.78 | 0.77326 | 1.8145 |
| -41 | 2.4672 | 0.62379 | 1350.1 | 2.9682 | 143.7 | 371.45 | 0.77897 | 1.8126 |
| -40 | 2.564 | 0.65768 | 1347.1 | 3.1188 | 145.03 | 372.12 | 0.78466 | 1.8107 |
| -39 | 2.6636 | 0.69303 | 1344 | 3.2755 | 146.36 | 372.78 | 0.79033 | 1.8088 |
| -38 | 2.766 | 0.7299 | 1341 | 3.4384 | 147.7 | 373.45 | 0.79599 | 1.807 |
| -37 | 2.8713 | 0.76832 | 1337.9 | 3.6076 | 149.04 | 374.12 | 0.80162 | 1.8052 |
| -36 | 2.9796 | 0.80834 | 1334.8 | 3.7833 | 150.37 | 374.78 | 0.80724 | 1.8034 |
| -35 | 3.0909 | 0.85002 | 1331.7 | 3.9658 | 151.71 | 375.45 | 0.81284 | 1.8017 |
| -34 | 3.2053 | 0.8934 | 1328.6 | 4.1552 | 153.05 | 376.11 | 0.81843 | 1.8 |
| -33 | 3.3227 | 0.93853 | 1325.5 | 4.3516 | 154.4 | 376.78 | 0.824 | 1.7983 |
| -32 | 3.4433 | 0.98545 | 1322.4 | 4.5553 | 155.74 | 377.44 | 0.82955 | 1.7967 |
| -31 | 3.5671 | 1.0342 | 1319.3 | 4.7665 | 157.09 | 378.1 | 0.83509 | 3.5671 |
| -30 | 3.6941 | 1.0849 | 1316.1 | 4.9854 | 158.44 | 378.76 | 0.84061 | 3.6941 |
| -29 | 3.8244 | 1.1375 | 1313 | 5.2121 | 159.79 | 379.42 | 0.84611 | 3.8244 |
| -28 | 3.9581 | 1.1922 | 1309.8 | 5.4468 | 161.14 | 380.08 | 0.8516 | 3.9581 |
| -27 | 4.0952 | 1.2489 | 1306.6 | 5.6899 | 162.5 | 380.74 | 0.85707 | 4.0952 |
| -26 | 4.2357 | 1.3077 | 1303.5 | 5.9414 | 163.86 | 381.39 | 0.86253 | 4.2357 |
| -25 | 4.3797 | 1.3687 | 1300.3 | 6.2017 | 165.21 | 382.05 | 0.86798 | 4.3797 |
| -24 | 4.5273 | 1.432 | 1297.1 | 6.4708 | 166.58 | 382.7 | 0.87341 | 4.5273 |
| -23 | 4.6784 | 1.4975 | 1293.8 | 6.7491 | 167.94 | 383.35 | 0.87882 | 4.6784 |
| -22 | 4.8332 | 1.5653 | 1290.6 | 7.0367 | 169.31 | 384 | 0.88423 | 4.8332 |
| -21 | 4.9916 | 1.6356 | 1287.4 | 7.334 | 170.67 | 384.65 | 0.88961 | 4.9916 |
| -20 | 5.1539 | 1.7083 | 1284.1 | 7.641 | 172.05 | 385.3 | 0.89499 | 5.1539 |
| -19 | 5.3198 | 1.7835 | 1280.8 | 7.9581 | 173.42 | 385.94 | 0.90035 | 5.3198 |
| -18 | 5.4897 | 1.8614 | 1277.6 | 8.2855 | 174.79 | 386.58 | 0.9057 | 5.4897 |
| -17 | 5.6634 | 1.9418 | 1274.3 | 8.6235 | 176.17 | 387.23 | 0.91104 | 5.6634 |
| -16 | 5.841 | 2.025 | 1271 | 8.9722 | 177.55 | 387.87 | 0.91636 | 5.841 |
| -15 | 6.0227 | 2.1109 | 1267.7 | 9.332 | 178.93 | 388.51 | 0.92167 | 6.0227 |
| -14 | 6.2083 | 2.1997 | 1264.3 | 9.7031 | 180.32 | 389.14 | 0.92697 | 6.2083 |
| -13 | 6.3981 | 2.2914 | 1261 | 10.086 | 181.71 | 389.78 | 0.93225 | 6.3981 |
| -12 | 6.5919 | 2.386 | 1257.6 | 10.48 | 183.1 | 390.41 | 0.93753 | 6.5919 |
| -11 | 6.79 | 2.4837 | 1254.2 | 10.887 | 184.49 | 391.04 | 0.94279 | 6.79 |
| -10 | 6.9922 | 2.5845 | 1250.8 | 11.306 | 185.89 | 391.67 | 0.94804 | 6.9922 |
| -9 | 7.1987 | 2.6884 | 1247.4 | 11.738 | 187.28 | 392.3 | 0.95329 | 7.1987 |
| -8 | 7.4096 | 2.7955 | 1244 | 12.183 | 188.68 | 392.92 | 0.95852 | 7.4096 |
| -7 | 7.6248 | 2.906 | 1240.6 | 12.641 | 190.09 | 393.54 | 0.96374 | 7.6248 |
| -6 | 7.8444 | 3.0198 | 1237.1 | 13.112 | 191.5 | 394.16 | 0.96895 | 7.8444 |
| -5 | 8.0685 | 3.1371 | 1233.6 | 13.598 | 192.91 | 394.78 | 0.97415 | 8.0685 |
| -4 | 8.2971 | 3.2579 | 1230.2 | 14.097 | 194.32 | 395.4 | 0.97933 | 8.2971 |
| -3 | 8.5302 | 3.3822 | 1226.6 | 14.612 | 195.73 | 396.01 | 0.98451 | 8.5302 |
| -2 | 8.7679 | 3.5102 | 1223.1 | 15.141 | 197.15 | 396.62 | 0.98969 | 8.7679 |
| -1 | 9.0103 | 3.642 | 1219.6 | 15.685 | 198.57 | 397.23 | 0.99485 | 9.0103 |

