TECHNICAL
DATA SHEET

R-453A (RS-70)

Features and uses of RS-70

RS-70 is a non-azeotropic blend of HFC with zero Ozone Depletion Potential et low Global Warming Potential (GWP), formulated to meet the requirements of the F-Gas Regulation in Europe which aims to reduce CO_2 emissions into the atmosphere. It is compatible with mineral traditional 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 in refrigeration and air conditioning, in low, medium and high evaporating temperatures, providing an easy and long-term solution.
- One single replacement for R-22 in all applications except for flooded evaporators.
- **Low Global Warming Potential** (GWP) suitable for R-22 installations, which had been previously converted to other HFC such as R-417A, R-417B, R-422D, R-438A, R-424A (RS44) and R-434A (RS45).
- Simple solution able to work both with expansion valve (TXV) and capillary systems.
- Due to the fact that there is no need for expensive and hygroscopic synthetic lubricants, the risk of humidity in the system is completely avoided.
- Thanks to its discharge temperature, significantly lower than R-22, there is no concern about oil decomposition.

Applications

RS-70 is suitable as a direct replacement for R-22 in low, medium and high temperatures in a great number of applications:

- Commercial air conditioners, splits, chillers, industrial cooling processes
- Cooling chambers, supermarkets, refrigerated cellars, refrigerated transport, cold-drink vending machines, milk-cooling cabinets, ice rinks.
- Others.

Conditions for service and work

Due to the fact that RS-70 is a blend, it must be transferred in liquid phase or in full loads if it transferred in gas phase.

In most cases, there is no need to change the existing refrigerant oil, RS-70 can be used directly as indicated in the conversion guidelines.

In the event of a partial leak, the system can be top up with RS-70 without their properties being significantly affected.

Lubricants

RS-70 is compatible with mineral and alkyl benzene oils which are in R-22 systems, and also with polyolester lubricants.

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

Environmental Data

None of the RS-70 components contains chlorine, so the product has ODP = 0 (ozone depleting potential). As with all hydro fluorocarbons (HFCs), RS-70 has a direct Global Warming Potential (GWP), but this is counterbalanced by its low TEWI-Total Equivalent Warming Impact (greenhouse effect).

Security

RS-70 is non-toxic, non-flammable, high security.
It belongs to security classification **A1 / group L1**.

Material compatibility

RS-70 is compatible with all materials commonly used in refrigeration systems which have previously worked with R-22.
In general, compatible materials with R-22 can be used with RS-70. It is recommended to check with the manufacturer the particularities for equipment adaptation with regard to compatibility of materials. In existing facilities with R-22, it may be necessary to replace some joints due to the different composition of RS-70, 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: The temperature at which liquid refrigerant begins to vaporize at the given pressure. Below this temperature, refrigerant liquid is sub cooled.

Pressure dew point: The temperature at which refrigerant vapour begins to condense at given pressure. Above this temperature, 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 the refrigerant 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 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	% in weight	CAS Nº	EC Nº
1,1,1,2- Tetrafluoroethane (R-134a)	53,8	811-97-2	212-377-0
Pentafluoroethane (R-125)	20,0	354-33-6	206-557-8
Difluoromethane (R-32)	20,0	75-10-5	200-839-4
1,1,1,2,3,3,3-Heptafluoropropane (R-227ea)	5,0	431-89-0	207-079-2
Iso-pentane (R-601a)	0,6	78-78-4	201-142-8
N-butane (R-600)	0,6	106-97-8	203-448-7

Physical properties

PHYSICAL PROPERTIES	UNITS	R-453A (RS-70)	R-22
Molecular Weight	(kg/kmol)	88,80	86,5
Boiling point (1 atm.)	(ºC)	-42,2 (1)	-40,8
Critical temperature	(ºC)	87,9	96,10
Critical pressure	(bar a)	45,3	49,9
Liquid Density at 25ºC	(kg/m^3)	1136	1191
Saturated vapour density at 25ºC	(kg/m^3)	41,7	44,2
Specific heat liquid at 25ºC	(kJ/kgºC)	1,52	1,26
Specific heat vapour at 1 atm and 25ºC	(kJ/kgºC)	1,137	1,18
Steam pressure at 25ºC	(bar a)	11,2 (1)	10,44
Latent heat of vaporization (at boiling point)	(kJ/kgºC)	243 (1)	234
Glide temperature	(ºC)	Aprox. 4,2	0
Flammability in air at 1 atm	%vol.	No	No
ODP		0	0,055
GWP		1765*	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 RS-70 conversion.

