



R-428A (RS-52)

Features and uses of the R-428A (RS-52)

R-428A (RS-52) is a non flammable azeotropic blend, with zero ODP, compatible with traditional mineral lubricants, alkyl benzene and also with synthetic POE, thus not being necessary to make changes in the installation.

- "Drop-in" direct replacement for R-22 and R-502 and a replacement of R502 that are HCFC as R-408A, DI-44, etc. providing an easy and long term solution.
- The use of RS-52 avoids the need for expensive and technically unsatisfactory retrofits including oil changes, and changes in different parts of the installation.
- Low glide of about 0,8°C.

Applications

R-428A (RS-52) can be used in most applications of R-502 and HCFC substitutes and they are not limited to supermarkets, ice machines, cold stores, refrigerated transport, ice rinks, etc.

RS-52 can replace R-22 in those installations set at the same pressure as R-502. RS-52 is a long-term economic solution, and solves the problem of replacing refrigerants that harm the ozone layer.

- Capacity and pressure similar to R-507.
- Flooded systems.
- Low temperature (-46.7°C).
- R22 replacement as long as the condenser has the right size.

See the application guide for more information RS.

Service and work terms

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

In most cases there is no need to change the existing lubricant, so RS-52 can be used directly as indicated in the conversion guidelines.

Lubricants

RS-52 is compatible with mineral and alkyl benzene oils which are in R-502 and R-22 systems, and polyester lubricants.

While in most cases there is no need to change the lubricant, it is recommended to follow the directions in relation to the viscosity and lubrication qualities of compressor manufacturers. However, in systems configured with extensive and complex piping, or in large volume liquid containers or at very low operating temperatures, it may be necessary to add a part of POE.

Environmental Information

None of RS-52 components contains chlorine, so the product has ODP = 0 (ability to deplete the ozone layer). As all hydro fluorocarbons (HFC), RS-52 has a direct warming potential (GWP), but this is compensated by its low TEWI-Total Equivalent Warming Impact-(greenhouse effect).



Safety

R-428A (RS-52) is not toxic or flammable, high security. It belongs to the security classification A1 / group L1.

Compatibility with materials

R-428A (RS-52) is compatible with all materials commonly used in refrigeration systems that have previously worked with R-22 or R-502.

In general, the materials compatible with R-22 and R-502 can be used with RS-52. It is recommended to check with the manufacturer the particularities of the equipment for its adaptation with regard to materials' compatibility. In existing installations with R-22, it may be necessary to replace some joints due to the different composition of RS-52, which contains HFC's

Pressure and Temperature Tables

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

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

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 steam: To determine the superheat of evaporator, 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: To determine sub-cooling in 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 the difference is sub cooling of condenser refrigerant liquid.

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

Note: with the RS range of refrigerants, the average of the evaporation and condensation temperatures is the half way point between the temperatures of the bubble point and the dew point.

Components

Chemical name	% by weight	CAS N°	EC No.
1,1,1,2,2-Pentafluoroethane (HFC 125)	77,5	354-33-6	206-557-8
1,1,1- Trifluoroethane (HFC 143a)	20,0	420-46-2	206-996-5
Isobutane (R-600a)	1,9	75-28-5	200-857-2
Propane (R290)	0,6	74-98-6	200-827-9



Physical properties

PHYSICAL PROPERTIES	UNITS	R-428A (RS-52)	R-502	R-22
Molecular weight	(kg/kmol)	107,5	111,6	86,5
Boiling point (1 atm.)	(°C)	-46,7 ⁽¹⁾	-45.4 ⁽¹⁾	-40.8 ⁽¹⁾
Critical temperature	(°C)	73	82,2	96,1
Critical pressure	(bar a)	38,1	40,7	49,9
Liquid Density at 25 ° C	(kg/m ³)	1053	1217	1191
Saturated vapour density at 25 ° C	(kg/m ³)	70,2	62,2	44,2
Specific heat of liquid at 25 ° C	(kJ/kg°C)	1,52	1,25	1,26
Specific heat steam at 25 ° C and 1 atm	(kJ/kg°C)	0,87	0,706	1,18
Steam Pressure 25 ° C	(bar a)	12,68 ⁽¹⁾	11,5	10,44
Latent heat of vaporization	(kJ/kg°C)	189,2 ⁽¹⁾	173 ⁽¹⁾	234 ⁽¹⁾
Slip temp.	(°C)	Aprox. 0,8	0,2 ⁽¹⁾	0
Flammability in air at 1 atm	%vol	No	No	No
ODP		0	0,33	0,055
GWP		3607*	4657*	1810*
Inhalation exposure (8h/day and 40 h / week	(ppm)	1000	1000	1000