R-470B (RS-51) Absolute Saturation Properties

| T [°C] | Pressure Liquid [bar] | Pressure Vapour [bar] | Density Liquid [kg/m ³] | Density Vapour [kg/m ³] | Enthalpy Liquid [kJ/kg] | Enthalpy Vapour [kJ/kg] | Entropy Liquid [kJ/K·kg] | Entropy Vapour [kJ/K·kg] |
|-----------|-----------------------------|-----------------------------|---|---|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| 0 | 9.2574 | 3.7776 | 1216 | 16.245 | 200 | 397.83 | 1 | 9.2574 |
| 1 | 9.5091 | 3.917 | 1212.4 | 16.821 | 201.43 | 398.43 | 1.0051 | 9.5091 |
| 2 | 9.7657 | 4.0604 | 1208.8 | 17.413 | 202.86 | 399.03 | 1.0103 | 9.7657 |
| 3 | 10.027 | 4.2078 | 1205.2 | 18.021 | 204.3 | 399.63 | 1.0154 | 10.027 |
| 4 | 10.293 | 4.3594 | 1201.6 | 18.647 | 205.73 | 400.22 | 1.0205 | 10.293 |
| 5 | 10.565 | 4.5151 | 1197.9 | 19.29 | 207.18 | 400.81 | 1.0256 | 10.565 |
| 6 | 10.841 | 4.6752 | 1194.3 | 19.951 | 208.62 | 401.4 | 1.0307 | 10.841 |
| 7 | 11.122 | 4.8395 | 1190.6 | 20.63 | 210.07 | 401.98 | 1.0358 | 11.122 |
| 8 | 11.408 | 5.0083 | 1186.8 | 21.328 | 211.52 | 402.57 | 1.0409 | 11.408 |
| 9 | 11.699 | 5.1817 | 1183.1 | 22.045 | 212.98 | 403.14 | 1.046 | 11.699 |
| 10 | 11.996 | 5.3596 | 1179.3 | 22.781 | 214.44 | 403.72 | 1.0511 | 11.996 |
| 11 | 12.297 | 5.5422 | 1175.5 | 23.538 | 215.9 | 404.29 | 1.0562 | 12.297 |
| 12 | 12.604 | 5.7296 | 1171.7 | 24.314 | 217.37 | 404.85 | 1.0612 | 12.604 |
| 13 | 12.916 | 5.9218 | 1167.9 | 25.112 | 218.84 | 405.42 | 1.0663 | 12.916 |
| 14 | 13.233 | 6.119 | 1164 | 25.931 | 220.32 | 405.98 | 1.0713 | 13.233 |
| 15 | 13.556 | 6.3212 | 1160.1 | 26.772 | 221.8 | 406.53 | 1.0764 | 13.556 |
| 16 | 13.884 | 6.5286 | 1156.2 | 27.635 | 223.28 | 407.09 | 1.0814 | 13.884 |
| 17 | 14.217 | 6.7412 | 1152.3 | 28.522 | 224.77 | 407.63 | 1.0865 | 14.217 |
| 18 | 14.556 | 6.959 | 1148.3 | 29.432 | 226.26 | 408.18 | 1.0915 | 14.556 |
| 19 | 14.901 | 7.1823 | 1144.3 | 30.366 | 227.76 | 408.72 | 1.0965 | 14.901 |
| 20 | 15.251 | 7.4111 | 1140.3 | 31.324 | 229.26 | 409.25 | 1.1016 | 15.251 |
| 21 | 15.606 | 7.6454 | 1136.2 | 32.308 | 230.77 | 409.78 | 1.1066 | 15.606 |
| 22 | 15.967 | 7.8854 | 1132.1 | 33.318 | 232.28 | 410.31 | 1.1116 | 15.967 |
| 23 | 16.334 | 8.1313 | 1128 | 34.355 | 233.8 | 410.83 | 1.1166 | 16.334 |
| 24 | 16.707 | 8.383 | 1123.8 | 35.419 | 235.32 | 411.35 | 1.1216 | 16.707 |
| 25 | 17.085 | 8.6407 | 1119.6 | 36.51 | 236.84 | 411.86 | 1.1267 | 17.085 |
| 26 | 17.469 | 8.9044 | 1115.4 | 37.63 | 238.37 | 412.36 | 1.1317 | 17.469 |
| 27 | 17.858 | 9.1744 | 1111.2 | 38.78 | 239.91 | 412.87 | 1.1367 | 17.858 |