R-453A (RS-70) Saturation Properties Absolute

T [°C]	Pressure Liquid [bar]	Pressure Vapour [bar]	Density Liquid [kg/m3]	Density Vapour [kg/m3]	Enthalpy Liquid [kJ/kg]	Enthalpy Vapour [kJ/kg]	Entropy Liquid [kJ/K·kg]	Entropy Vapour [kJ/K·kg]
-60	0.40124	0.25403	1422.4	1.2933	120.94	371.93	0.77845	1.9772
-59	0.42472	0.27052	1419.5	1.3717	122.22	372.55	0.78445	1.9743
-58	0.44930	0.28786	1416.6	1.4540	123.50	373.17	0.79042	1.9715
-57	0.47502	0.30611	1413.6	1.5402	124.79	373.79	0.79637	1.9687
-56	0.50191	0.32529	1410.7	1.6304	126.08	374.41	0.80230	1.9660
-55	0.53002	0.34543	1407.8	1.7249	127.36	375.03	0.80821	1.9633
-54	0.55938	0.36658	1404.8	1.8236	128.65	375.64	0.81409	1.9606
-53	0.59004	0.38877	1401.9	1.9269	129.94	376.26	0.81996	1.9581
-52	0.62202	0.41204	1398.9	2.0348	131.23	376.87	0.82580	1.9555
-51	0.65539	0.43642	1396.0	2.1475	132.53	377.49	0.83162	1.9530
-50	0.69017	0.46195	1393.0	2.2651	133.82	378.10	0.83743	1.9506
-49	0.72641	0.48868	1390.0	2.3878	135.12	378.71	0.84321	1.9482
-48	0.76415	0.51665	1387.1	2.5157	136.41	379.33	0.84897	1.9458
-47	0.80345	0.54589	1384.1	2.6490	137.71	379.94	0.85471	1.9435
-46	0.84433	0.57645	1381.1	2.7879	139.01	380.55	0.86044	1.9413
-45	0.88686	0.60836	1378.1	2.9326	140.32	381.16	0.86614	1.9390
-44	0.93106	0.64168	1375.1	3.0831	141.62	381.77	0.87183	1.9369
-43	0.97700	0.67645	1372.1	3.2397	142.92	382.37	0.87750	1.9347
-42	1.02470	0.71271	1369.0	3.4026	144.23	382.98	0.88315	1.9326
-41	1.07430	0.75051	1366.0	3.5719	145.54	383.59	0.88878	1.9305
-40	1.12570	0.78990	1363.0	3.7478	146.85	384.19	0.89439	1.9285
-39	1.17900	0.83091	1359.9	3.9305	148.16	384.79	0.89999	1.9265
-38	1.23430	0.87361	1356.9	4.1202	149.47	385.39	0.90557	1.9246
-37	1.29160	0.91803	1353.8	4.3170	150.79	385.99	0.91114	1.9226
-36	1.35100	0.96423	1350.7	4.5213	152.11	386.59	0.91668	1.9207
-35	1.41260	1.01230	1347.6	4.7331	153.43	387.19	0.92221	1.9189
-34	1.47630	1.06220	1344.5	4.9526	154.75	387.78	0.92773	1.9171
-33	1.54220	1.11400	1341.4	5.1802	156.07	388.38	0.93323	1.9153