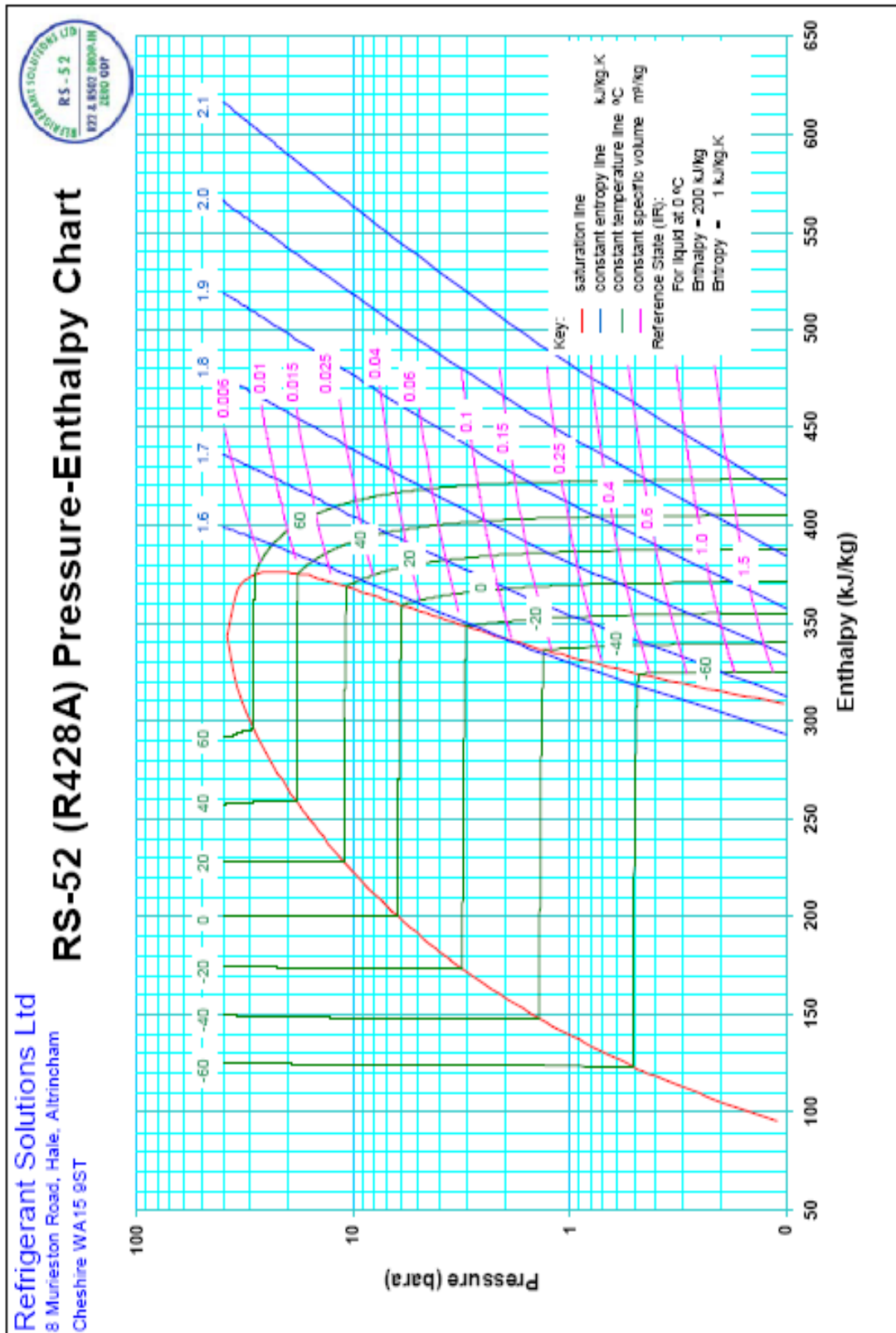
(1) Bubble point

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

Remember to consult the guidelines for the reconversion of R428A (RS-52)