| 28 | 18.254 | 9.4507 | 1106.9 | 39.96 | 241.45 | 413.36 | 1.1417 | 18.254 |
| 29 | 18.655 | 9.7334 | 1102.6 | 41.171 | 243 | 413.85 | 1.1467 | 18.655 |
| 30 | 19.063 | 10.023 | 1098.2 | 42.413 | 244.55 | 414.34 | 1.1517 | 19.063 |
| 31 | 19.476 | 10.318 | 1093.8 | 43.688 | 246.11 | 414.82 | 1.1567 | 19.476 |
| 32 | 19.895 | 10.621 | 1089.3 | 44.997 | 247.67 | 415.29 | 1.1617 | 19.895 |
| 33 | 20.32 | 10.93 | 1084.8 | 46.34 | 249.24 | 415.76 | 1.1667 | 20.32 |
| 34 | 20.751 | 11.247 | 1080.3 | 47.718 | 250.81 | 416.22 | 1.1717 | 20.751 |
| 35 | 21.188 | 11.57 | 1075.7 | 49.133 | 252.4 | 416.67 | 1.1767 | 21.188 |
| 36 | 21.632 | 11.901 | 1071.1 | 50.585 | 253.98 | 417.12 | 1.1817 | 21.632 |
| 37 | 22.081 | 12.239 | 1066.5 | 52.076 | 255.58 | 417.56 | 1.1867 | 22.081 |
| 38 | 22.536 | 12.584 | 1061.8 | 53.606 | 257.18 | 417.99 | 1.1918 | 22.536 |
| 39 | 22.998 | 12.937 | 1057 | 55.177 | 258.79 | 418.42 | 1.1968 | 22.998 |
| 40 | 23.466 | 13.298 | 1052.2 | 56.791 | 260.4 | 418.84 | 1.2018 | 23.466 |
| 41 | 23.939 | 13.666 | 1047.3 | 58.447 | 262.02 | 419.25 | 1.2068 | 23.939 |
| 42 | 24.419 | 14.043 | 1042.4 | 60.148 | 263.65 | 419.65 | 1.2119 | 24.419 |
| 43 | 24.906 | 14.427 | 1037.4 | 61.896 | 265.29 | 420.05 | 1.2169 | 24.906 |
| 44 | 25.398 | 14.82 | 1032.4 | 63.69 | 266.93 | 420.44 | 1.2219 | 25.398 |
| 45 | 25.897 | 15.221 | 1027.3 | 65.534 | 268.58 | 420.82 | 1.227 | 25.897 |
| 46 | 26.402 | 15.631 | 1022.2 | 67.429 | 270.24 | 421.18 | 1.232 | 26.402 |
| 47 | 26.913 | 16.049 | 1016.9 | 69.376 | 271.91 | 421.55 | 1.2371 | 26.913 |
| 48 | 27.431 | 16.477 | 1011.7 | 71.378 | 273.59 | 421.9 | 1.2422 | 27.431 |
| 49 | 27.955 | 16.913 | 1006.3 | 73.436 | 275.27 | 422.24 | 1.2472 | 27.955 |
| 50 | 28.485 | 17.358 | 1000.9 | 75.551 | 276.97 | 422.57 | 1.2523 | 28.485 |
| 51 | 29.021 | 17.813 | 995.38 | 77.728 | 278.67 | 422.89 | 1.2574 | 29.021 |
| 52 | 29.564 | 18.277 | 989.8 | 79.967 | 280.39 | 423.2 | 1.2625 | 29.564 |
| 53 | 30.113 | 18.751 | 984.15 | 82.27 | 282.11 | 423.5 | 1.2677 | 30.113 |
| 54 | 30.668 | 19.235 | 978.41 | 84.642 | 283.85 | 423.78 | 1.2728 | 30.668 |
| 55 | 31.229 | 19.729 | 972.58 | 87.083 | 285.59 | 424.06 | 1.278 | 31.229 |
| 56 | 31.797 | 20.233 | 966.67 | 89.598 | 287.35 | 424.32 | 1.2831 | 31.797 |
| 57 | 32.37 | 20.748 | 960.66 | 92.189 | 289.12 | 424.57 | 1.2883 | 32.37 |
| 58 | 32.95 | 21.273 | 954.55 | 94.86 | 290.9 | 424.8 | 1.2935 | 32.95 |
| 59 | 33.536 | 21.81 | 948.33 | 97.613 | 292.7 | 425.02 | 1.2988 | 33.536 |
| 60 | 34.128 | 22.357 | 942.01 | 100.45 | 294.5 | 425.23 | 1.304 | 34.128 |