-32	1.61040	1.16780	1338.3	5.4159	157.39	388.97	0.93871	1.9135
-31	1.68100	1.22360	1335.2	5.6600	158.72	389.56	0.94418	1.9118
-30	1.75390	1.28160	1332.1	5.9128	160.05	390.15	0.94964	1.9101
-29	1.82930	1.34160	1328.9	6.1743	161.38	390.74	0.95508	1.9084
-28	1.90720	1.40390	1325.8	6.4449	162.71	391.32	0.96050	1.9068
-27	1.98760	1.46840	1322.6	6.7248	164.05	391.91	0.96591	1.9052
-26	2.07070	1.53520	1319.4	7.0142	165.39	392.49	0.97131	1.9036
-25	2.15640	1.60440	1316.3	7.3134	166.73	393.07	0.97669	1.9020
-24	2.24480	1.67600	1313.1	7.6225	168.07	393.65	0.98206	1.9005
-23	2.33600	1.75010	1309.8	7.9419	169.41	394.23	0.98742	1.8990
-22	2.43010	1.82670	1306.6	8.2718	170.76	394.80	0.99276	1.8975
-21	2.52710	1.90600	1303.4	8.6123	172.11	395.37	0.99809	1.8961
-20	2.62700	1.98780	1300.1	8.9639	173.46	395.94	1.00340	1.8946
-19	2.72990	2.07240	1296.9	9.3268	174.81	396.51	1.00870	1.8932
-18	2.83590	2.15980	1293.6	9.7011	176.17	397.07	1.01400	1.8918
-17	2.94510	2.25000	1290.3	10.0870	177.53	397.64	1.01930	1.8905
-16	3.05740	2.34310	1287.0	10.4860	178.89	398.20	1.02460	1.8891
-15	3.17300	2.43920	1283.7	10.8960	180.25	398.76	1.02980	1.8878
-14	3.29190	2.53830	1280.4	11.3190	181.62	399.31	1.03510	1.8865
-13	3.41420	2.64040	1277.1	11.7560	182.99	399.86	1.04030	1.8852
-12	3.54000	2.74580	1273.7	12.2050	184.36	400.41	1.04550	1.8839
-11	3.66920	2.85440	1270.3	12.6680	185.73	400.96	1.05070	1.8827
-10	3.80200	2.96620	1266.9	13.1450	187.11	401.51	1.05590	1.8815
-9	3.93850	3.08140	1263.5	13.6360	188.49	402.05	1.06110	1.8803
-8	4.07870	3.20010	1260.1	14.1410	189.88	402.59	1.06630	1.8791
-7	4.22260	3.32220	1256.7	14.6620	191.26	403.12	1.07150	1.8779
-6	4.37030	3.44780	1253.3	15.1980	192.65	403.66	1.07670	1.8767
-5	4.52200	3.57720	1249.8	15.7490	194.04	404.19	1.08180	1.8756
-4	4.67760	3.71020	1246.3	16.3160	195.44	404.71	1.08700	1.8745
-3	4.83720	3.84690	1242.8	16.8990	196.84	405.24	1.09210	1.8734
-2	5.00090	3.98750	1239.3	17.4990	198.24	405.76	1.09720	1.8723
-1	5.16880	4.13200	1235.7	18.1160	199.64	406.28	1.10240	1.8712