Mollier Diagram



R-428A (RS-52) 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	-0.448	-0.480	1417.500	3.246	0.705	0.308	125.790	314.070	0.696	1.581
-58	-0.385	-0.420	1411.200	3.597	0.709	0.278	128.110	315.280	0.707	1.578
-56	-0.317	-0.354	1404.900	3.977	0.712	0.251	130.440	316.490	0.718	1.576
-54	-0.243	-0.282	1398.600	4.388	0.715	0.228	132.790	317.700	0.728	1.574
-52	-0.162	-0.205	1392.200	4.832	0.718	0.207	135.130	318.910	0.739	1.571
-50	-0.075	-0.120	1385.800	5.311	0.722	0.188	137.490	320.110	0.749	1.569
-48	0.020	-0.029	1379.300	5.826	0.725	0.172	139.860	321.310	0.760	1.567
-46	0.121	0.069	1372.800	6.380	0.728	0.157	142.240	322.510	0.770	1.566
-44	0.231	0.175	1366.300	6.974	0.732	0.143	144.620	323.700	0.781	1.564
-42	0.348	0.289	1359.700	7.611	0.735	0.131	147.020	324.900	0.791	1.562
-40	0.475	0.412	1353.000	8.293	0.739	0.121	149.420	326.080	0.802	1.561
-38	0.610	0.543	1346.300	9.021	0.743	0.111	151.840	327.270	0.812	1.559
-36	0.755	0.684	1339.600	9.799	0.746	0.102	154.260	328.440	0.822	1.558
-34	0.910	0.835	1332.800	10.628	0.750	0.094	156.700	329.620	0.832	1.557
-32	1.075	0.996	1325.900	11.512	0.754	0.087	159.150	330.780	0.842	1.555
-30	1.251	1.167	1319.000	12.452	0.758	0.080	161.600	331.950	0.853	1.554
-28	1.438	1.350	1312.000	13.452	0.762	0.074	164.070	333.100	0.863	1.553
-26	1.637	1.544	1305.000	14.514	0.766	0.069	166.550	334.250	0.873	1.552
-24	1.848	1.750	1297.900	15.641	0.770	0.064	169.040	335.400	0.883	1.551
-22	2.072	1.969	1290.700	16.837	0.775	0.059	171.550	336.530	0.893	1.551
-20	2.309	2.201	1283.500	18.104	0.779	0.055	174.070	337.660	0.902	1.550
-18	2.559	2.446	1276.200	19.445	0.784	0.051	176.600	338.780	0.912	1.549
-16	2.824	2.705	1268.800	20.866	0.788	0.048	179.140	339.890	0.922	1.548
-14	3.104	2.979	1261.300	22.368	0.793	0.045	181.690	340.990	0.932	1.548
-12	3.399	3.268	1253.700	23.955	0.798	0.042	184.260	342.080	0.942	1.547
-10	3.709	3.573	1246.000	25.633	0.803	0.039	186.850	343.160	0.952	1.547
-8	4.036	3.894	1238.300	27.405	0.808	0.036	189.450	344.230	0.961	1.546
-6	4.379	4.231	1230.400	29.276	0.813	0.034	192.060	345.290	0.971	1.546
-4	4.740	4.586	1222.500	31.251	0.818	0.032	194.690	346.340	0.981	1.545
-2	5.119	4.958	1214.400	33.335	0.823	0.030	197.340	347.370	0.990	1.545
0	5.516	5.349	1206.200	35.533	0.829	0.028	200.000	348.390	1.000	1.544
2	5.932	5.759	1197.900	37.851	0.835	0.026	202.680	349.400	1.010	1.544
4	6.368	6.188	1189.500	40.296	0.841	0.025	205.380	350.390	1.019	1.543
6	6.824	6.637	1180.900	42.874	0.847	0.023	208.090	351.360	1.029	1.543
8	7.300	7.107	1172.200	45.593	0.853	0.022	210.830	352.320	1.039	1.543
10	7.798	7.599	1163.300	48.460	0.860	0.021	213.580	353.250	1.048	1.542
12	8.318	8.112	1154.300	51.485	0.866	0.019	216.360	354.170	1.058	1.542
14	8.861	8.648	1145.100	54.676	0.873	0.018	219.160	355.070	1.067	1.541



