



R-434A (RS-45)

Features and uses of RS-45

R-434A (RS-45) is a non-flammable HFC mixture. ODP = 0, compatible with traditional mineral lubricants, alkyl benzene and also with synthetic POE, so there is no need to make changes in the installation.

- It is a **"Drop-in" direct** replacement for R-22 in both cooling and air conditioning, low and high temperatures, providing an easy and long term solution.
- Due to its low temperature glide about 1.5 approx. (75% less than R-407C and R-427A), it is suitable for a wide range of applications.
- It is a simple solution for R-22 facilities with an adjustable expansion mechanism. The molecular structure is different to R-22, so it is necessary to adjust the expansion valve to permit to larger molecules to pass from R-434A (RS-45) to R-404A, depending on the system.
- RS-45 (R-434A) is not recommended, in most cases, for fixed orifices installation working with R-22, RS-44 (R-424A) would be the solution in medium and high temperatures.
- Since there is no need for expensive and hygroscopic synthetic lubricants, the risk of humidity in the refrigerator equipment is completely avoided.
- The discharge temperature is significantly lower than R-22, so the problem of oil decomposition is significantly reduced.

RS-45 (R-434A) is the perfect solution to use in Original Equipment (OEM's) due to its high cooling capacity, low compression ratio, similar coefficient of performance, low discharge temperature and compatibility with traditional oils and oils synthetic (POE).

Applications

R-434A (RS-45) is adequate as a direct replacement for R-22 in both low and high temperature in a large number of applications.

- Commercial air conditioning, flooded systems, chillers, industrial cooling process and enclosing multi-tubes.
- Cold-storage rooms, supermarkets, refrigerated transport, refrigerated warehouses, cooling process, cold drink vending machines, refrigerated cases, milk coolers, ice rinks.
- Others.

See the application guide for more information RS.

Conditions for service and work

In the event of a leakage, it can be recharged directly due to the low temperature glide. Only in systems where the leakage is almost the entire load, it is recommended to recover the refrigerant, to perform a vacuum and replace it with virgin refrigerant.

Because it is a blend, it must always be transferred in liquid phase or full loads if it is made in gas phase. Since in most cases there is no need to change the existing lubricant, RS-45 can be used directly as indicated in the pattern conversion.



Lubricants

RS-45 is compatible with mineral and alkyl benzene oils used with R-22 systems, and polyester lubricants. Despite there is no need to change the lubricant in most cases, it is advisable to follow the directions in relation to the viscosity and lubrication qualities of compressor manufacturers. However, in systems with an extensive and complex piping configuration, or in large volume liquid containers or working with very low temperatures, it may be necessary to add a part of POE.

Environmental data

None of the RS-45 components contains chlorine, so that the product has ODP = 0 (ability to deplete the ozone layer).

Security

R-434A (RS-45) is not toxic or flammable, high security. It belongs to the security classification **A1 / group L1**.

Material compatibility

R-434A (RS-45) is compatible with all materials commonly used in refrigeration systems which have previously worked with R-22.

In general, materials compatible with R-22 can be used with RS-45. You should check with your computer manufacturer for the equipment adaptation and compatibility of materials. In older facilities that have been operating with R-22, it may be necessary to replace some joints due to the different composition of the RS-45, containing HFC's.

Pressure and Temperature Tables

The tables of refrigerant temperature pressure and graphs indicate both bubble liquid point and the dew point of steam.

Bubble temperature: The temperature at which the liquid refrigerant begins to vaporize at given pressure. Below this temperature the refrigerant liquid is sub-cooled.

Vapour dew point: This is the temperature at which the refrigerant vapour begins to condense at the given pressure. Above this temperature, the refrigerant vapour is considered in superheated state.

Superheated vapour: To determine evaporator superheat, measure temperature and pressure line suction in evaporator outlet piping. Using P / T tables you can determine pressure dew point, with pressure measured in suction. Subtract to the dew point current temperature and this difference is the evaporator superheat.