R-453A (RS-70) Saturation Properties Absolute

T [°C]	Pressure Liquid [bar]	Pressure Vapour [bar]	Density Liquid [kg/m3]	Density Vapour [kg/m3]	Enthalpy Liquid [kJ/kg]	Enthalpy Vapour [kJ/kg]	Entropy Liquid [kJ/K·kg]	Entropy Vapour [kJ/K·kg]
0	5.34090	4.28050	1232.2	18.7510	201.05	406.79	1.10750	1.8701
1	5.51720	4.43310	1228.6	19.4030	202.46	407.30	1.11260	1.8691
2	5.69800	4.58980	1225.0	20.0740	203.88	407.81	1.11770	1.8680
3	5.88310	4.75060	1221.4	20.7630	205.30	408.31	1.12280	1.8670
4	6.07280	4.91580	1217.8	21.4710	206.72	408.81	1.12780	1.8660
5	6.26700	5.08530	1214.1	22.1990	208.14	409.31	1.13290	1.8649
6	6.46590	5.25920	1210.4	22.9470	209.57	409.80	1.13800	1.8639
7	6.66940	5.43760	1206.7	23.7160	211.01	410.28	1.14310	1.8630
8	6.87780	5.62060	1203.0	24.5050	212.44	410.77	1.14810	1.8620
9	7.09100	5.80830	1199.3	25.3170	213.88	411.25	1.15320	1.8610
10	7.30900	6.00070	1195.5	26.1500	215.33	411.72	1.15820	1.8600
11	7.53210	6.19790	1191.7	27.0050	216.78	412.19	1.16330	1.8591
12	7.76020	6.40000	1187.9	27.8840	218.23	412.66	1.16830	1.8581
13	7.99350	6.60710	1184.1	28.7860	219.69	413.12	1.17330	1.8572
14	8.23190	6.81930	1180.2	29.7130	221.15	413.58	1.17830	1.8562
15	8.47570	7.03660	1176.3	30.6640	222.61	414.03	1.18340	1.8553
16	8.72470	7.25910	1172.4	31.6410	224.08	414.48	1.18840	1.8544
17	8.97920	7.48690	1168.4	32.6440	225.56	414.92	1.19340	1.8535
18	9.23920	7.72010	1164.4	33.6740	227.03	415.35	1.19840	1.8525
19	9.50470	7.95870	1160.4	34.7320	228.52	415.79	1.20340	1.8516
20	9.77580	8.20300	1156.4	35.8170	230.01	416.21	1.20840	1.8507
21	10.05300	8.45290	1152.3	36.9320	231.50	416.63	1.21340	1.8498
22	10.33500	8.70850	1148.2	38.0760	233.00	417.05	1.21840	1.8489
23	10.62400	8.96990	1144.1	39.2500	234.50	417.45	1.22340	1.8480
24	10.91800	9.23730	1139.9	40.4560	236.01	417.86	1.22840	1.8471
25	11.21900	9.51060	1135.7	41.6940	237.52	418.25	1.23340	1.8462
26	11.52500	9.79010	1131.5	42.9650	239.04	418.64	1.23840	1.8453
27	11.83800	10.07600	1127.2	44.2700	240.57	419.02	1.24340	1.8444
28	12.15700	10.36800	1122.9	45.6100	242.10	419.40	1.24840	1.8435