R-428A (RS-52) 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	9.426	9.207	1135.700	58.044	0.881	0.017	221.970	355.940	1.077	1.541
18	10.016	9.789	1126.200	61.599	0.888	0.016	224.820	356.790	1.087	1.541
20	10.629	10.397	1116.400	65.354	0.896	0.015	227.690	357.610	1.096	1.540
22	11.269	11.029	1106.400	69.323	0.904	0.014	230.580	358.410	1.106	1.540
24	11.933	11.688	1096.200	73.520	0.912	0.014	233.500	359.180	1.116	1.539
26	12.625	12.373	1085.700	77.962	0.921	0.013	236.450	359.910	1.125	1.539
28	13.344	13.086	1075.000	82.667	0.930	0.012	239.430	360.610	1.135	1.538
30	14.090	13.827	1064.000	87.657	0.940	0.011	242.440	361.270	1.145	1.537
32	14.866	14.597	1052.600	92.956	0.950	0.011	245.490	361.890	1.154	1.536
34	15.670	15.396	1040.900	98.590	0.961	0.010	248.580	362.460	1.164	1.536
36	16.506	16.227	1028.900	104.590	0.972	0.010	251.700	362.990	1.174	1.535
38	17.372	17.089	1016.400	110.990	0.984	0.009	254.870	363.460	1.184	1.534
40	18.270	17.983	1003.500	117.840	0.996	0.008	258.080	363.870	1.194	1.532
42	19.202	18.911	990.090	125.180	1.010	0.008	261.340	364.210	1.204	1.531
44	20.167	19.874	976.110	133.080	1.024	0.008	264.670	364.480	1.214	1.530
46	21.167	20.872	961.490	141.610	1.040	0.007	268.050	364.660	1.225	1.528
48	22.204	21.907	946.130	150.850	1.057	0.007	271.500	364.740	1.235	1.526
50	23.277	22.981	929.930	160.920	1.075	0.006	275.040	364.710	1.246	1.524
52	24.389	24.094	912.730	171.960	1.096	0.006	278.670	364.540	1.257	1.521
54	25.541	25.248	894.340	184.160	1.118	0.005	282.410	364.220	1.268	1.518
56	26.733	26.446	874.480	197.790	1.144	0.005	286.290	363.700	1.279	1.515
58	27.969	27.689	852.760	213.220	1.173	0.005	290.330	362.940	1.291	1.510
60	29.250	28.980	828.570	231.010	1.207	0.004	294.590	361.860	1.303	1.505
62	30.578	30.322	800.930	252.110	1.249	0.004	299.160	360.340	1.316	1.499
64	31.955	31.720	768.000	278.230	1.302	0.004	304.200	358.170	1.331	1.491
66	33.385	33.182	725.580	313.320	1.378	0.003	310.080	354.850	1.348	1.480



Questions and answers about R-428A (RS-52)

1 Q: What is R-428A (RS-52)?

A: R-428A (RS-52) is a direct replacement (drop-in) of R-502, R-502 and R-22 replacement at low temperatures and also without effect on the ozone layer (ODP = 0).

2 Q: What has R-428A (RS-52)?

A: R-428A (RS-52) is a blend of HFC 143a, HFC 125, iso-butane and propane.

3 Q: Does RS-52 an ASHRAE number and what is its classification?

A: Yes, RS-52 has been assigned an ASHRAE number, R-428A, it is rated A1, nontoxic and non flammable in all conditions of fractionation.

4 Q: Is R-428A (RS-52) subject to a phase-out according to the regulations, such as CFC and HCFC?

A: No, none of the components of R-428A (RS-52) is subject to a gradual phase-out schedule under the Montreal Protocol or the European regulations.

5 Q: Is R-428A (RS-52) can be used with mineral and alkyl benzene lubricants?

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

Oil return depends on certain design and operating conditions. In some configurations of systems with extensive and complex piping, 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 the compressor oil load with POE. See guidelines for conversion.

6 Q: Is R-428A (RS-52) approved by the manufacturers of compressors?

A: The individual elements that compose RS-52 are widely used in compressors produced by major manufacturers.

7 Q: Is R-428A (RS-52) as efficient as R-22?

A: Tests show that RS-52 is so efficient as R-502.

8 Q: What is the Glide of R-428A (RS-52)?

A: Less than 1°C.

9 Q: Should R-428A (RS-52) be charged in liquid or gas phase?

A: Because RS-52 is almost an azeotropic blend, the recommendation is to load the system in liquid phase. However, if the entire contents of the bottle must be introduced, it can be performed in gas phase.

10 Q: Have containers of R-428A (RS-52) dip tube?

A: It depends on the type of container. All blue containers of Servei Gas S.A. have it. In case of not having it, the recommendation is to reverse the container.