Sub-cooling in cooling liquid: In order to determine the sub-cooling value in the condenser, measure temperature condenser outlet pipe and measure pressure condenser outlet of the same pipe. Using table Pressure / Temperature to determine bubble point of fluid from condenser. Subtract measured temperature from boiling point determined and this difference is sub cooling of condenser refrigerant liquid.

Note: With the range of refrigerants RS, the average of evaporating and condensing temperatures will be the midpoint between bubble and dew temperature.



Components

Chemical Name	% By weight	CAS N°	EC N °
Pentafluoroethane (R-125)	63,2	354-33-6	206-557-8
1,1,1-Trifluoroethane (R-143a)	18,0	420-46-2	206-996-5
1,1,1,2- Tetrafluoroethane (R-134a)	16,0	811-97-2	212-377-0
Iso-butane (R-600a)	2,8	75-28-5	200-857-2

Physical properties

PHYSICAL PROPERTIES:	UNITS	R-434A (RS-45)	R-22
Molecular weight	(kg/kmol)	105.30	86.5
Boiling point (1 atm.)	(°C)	-44.9 ⁽¹⁾	-40.8
Critical temperature	(°C)	77.8	96.10
Critical pressure	(bar a)	39.7	49.9
Liquid Density at 25 ° C	(kg/m ³)	1096	1191
Saturated vapour density at 25 ° C	(kg/m ³)	53.1	44.2
Specific heat of liquid at 25 ° C	(kJ/kg°C)	1.50	1.26
Specific heat steam at 25 ° C and 1 atm	(kJ/kg°C)	1.11	1.18
Steam Pressure 25 ° C	(bar a)	10.2 ⁽¹⁾	10.44
Latent heat of vaporization	(kJ/kg°C)	190 ⁽¹⁾	234
Slip temp.	(°C)	Aprox. 1.5	0
Flammability in air at 1 atm	%vol.	No	No
ODP		0	0.055
GWP		3245*	1810
Inhalation exposure (8h/day and 40 h / week	(ppm)	1000	1000