29	12.48200	10.66600	1118.6	46.9860	243.63	419.77	1.25340	1.8425
30	12.81400	10.97100	1114.2	48.3990	245.18	420.13	1.25840	1.8416
31	13.15200	11.28200	1109.7	49.8500	246.72	420.49	1.26340	1.8407
32	13.49700	11.60000	1105.3	51.3400	248.28	420.83	1.26840	1.8398
33	13.84800	11.92500	1100.8	52.8700	249.84	421.17	1.27340	1.8389
34	14.20600	12.25600	1096.2	54.4420	251.41	421.50	1.27840	1.8379
35	14.57100	12.59500	1091.6	56.0570	252.98	421.82	1.28340	1.8370
36	14.94300	12.94100	1086.9	57.7160	254.56	422.14	1.28840	1.8360
37	15.32100	13.29400	1082.2	59.4210	256.15	422.44	1.29340	1.8351
38	15.70700	13.65400	1077.5	61.1730	257.74	422.74	1.29850	1.8341
39	16.10000	14.02100	1072.7	62.9740	259.35	423.03	1.30350	1.8331
40	16.50000	14.39600	1067.8	64.8250	260.96	423.30	1.30850	1.8321
41	16.90700	14.77900	1062.9	66.7280	262.57	423.57	1.31360	1.8311
42	17.32200	15.16900	1058.0	68.6850	264.20	423.83	1.31860	1.8301
43	17.74400	15.56800	1052.9	70.6980	265.83	424.07	1.32360	1.8291
44	18.17300	15.97400	1047.8	72.7690	267.48	424.31	1.32870	1.8280
45	18.61000	16.38800	1042.7	74.9000	269.13	424.53	1.33380	1.8270
46	19.05500	16.81100	1037.5	77.0930	270.79	424.75	1.33880	1.8259
47	19.50800	17.24100	1032.2	79.3520	272.46	424.94	1.34390	1.8248
48	19.96900	17.68100	1026.8	81.6770	274.14	425.13	1.34900	1.8237
49	20.43700	18.12900	1021.4	84.0730	275.83	425.30	1.35410	1.8225
50	20.91400	18.58500	1015.9	86.5420	277.52	425.46	1.35930	1.8214
51	21.39800	19.05100	1010.3	89.0870	279.24	425.61	1.36440	1.8202
52	21.89100	19.52500	1004.6	91.7110	280.96	425.74	1.36960	1.8190
53	22.39300	20.00900	998.8	94.4190	282.69	425.85	1.37470	1.8177
54	22.90200	20.50100	993.0	97.2140	284.44	425.95	1.37990	1.8164
55	23.42100	21.00400	987.0	100.1000	286.19	426.03	1.38510	1.8151
56	23.94700	21.51600	981.0	0.00970	287.96	426.10	1.39030	1.8138
57	24.48300	22.03800	974.8	0.00942	289.75	426.14	1.39560	1.8124
58	25.02700	22.56900	968.5	0.00914	291.55	426.17	1.40090	1.8110
59	25.58000	23.11100	962.1	0.00888	293.36	426.17	1.40620	1.8095
60	26.14300	23.66300	955.6	0.00862	295.19	426.15	1.41150	1.8080