Questions and answers regarding RS-51

1 Q: What is RS-51?

A: RS-51 is an HFC+HFO blend that is a direct replacement for R-404A and R-507, and their replacements (R-407A/F/H, R-448A, R-449A). It is non-flammable, has a low global warming potential (GWP) and a zero ozone depletion potential (ODP). It is also an indirect replacement for R-22 and its replacements (R-434A, R-438A, R-453A) in refrigeration.

2 Q: OK, but what does RS-51 contain?

A: RS-51 is a blend of R-1234ze, R-32, R-125, R-744, R-227ea and R-134a.

3 Q: Is RS-51 in the process of being phased out, in accordance with regulations, as is the case with CFCs and HCFCs?

A: No, none of the components of RS-51 are subject to a phase-out calendar within the framework of the Montreal Protocol or other European regulations.

4 Q: Can RS-51 be used with the same oil when used as a replacement for R-404A or R-507?

A: Yes. RS-51 is fully compatible with synthetic oils such as polyolester oils (POE), which are commonly used with R-404A, R-507 and their replacements (R-407A/F/H, R-448A, R-449A).

5 Q: Can RS-51 be used with the same oil when used as a replacement for R-22?

A: No. RS-51 is not compatible with mineral or alkylbenzene oils, which are normally used with R-22. It would be best to replace all the existing oil with a POE.

6 Q: Is RS-51 non-flammable and non-toxic?

A: RS-51 is non-flammable and has a low toxicity. It is non-flammable under all fractionation conditions. It is classified as group L1.

7 Q: Is RS-51 approved by compressor manufacturers?

A: The components that make up RS-51 are widely used for compressors produced by the main manufacturers.

8 Q: Can RS-51 be used in new systems?

A: RS-51 has also been developed as an alternative to R-404A and R-507 in new systems, due to its low global warming potential (GWP).

9 Q: Is RS-51 as efficient as R-404A and R-507?

A: The tests demonstrate that RS-51 has a similar COP to R-404A and R-507.

10 Q: What are the pressures of RS-51 compared with R-404A, R-507 and R-22?

A: The discharge pressure of RS-51 is less than that of R-404A and R-507.

11 Q: What is the capacity of RS-51 compared with R-404A and R-507?

A: The capacity of RS-51 is similar to that of R-404A and R-507.

12 Q: What are the working temperatures of RS-51 compared with R-404A and R-507?

A: The discharge temperature of RS-51 is slightly more than that of R-404A and R-507, as with R-448A and R-449A.

13 Q: What tests have been carried out on RS-51, and what were the results?

A: The refrigerant in a chest freezer was changed from R-404A to RS-51 and the resulting performance and operating parameters were both satisfactory.

14 Q: Should RS-51 be charged in liquid or gas phase?

A: Since RS-51 is a blend, it is recommended that it be charged in liquid phase. However, if the entire content of the cylinder is being charged into a system, it can be done in gas phase.



15 Q: Do RS-51 cylinders have probe tubes?

A: It depends on the type of cylinder. All the blue cylinders from Gas Servei S.A. have them. If there isn't one, it is recommended that you turn the cylinder upside down.

16 Q: Does RS-51 have an ASHRAE number, and what is its classification?

A: The ASHRAE number is currently being processed and its safety classification is A1, meaning that it has low toxicity and is non-flammable under all fractionation conditions.