11 Q: Is R-428A (RS-52) included in the SNAP (Significant New Alternatives Project)

A: Yes, R-428A (RS-52) is approved in the U.S. by the Environmental Protection Agency as a replacement for R-22 and is on the SNAP list.

12 Q: How are R-428A (RS-52) pressures compared to R-502?

A: The discharge pressure of RS-52 is 1 bar higher than R-502 and similar to R-507.

13 Q: What is R-428A (RS-52) capacity compared to R-502?

A: The capacity of RS-52 is the same as R-502.

14 Q: What is R-428A (RS-52) capacity compared to R-22?

A: RS-52 capacity is 17% higher than R-22.

15 Q: How are the R-428A (RS-52) operating temperatures compared to R-22?

A: R-428A (RS-52) discharge temperatures are slightly superior to those of R-502 and lower than R-22

16 Q: What are R-428A (RS-52) flammability characteristics?

A: R-428A (RS-52) 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.

17 Q: What are the decomposition products resulting from R-428A (RS-52) combustion?

A: The decomposition products resulting from R-428A (RS-52) exposure to a high temperature source are similar to those formed by R-22 when they are exposed to fire. Decomposition products are in each case irritating and toxic, and breathing apparatus should be used if such possibility exists.

18 Q: Must any special precaution be taken when using R-428A (RS-52)?

A: No special precautions should be taken with RS-52. 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-52, so there is no need to take special care with humidity. However, humidity has to be always controlled.

19 Q: Is R-428A (RS-52) compatible with refrigeration and air conditioning systems designed for R-502?

A: Yes, R-428A (RS-52) is compatible with all materials commonly used in systems that were designed and loaded with R-502. As in the case of R-502, magnesium and zinc alloys should be avoided.

20 Q: Is R-428A (RS-52) recovered and recycled?

A: Yes, R-428A (RS-52) can be recovered and reused after a cleaning process, and delivered to an authorized waste manager for further regeneration.

21 Q: What is the technical guide for changing R-502 to R-428A (RS-52)?

A: The procedure for the conversion of R-502 to RS-52 is simple. After recovering the R-502 and evacuating the system, use the same type of lubricant, replace the filter/drier and introduce about 15% less than the original charge of R-502. See guidelines for conversion.

22 Q: What is R-428A (RS-52) main advantage?

A: R-428A (RS-52) is a long-term solution for R-22, R-502 and R-502, and its main advantage is that can be used to replace R-502, without changing the original mineral oil in the system. Therefore, there is no need to adapt to a synthetic lubricant such as POE.

23 Q: What is the R-428A (RS-52) coefficient of performance (COP) compared to R-22?

A: Tests show that RS-52 provides a COP similar to R-502.

24 Q: What is R-428A (RS-52) specification?

A: R-428A (RS-52) complies with the specification of refrigerants ARI 700-95 for fluorocarbon refrigerants.

25 Q: What are the effects of high exposure to R-428A (RS-52) by inhalation?

A: All CFC, HCFC and HFC are the base of the refrigerants. High exposure to RS-52 can produce anaesthetic effects. Very high exposures may cause an abnormal heart rhythm and be fatal as happens with all CFC, HCFC and HFC

26 Q: What is R-428A (RS-52) flash point, explosive and ignition temperature?

A: R-428A (RS-52) is listed as a non-flammable as defined in ASHRAE test EN 681-98, and therefore has no flash point or explosion limits. RS-52 ignition temperature has not been determined, but it is expected to exceed 750°C.

27 Q: Can R-428A (RS-52) be used in flooded evaporators?

A: Tests continue in this field and the results are encouraging.



TECHNICAL
DATA SHEET
R-428A (RS-52)



28 Q: What types of leak detectors should be used with R-428A (RS-52)?

A: You can use the same leak detectors used with HFC.

29 Q: What would be the effect of a large emission of R-428A (RS-52)?

A: As with other refrigerants, the area should be immediately evacuated. 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.

30 Q: Is R-428A (RS-52) available in disposable bottles?

A: Not to be used in the European Union.

31 Q: Is R-428A (RS-52) appropriate to be used with new equipment?

A: R-428A (RS-52) is able to replace R-22 and R-502 due to its similar or greater capacity, lower discharge temperature than R-22, it has no (ODP), support traditional lubricants, low slip and energy efficient.