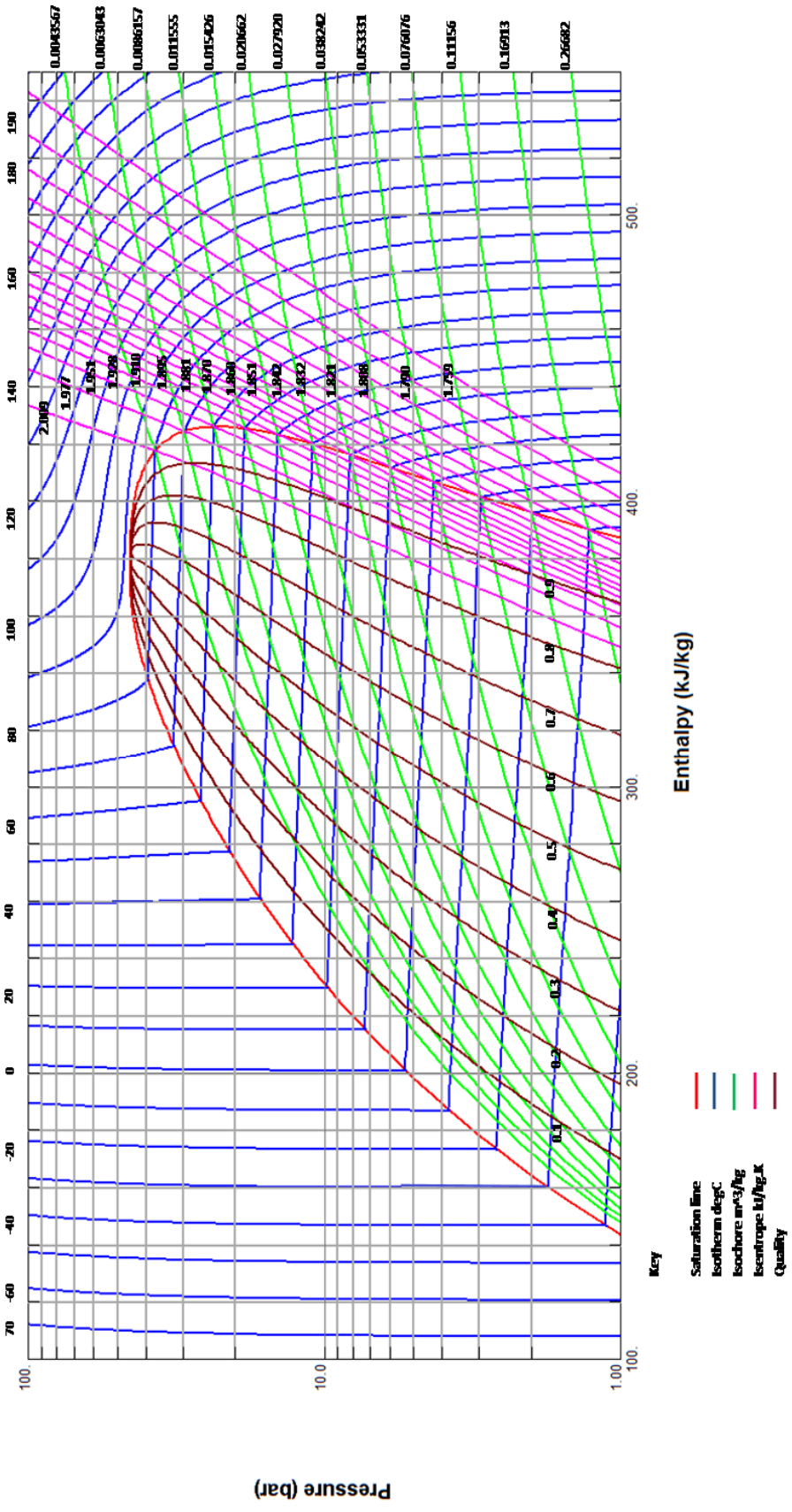
R-453A (RS-70) Saturation Properties Gauge