17 Q: What are the flammability properties of RS-51?

A: RS-51 is non-flammable at room temperature and atmospheric pressure, and has the same classification as R-410A, R-134a, R-404A, R-507, R-448A, R-449A, etc.

18 Q: What are the decomposition products resulting from the combustion of RS-51?

A: The decomposition products resulting from the exposure of RS-51 to a high temperature source are similar to those produced by R-404A, R-507, R-448A and R-449A when they are exposed to fire. The decomposition products in any case are irritants and toxic, and in the case of exposure, a self-contained breathing apparatus should be used.

19 Q: Should any special precautions be taken into account with RS-51?

A: There are no particular precautions that need to be taken with RS-51. Common sense and good practices are always recommended, as with all refrigerants.

20 Q: Is RS-51 compatible with refrigeration and air conditioning systems designed for R-404A, R-507 and R-22?

A: Yes, RS-51 is compatible with all the materials commonly used in systems that were designed for and charged with R-404A, R-507 and their replacements (R-407A/F/H, R-448A, R-449A), as well as R-22.

21 Q: What technical advice would we give when changing from R-404A or R-507 to RS-51?

A: Use the same kind of oil that is already in use, which should be POE. After recovering the R-404A or R-507 and emptying the system, change the filter dehydrator and charge 10% less than the original charge of the R-404A or R-507. If the expansion system is a thermostatic valve (TXV), replace it with one for R-134a and fit it. Finish charging the equipment with small charges of RS-51 while controlling the superheating.

22 Q: What technical advice would we give when changing from R-22 to RS-51?

A: If your system uses mineral oil or alkylbenzene, which is usually the case, it should be entirely replaced with POE oil. It is a good idea to check the type of oil used and its viscosity with the manufacturer of the compressor. The amount of mineral oil or alkylbenzene leftover should be less than 5%. After recovering all the R-22 and emptying the system, change the filter dehydrator and charge 10% less than the original charge of R-22. The flow rate of the liquid is a bit less than R-22, so the expansion valve will need to be adjusted by being closed slightly. Finish charging the equipment with small charges of RS-51 while controlling the superheating.

As with any change from HCFC to HFC, it may be necessary to replace some of the joints due to the different composition.

23 Q: How does the price of RS-51 compare to other alternatives?

A: RS-51 is more cost-effective than R-404A and R-507, it is competitively priced compared to the replacements (R-407A/F/H, R-448A, R-449A) and the tax is approximately 81% lower than that of R-404A and 46% lower than that of R-448A and R-449A.

24 Q: What is the main benefit of RS-51?

A: The global warming potential (GWP) of RS-51 is 81% lower than that of R-404A and R-507, and 46% lower than that of R-448A and R-449A, thus reducing the carbon footprint.

25 Q: Is RS-51 compatible with the joints, seals, hoses and toric joints that are used with R-404A and R-507?

A: Yes. There is no need to change the joints when changing a system with these refrigerants to RS-51.

26 Q: Is RS-51 compatible with the joints, seals, hoses and toric joints that are used with R-22?

A: RS-51 is compatible with the materials that are normally used in refrigeration systems that previously used R-22. The materials used with R-22 are generally compatible with RS-51. To be properly advised on this, it is a good idea to check the equipment manufacturers' documentation when doing the retrofitting. For systems that have been using R-22 for many years, it may be necessary to change the seals and joints due to the different composition of RS-51, since it is an HFC+HFO. The same is also true when changing from R-22 to an HFC or an HFC+HFO, such as R-404A, R-422D, R-134a, R-434A, R-448A, R-449A, etc.

27 Q: What are the effects of prolonged exposure to RS-51 by inhalation?

A: As is the case with all CFC, HCFC, HFC and HFC+HFO refrigerants, prolonged exposure to RS-51 may cause anaesthetic effects. Very prolonged exposure may lead to heart arrhythmia and could be fatal, as is the case with all CFC, HCFC, HFC and HFC+HFO refrigerants.

28 Q: What kinds of leak detectors should be used with RS-51?

A: The same leak detectors used for other HFC and HFC+HFO refrigerants can also be used with RS-51.

29 Q: What is the correct way to respond to a major leak of RS-51?

A: As is the case with all other refrigerants of this type, the area should be immediately evacuated. The vapours may concentrate at ground level and in poorly ventilated areas they may disperse slowly. The area should be properly ventilated before entering.

30 Q: Is RS-51 available in rechargeable and disposable cylinders?

A: Yes, although disposable cylinders may only be used outside of the European Union.