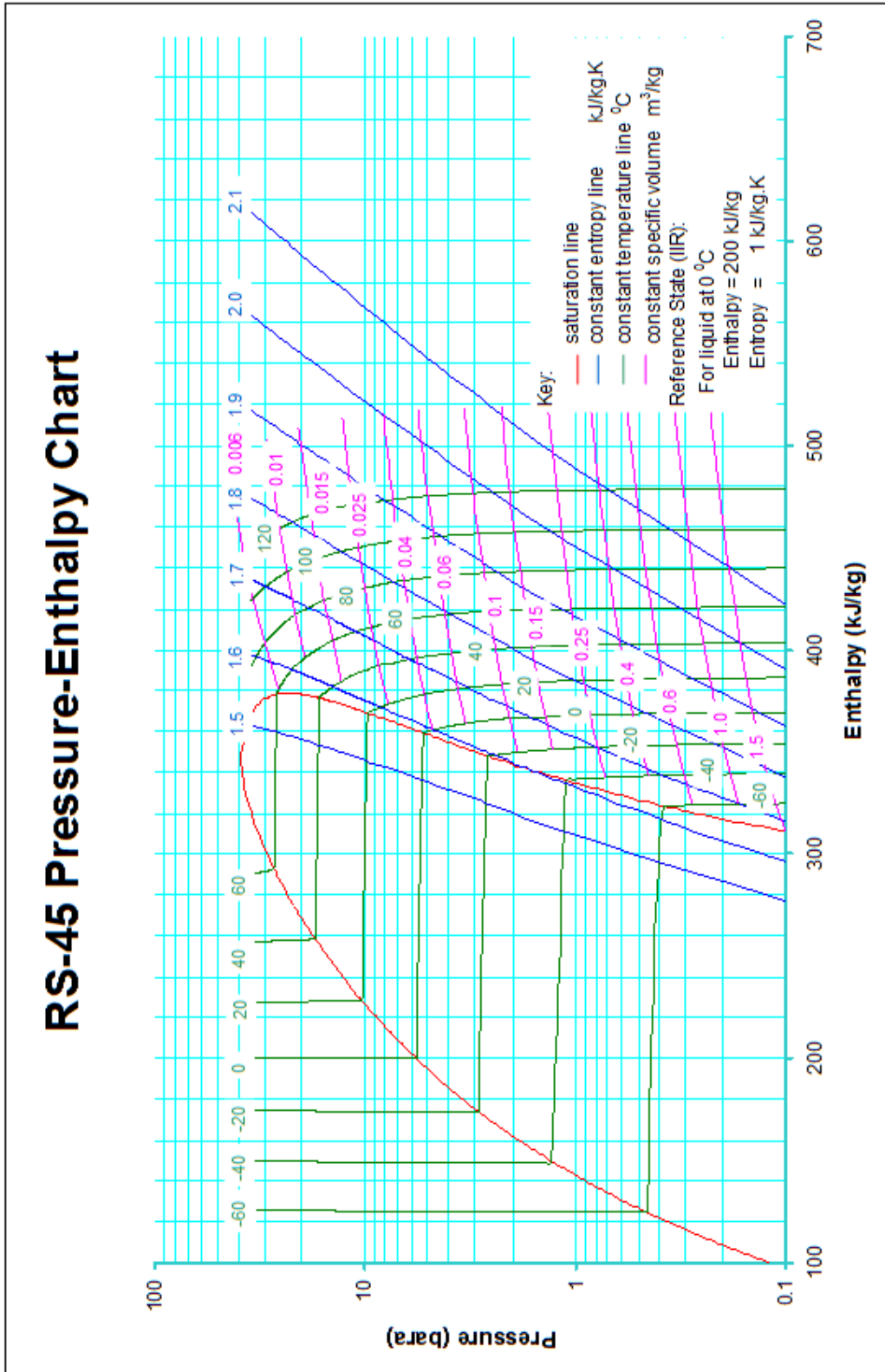
(1) Bubble point

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

Remember to consult guidelines for R- 434A (RS-45) conversion



Mollier Diagram



R-434A (RS-45) Saturation Properties Absolute

T [°C]	Pressure Liquid [bar]	Pressure Vapour [bar]	Density Liquid [kg/m ³]	Density Vapour [kg/m ³]	Volume Liquid litre/kg	Volume Vapour litre/kg	Enthalpy Liquid [kJ/kg]	Enthalpy Vapour [kJ/kg]	Entropy Liquid [kJ/K·kg]	Entropy Vapour [kJ/K·kg]
-60	0.45747	0.38584	1401.9	2.344	0.713	426.560	124.71	323.64	0.6912	1.6324
-58	0.51108	0.43338	1396.0	2.614	0.716	382.600	127.07	324.88	0.7023	1.6293
-56	0.56961	0.48550	1389.9	2.907	0.719	343.990	129.45	326.13	0.7132	1.6263
-54	0.63336	0.54251	1383.9	3.226	0.723	310.000	131.83	327.37	0.7241	1.6235
-52	0.70268	0.60474	1377.8	3.571	0.726	280.000	134.22	328.61	0.7350	1.6208
-50	0.77788	0.67253	1371.7	3.946	0.729	253.440	136.62	329.85	0.7458	1.6183
-48	0.85932	0.74620	1365.6	4.350	0.732	229.890	139.03	331.09	0.7565	1.6158
-46	0.94736	0.82611	1359.4	4.786	0.736	208.930	141.45	332.33	0.7671	1.6136
-44	1.0423	0.91263	1353.1	5.256	0.739	190.260	143.87	333.56	0.7777	1.6114
-42	1.1446	1.0061	1346.9	5.761	0.742	173.570	146.31	334.79	0.7883	1.6094
-40	1.2547	1.1070	1340.6	6.304	0.746	158.630	148.75	336.02	0.7988	1.6075
-38	1.3728	1.2156	1334.2	6.886	0.750	145.230	151.21	337.24	0.8092	1.6057
-36	1.4994	1.3323	1327.8	7.509	0.753	133.180	153.67	338.46	0.8196	1.6039
-34	1.6349	1.4576	1321.4	8.175	0.757	122.330	156.15	339.67	0.8300	1.6023
-32	1.7797	1.5919	1314.9	8.886	0.761	112.530	158.63	340.89	0.8403	1.6008