T [°C]	Pressure Liquid [bar]	Pressure Vapour [bar]	Density Liquid [kg/m3]	Density Vapour [kg/m3]	Enthalpy Liquid [kJ/kg]	Enthalpy Vapour [kJ/kg]	Entropy Liquid [kJ/K·kg]	Entropy Vapour [kJ/K·kg]
-60	-0.61201	-0.75922	1422.4	12.933	120.94	371.93	0.77845	19.772
-59	-0.58853	-0.74273	1419.5	13.717	122.22	372.55	0.78445	19.743
-58	-0.56395	-0.72539	1416.6	14.540	123.50	373.17	0.79042	19.715
-57	-0.53823	-0.70714	1413.6	15.402	124.79	373.79	0.79637	19.687
-56	-0.51134	-0.68796	1410.7	16.304	126.08	374.41	0.80230	19.660
-55	-0.48323	-0.66782	1407.8	17.249	127.36	375.03	0.80821	19.633
-54	-0.45387	-0.64667	1404.8	18.236	128.65	375.64	0.81409	19.606
-53	-0.42321	-0.62448	1401.9	19.269	129.94	376.26	0.81996	19.581
-52	-0.39123	-0.60121	1398.9	20.348	131.23	376.87	0.82580	19.555
-51	-0.35786	-0.57683	1396.0	21.475	132.53	377.49	0.83162	19.530
-50	-0.32308	-0.55130	1393.0	22.651	133.82	378.10	0.83743	19.506
-49	-0.28684	-0.52457	1390.0	23.878	135.12	378.71	0.84321	19.482
-48	-0.24910	-0.49660	1387.1	25.157	136.41	379.33	0.84897	19.458
-47	-0.20980	-0.46736	1384.1	26.490	137.71	379.94	0.85471	19.435
-46	-0.16892	-0.43680	1381.1	27.879	139.01	380.55	0.86044	19.413
-45	-0.12639	-0.40489	1378.1	29.326	140.32	381.16	0.86614	19.390
-44	-0.08219	-0.37157	1375.1	30.831	141.62	381.77	0.87183	19.369
-43	-0.03625	-0.33680	1372.1	32.397	142.92	382.37	0.87750	19.347
-42	0.01146	-0.30054	1369.0	34.026	144.23	382.98	0.88315	19.326
-41	0.06100	-0.26274	1366.0	35.719	145.54	383.59	0.88878	19.305
-40	0.11242	-0.22335	1363.0	37.478	146.85	384.19	0.89439	19.285
-39	0.16575	-0.18234	1359.9	39.305	148.16	384.79	0.89999	19.265
-38	0.22106	-0.13964	1356.9	41.202	149.47	385.39	0.90557	19.246
-37	0.27839	-0.09522	1353.8	43.170	150.79	385.99	0.91114	19.226
-36	0.33780	-0.04902	1350.7	45.213	152.11	386.59	0.91668	19.207
-35	0.39932	-0.00100	1347.6	47.331	153.43	387.19	0.92221	19.189
-34	0.46303	0.04890	1344.5	49.526	154.75	387.78	0.92773	19.171
-33	0.52896	0.10074	1341.4	51.802	156.07	388.38	0.93323	19.153
-32	0.59718	0.15455	1338.3	54.159	157.39	388.97	0.93871	19.135
-31	0.66773	0.21039	1335.2	56.600	158.72	389.56	0.94418	19.118
-30	0.74067	0.26832	1332.1	59.128	160.05	390.15	0.94964	19.101
-29	0.81605	0.32839	1328.9	61.743	161.38	390.74	0.95508	19.084
-28	0.89393	0.39066	1325.8	64.449	162.71	391.32	0.96050	19.068
-27	0.97437	0.45518	1322.6	67.248	164.05	391.91	0.96591	19.052
-26	105.740	0.52200	1319.4	70.142	165.39	392.49	0.97131	19.036
-25	114.310	0.59118	1316.3	73.134	166.73	393.07	0.97669	19.020
-24	123.160	0.66279	1313.1	76.225	168.07	393.65	0.98206	19.005
-23	132.280	0.73687	1309.8	79.419	169.41	394.23	0.98742	18.990
-22	141.680	0.81349	1306.6	82.718	170.76	394.80	0.99276	18.975
-21	151.380	0.89271	1303.4	86.123	172.11	395.37	0.99809	18.961
-20	161.370	0.97458	1300.1	89.639	173.46	395.94	100.340	18.946
-19	171.660	105.920	1296.9	93.268	174.81	396.51	100.870	18.932
-18	182.270	114.650	1293.6	97.011	176.17	397.07	101.400	18.918
-17	193.180	123.670	1290.3	100.870	177.53	397.64	101.930	18.905
-16	204.410	132.980	1287.0	104.860	178.89	398.20	102.460	18.891
-15	215.970	142.590	1283.7	108.960	180.25	398.76	102.980	18.878
-14	227.870	152.500	1280.4	113.190	181.62	399.31	103.510	18.865
-13	240.100	162.720	1277.1	117.560	182.99	399.86	104.030	18.852
-12	252.670	173.250	1273.7	122.050	184.36	400.41	104.550	18.839
-11	265.600	184.110	1270.3	126.680	185.73	400.96	105.070	18.827
-10	278.880	195.300	1266.9	131.450	187.11	401.51	105.590	18.815
-9	292.530	206.820	1263.5	136.360	188.49	402.05	106.110	18.803
-8	306.540	218.680	1260.1	141.410	189.88	402.59	106.630	18.791
-7	320.930	230.890	1256.7	146.620	191.26	403.12	107.150	18.779
-6	335.710	243.460	1253.3	151.980	192.65	403.66	107.670	18.767
-5	350.870	256.390	1249.8	157.490	194.04	404.19	108.180	18.756
-4	366.430	269.690	1246.3	163.160	195.44	404.71	108.700	18.745
-3	382.390	283.370	1242.8	168.990	196.84	405.24	109.210	18.734
-2	398.760	297.430	1239.3	174.990	198.24	405.76	109.720	18.723
-1	415.550	311.880	1235.7	181.160	199.64	406.28	110.240	18.712