-30	1.9342	1.7355	1308.3	9.646	0.764	103.670	161.13	342.09	0.8505	1.5994
-28	2.0989	1.8890	1301.7	10.46	0.768	95.650	163.63	343.29	0.8607	1.5980
-26	2.2741	2.0528	1295.0	11.32	0.772	88.368	166.15	344.48	0.8709	1.5968
-24	2.4604	2.2272	1288.3	12.23	0.776	81.749	168.68	345.67	0.8810	1.5956
-22	2.6582	2.4129	1281.6	13.21	0.780	75.722	171.22	346.85	0.8911	1.5945
-20	2.8679	2.6101	1274.7	14.24	0.784	70.225	173.77	348.03	0.9012	1.5934
-18	3.0900	2.8195	1267.8	15.34	0.789	65.204	176.33	349.19	0.9112	1.5924
-16	3.3250	3.0415	1260.8	16.50	0.793	60.610	178.91	350.35	0.9212	1.5915
-14	3.5733	3.2765	1253.8	17.73	0.798	56.401	181.50	351.50	0.9311	1.5907
-12	3.8355	3.5251	1246.7	19.03	0.802	52.539	184.10	352.64	0.9411	1.5898
-10	4.1119	3.7878	1239.5	20.41	0.807	48.991	186.71	353.78	0.9509	1.5891
-8	4.4031	4.0650	1232.2	21.87	0.812	45.726	189.34	354.90	0.9608	1.5884
-6	4.7097	4.3573	1224.8	23.41	0.816	42.717	191.98	356.01	0.9706	1.5877
-4	5.0320	4.6653	1217.4	25.04	0.821	39.942	194.64	357.11	0.9805	1.5871
-2	5.3706	4.9893	1209.9	26.75	0.827	37.378	197.31	358.20	0.9902	1.5864
0	5.7261	5.3301	1202.2	28.57	0.832	35.006	200.00	359.28	1.0000	1.5859
2	6.0989	5.6880	1194.5	30.48	0.837	32.810	202.70	360.35	1.0097	1.5853
4	6.4896	6.0637	1186.6	32.50	0.843	30.773	205.42	361.40	1.0195	1.5848
6	6.8988	6.4578	1178.7	34.62	0.848	28.883	208.16	362.43	1.0292	1.5843
8	7.3268	6.8707	1170.6	36.87	0.854	27.126	210.91	363.45	1.0389	1.5838
10	7.7745	7.3032	1162.4	39.23	0.860	25.491	213.69	364.46	1.0486	1.5834
12	8.2421	7.7557	1154.0	41.72	0.867	23.969	216.48	365.45	1.0583	1.5829
14	8.7305	8.2288	1145.6	44.35	0.873	22.549	219.29	366.42	1.0679	1.5825

R-434A (RS-45) Saturation Properties Absolute

T [°C]	Pressure Liquid [bar]	Pressure Vapour [bar]	Density Liquid [kg/m ³]	Density Vapour [kg/m ³]	Volume Liquid litre/kg	Volume Vapour litre/kg	Enthalpy Liquid [kJ/kg]	Enthalpy Vapour [kJ/kg]	Entropy Liquid [kJ/K·kg]	Entropy Vapour [kJ/K·kg]
16	9.2400	8.7232	1136.9	47.12	0.880	21.223	222.12	367.37	1.0776	1.5820
18	9.7714	9.2395	1128.2	50.04	0.886	19.984	224.97	368.30	1.0873	1.5815
20	10.325	9.7784	1119.2	53.12	0.893	18.826	227.85	369.20	1.0969	1.5811
22	10.902	10.340	1110.1	56.37	0.901	17.740	230.74	370.09	1.1066	1.5806
24	11.502	10.926	1100.8	59.80	0.908	16.723	233.67	370.95	1.1163	1.5801
26	12.127	11.537	1091.3	63.42	0.916	15.768	236.61	371.78	1.1260	1.5796
28	12.776	12.172	1081.6	67.25	0.925	14.871	239.59	372.58	1.1357	1.5790
30	13.451	12.834	1071.7	71.29	0.933	14.027	242.59	373.36	1.1454	1.5784
32	14.153	13.522	1061.5	75.57	0.942	13.233	245.62	374.10	1.1552	1.5777
34	14.881	14.237	1051.0	80.10	0.951	12.484	248.68	374.80	1.1650	1.5770
36	15.636	14.981	1040.3	84.91	0.961	11.778	251.78	375.46	1.1748	1.5763
38	16.420	15.754	1029.3	90.01	0.972	11.110	254.91	376.09	1.1846	1.5754
40	17.233	16.556	1017.9	95.43	0.982	10.479	258.07	376.66	1.1945	1.5745
42	18.076	17.389	1006.2	101.20	0.994	9.882	261.28	377.19	1.2045	1.5735
44	18.950	18.254	994.04	107.35	1.006	9.315	264.54	377.65	1.2145	1.5723
46	19.855	19.152	981.48	113.93	1.019	8.777	267.84	378.06	1.2246	1.5710
48	20.792	20.083	968.41	120.99	1.033	8.265	271.19	378.40	1.2347	1.5696
50	21.762	21.049	954.80	128.57	1.047	7.778	274.61	378.66	1.2450	1.5680
52	22.767	22.051	940.57	136.75	1.063	7.313	278.08	378.83	1.2554	1.5662
54	23.807	23.090	925.62	145.61	1.080	6.868	281.63	378.90	1.2660	1.5642
56	24.883	24.168	909.85	155.25	1.099	6.441	285.26	378.86	1.2767	1.5619
58	25.996	25.286	893.11	165.82	1.120	6.031	288.99	378.69	1.2876	1.5592
60	27.147	26.446	875.20	177.49	1.143	5.634	292.83	378.35	1.2988	1.5562
62	28.339	27.650	855.87	190.49	1.168	5.250	296.82	377.82	1.3103	1.5526
64	29.572	28.900	834.73	205.18	1.198	4.874	300.97	377.04	1.3222	1.5484
66	30.847	30.200	811.20	222.06	1.233	4.503	305.34	375.95	1.3347	1.5434
68	32.166	31.553	784.35	241.98	1.275	4.133	310.03	374.43	1.3480	1.5372
70	33.531	32.965	752.43	266.45	1.329	3.753	315.19	372.28	1.3625	1.5293
72	34.942	34.447	711.49	298.84	1.405	3.346	321.19	369.04	1.3794	1.5184
74	36.673	36.023	671.96	350.31	1.488	2.855	327.16	363.27	1.3959	1.5003
76	38.156	39.432	600.60	686.52	1.665	1.457	336.23	328.36	1.4213	1.3982



Questions and answers regarding R-434a (RS-45)

1 Q: What is R-434A (RS-45)?

A: R-434A (RS-45) is a direct substitute (drop-in) of R-22 in most applications and also without effect on the ozone layer (ODP = 0).

2 Q: What does R-434A (RS-45) contain?

A: R-434A (RS-45) is a mixture of HFC 134a, HFC 125, R-143a and iso butane (R-600a).

3 Q: Has RS-45 an ASHRAE numbers and what is its classification?

A: Yes it has. RS-45 has been assigned an ASHRAE number, R-434A is rated A1, which means low toxicity and non-flammability under all fractionation conditions.

4 Q: Is R-434A (RS-45) subject to a phase-out according to the regulations, such as CFCs and HCFCs?

A: No, none of the components of R-434A (RS-45) is subject to a gradual elimination schedule under the Montreal Protocol or the European regulations.

5 Q: Is R-434A (RS-45) non-flammable and non-toxic?

A: R-434A (RS-45) is non-toxic and not flammable under all fractionation conditions ASTM 681-98. It belongs to the group L1.

6 Q: Can R-434A (RS-45) be used with mineral and alkyl benzene lubricants?

A: Yes, there is no need to change to synthetic polyester oil (POE), since it works satisfactorily with traditional lubricants.

The return of the oil depends on certain design and operating conditions. In some systems with extensive and complex piping configurations, in flooded evaporators or in systems in which the accumulator of the suction line acts as a low pressure receiver, it is recommended the replacement of all or part (approximately 25%) of oil load of POE compressor. See guidelines for conversion.

7 Q: What is R-434A (RS-45) main advantage?

A: RS-45 is the only direct substitute for R-22 compatible with mineral oil, to high and low temperatures without loss of cooling capacity. Furthermore, R-434A (RS-45) has a low temperature glide 1.5 approx. (approx. 75% lower than R-427A and R-407C, approx. 70% lower than R-417A and approx. less than 65% R-422D) so the possibility of fractionation in the event of a leakage is minimum. Because of this, the possibility of ice formation on the evaporator is also reduced, the pressure increases in the condenser, limit the number of applications, etc. Even though the light increase of cooling capacity, the working pressures allow to operate in most cases with the cylinders and other existing elements in the installation without any need to change them.

It is the best choice for facilities designed too precisely, in which a loss of cooling capacity would be a problem. It is also perfect for food industries whose facilities working with R-22, and cannot stop production during several days due to the replacement of R-22 by a refrigerant as R-404A, as a direct substitute without losing refrigerating capacity is the best option.

8 Q: Can R-434A (RS-45) be used to recharge an installation containing R-22?

A: The standard recommendation is to not to mix refrigerants. However, because RS-45 does not form an azeotropic mixture with R-22, the addition of RS-45 to R-22 in a system will not generate higher pressures. In strictly technical terms, tests have shown that RS-45 can be added to R-22 with no adverse effects.

9 Q: What is the R-434A (RS-45) compression ratio?

A: High compression ratios can lead to increased energy consumption and damage the compressor. RS-45 has a compression ratio equal to R-22 commonly used in applications with R-22.

10 Q: Is R-434A (RS-45) as efficient as R-22?

A: The tests show that RS-45 has a higher coefficient of performance than R-22 and therefore is more energetically efficient.

11 Q: What tests have been carried out with R-434A (RS-45), and what are the results?

A: RS-45 shows results comparable to R-22 in expansion valve systems. RS-45 is particularly effective at low temperatures. The results showed good oil return to the compressor.

12 Q: What is the R-434A (RS-45) Glide?

A: 1.5 °C. approx.

13 Q: Should R-434A (RS-45) be charged in liquid or gas form?

A: Because RS-45 is a near-azeotropic mixture, the recommendation is to load the system in liquid phase. However, if the entire contents of the bottle must be introduced, it can be charged in gas phase.

14 Q: Has containers of R-434A (RS-45) dip tube?

A: It depends on the type of container. All blue containers of Servei Gas S.A. have it. Should they not have it, it is recommended to reverse the container.

15 Q: Is R-434A (RS-45) included in the SNAP (U.S. alternatives)?

A: Yes, it is.

16 Q: How are R-434A (RS-45) pressures compared to R-22?

A: The RS-45 pressure discharge is slightly higher than R-22 and similar to R-407C.

17 Q: What is the R-434A (RS-45) capacity compared to R-22?

A: There is no loss of RS-45 cooling capacity respect to R-22 in high and low temperatures.

18 Q: How is the R-434A (RS-45) operating temperature compared to R-22?

A: The R-434A (RS-45) temperature discharge is considerably lower than R-22.

19 Q: What are the R-434A (RS-45) flammability characteristics?

A: R-434A (RS-45) is not flammable at room temperature and atmospheric pressure, and has the same classification as R-410A, R-134a, R-404A, R-409A (FX56), R-507, etc.

20 Q: What are the decomposition products resulting from the R-434A (RS-45) combustion?

A: The decomposition products resulting from R-434A (RS-45) exposed to a source of high temperature are similar to those formed by R-22 when they are exposed to fire. The decomposition products in each case are irritating and toxic, and breathing apparatus should be used if such a possibility happens.

21 Q: Must R-434A (RS-45) be taken into account any special precautions?

A: No special precautions should be taken with RS-45. As with all refrigerants, common sense and good practices are always recommended. The use of hygroscopic synthetic lubricants (POE) can be avoided with the use of RS-45, so there is no need to take special care with humidity; however, this has to be always controlled.

22 Q: Is R-434A (RS-45) compatible with refrigeration and air conditioning systems designed for R-22?

A: Yes, R-434A (RS-45) is compatible with all materials commonly used in systems designed and loaded with R-22. As in R-22, magnesium and zinc alloys should be avoided.

23 Q: Can R-434A (RS-45) be recovered and recycled?

A: Yes, R-434A (RS-45) can be recovered and reused after a cleaning process, and later delivered to an authorised waste manager for further regeneration.

24 Q: Which is the technical guide to change R-22 to R-434A (RS-45)?

A: The procedure for the conversion of R-22 to RS-45 is simple: after having recovered R-22 and evacuating the system, use the same type of lubricant, replace the filter drier and introduce about the same amount of RS-45 as the original R-22 charge. See guidelines for more information about conversion.

25 Q: What is the price of R-434A (RS-45) compared to other alternative?

A: RS-45 price is competitive compared to other R-22 alternative.

26 Q: Is R-434A (RS-45) approved by the manufacturers of compressors?

A: The individual elements that compose RS-45 are widely used in compressors produced by major manufacturers.

27 Q: What is the coefficient of performance (COP) of R-434A (RS-45) compared to R-22?

A: Tests show that RS-45 provides higher COP than R-22, depending on the application and equipment.

28 Q: What is the specification of R-434A (RS-45)?

A: R-434A (RS-45) complies with the specifications of refrigerant ARI-700 for all the fluorocarbon refrigerants.

29 Q: What are the effects of high exposure by inhalation of R-434A (RS-45)?

A: As in the case of all CFC, HCFC and HFC that are the base of refrigerants, prolonged exposure to RS-45 can produce anaesthetic effects. Very high exposures may cause an abnormal heart rhythm and be fatal as with all CFC, HCFC and HFC.

30 Q: What is the flash point, explosive ignition temperature of R-434A (RS-45)?

A: R-434A (RS-45) is listed as a non-flammable as defined in ASHRAE test EN 681-98, and therefore has no flash point or explosion limits. The ignition temperature of RS-45 has not been determined, but is expected to exceed 750 ° C.

31 Q: Can R-434A (RS-45) be used in flooded evaporators systems with liquid receivers and centrifugal compressors?

A: The results of the test in these applications are encouraging. R-434A (RS-45) is suitable for using in flooded evaporators and was specially designed for this application.

32 Q: What types of leak detectors should be used with R-434A (RS-45)?

A: You can use the same leak detectors as in HFC.

33 Q: What would be the effect of R-434A (RS-45) large release?

A: The same as with other refrigerants of the same type, the area should be evacuated immediately. The vapour can be concentrated at ground level and at low poorly ventilated areas so the dispersion can be slow. You must proceed to ventilate the area before entering it.

34 Q: Is R-434A (RS-45) available in disposable bottles?

A: Not in Spain.

35 Q: Can you use R-434A (RS-45) in R-22 systems and then used with hydrocarbons (HC)?

A: Although there are not experiments conducted with hydrocarbon systems designed to replace R-22, we believe RS-45 would be appropriate for this, although the refrigerant charge mass should be greater.

36 Q: Is R-434A (RS-45) appropriate to use in new equipment?

A: R-434A (RS-45) has not ODP, it reaches the cooling capacity at high and low temperatures, it can be used with traditional lubricants, low discharge temperature, low slip and it is efficient energetically.