R-453A (RS-70) Saturation Properties Gauge

T [°C]	Pressure Liquid [bar]	Pressure Vapour [bar]	Density Liquid [kg/m3]	Density Vapour [kg/m3]	Enthalpy Liquid [kJ/kg]	Enthalpy Vapour [kJ/kg]	Entropy Liquid [kJ/K·kg]	Entropy Vapour [kJ/K·kg]
0	432.760	326.730	1232.2	187.510	201.05	406.79	110.750	18.701
1	450.400	341.980	1228.6	194.030	202.46	407.30	111.260	18.691
2	468.470	357.650	1225.0	200.740	203.88	407.81	111.770	18.680
3	486.990	373.740	1221.4	207.630	205.30	408.31	112.280	18.670
4	505.960	390.250	1217.8	214.710	206.72	408.81	112.780	18.660
5	525.380	407.200	1214.1	221.990	208.14	409.31	113.290	18.649
6	545.260	424.600	1210.4	229.470	209.57	409.80	113.800	18.639
7	565.620	442.440	1206.7	237.160	211.01	410.28	114.310	18.630
8	586.450	460.740	1203.0	245.050	212.44	410.77	114.810	18.620
9	607.770	479.510	1199.3	253.170	213.88	411.25	115.320	18.610
10	629.580	498.750	1195.5	261.500	215.33	411.72	115.820	18.600
11	651.890	518.470	1191.7	270.050	216.78	412.19	116.330	18.591
12	674.700	538.680	1187.9	278.840	218.23	412.66	116.830	18.581
13	698.020	559.390	1184.1	287.860	219.69	413.12	117.330	18.572
14	721.870	580.600	1180.2	297.130	221.15	413.58	117.830	18.562
15	746.240	602.330	1176.3	306.640	222.61	414.03	118.340	18.553
16	771.150	624.580	1172.4	316.410	224.08	414.48	118.840	18.544
17	796.590	647.360	1168.4	326.440	225.56	414.92	119.340	18.535
18	822.590	670.680	1164.4	336.740	227.03	415.35	119.840	18.525
19	849.140	694.550	1160.4	347.320	228.52	415.79	120.340	18.516
20	876.260	718.970	1156.4	358.170	230.01	416.21	120.840	18.507
21	903.950	743.960	1152.3	369.320	231.50	416.63	121.340	18.498
22	932.210	769.520	1148.2	380.760	233.00	417.05	121.840	18.489
23	961.060	795.670	1144.1	392.500	234.50	417.45	122.340	18.480
24	990.510	822.400	1139.9	404.560	236.01	417.86	122.840	18.471
25	1.020.600	849.740	1135.7	416.940	237.52	418.25	123.340	18.462
26	1.051.200	877.680	1131.5	429.650	239.04	418.64	123.840	18.453
27	1.082.500	906.250	1127.2	442.700	240.57	419.02	124.340	18.444
28	1.114.400	935.440	1122.9	456.100	242.10	419.40	124.840	18.435
29	1.146.900	965.270	1118.6	469.860	243.63	419.77	125.340	18.425
30	1.180.100	995.750	1114.2	483.990	245.18	420.13	125.840	18.416
31	1.213.900	1.026.900	1109.7	498.500	246.72	420.49	126.340	18.407
32	1.248.400	1.058.700	1105.3	513.400	248.28	420.83	126.840	18.398
33	1.283.500	1.091.200	1100.8	528.700	249.84	421.17	127.340	18.389
34	1.319.300	1.124.300	1096.2	544.420	251.41	421.50	127.840	18.379
35	1.355.800	1.158.200	1091.6	560.570	252.98	421.82	128.340	18.370
36	1.392.900	1.192.800	1086.9	577.160	254.56	422.14	128.840	18.360
37	1.430.800	1.228.000	1082.2	594.210	256.15	422.44	129.340	18.351
38	1.469.400	1.264.100	1077.5	611.730	257.74	422.74	129.850	18.341
39	1.508.600	1.300.800	1072.7	629.740	259.35	423.03	130.350	18.331
40	1.548.600	1.338.300	1067.8	648.250	260.96	423.30	130.850	18.321
41	1.589.400	1.376.600	1062.9	667.280	262.57	423.57	131.360	18.311
42	1.630.800	1.415.600	1058.0	686.850	264.20	423.83	131.860	18.301
43	1.673.000	1.455.400	1052.9	706.980	265.83	424.07	132.360	18.291
44	1.716.000	1.496.100	1047.8	727.690	267.48	424.31	132.870	18.280
45	1.759.700	1.537.500	1042.7	749.000	269.13	424.53	133.380	18.270
46	1.804.200	1.579.700	1037.5	770.930	270.79	424.75	133.880	18.259
47	1.849.500	1.622.800	1032.2	793.520	272.46	424.94	134.390	18.248
48	1.895.500	1.666.700	1026.8	816.770	274.14	425.13	134.900	18.237
49	1.942.400	1.711.500	1021.4	840.730	275.83	425.30	135.410	18.225
50	1.990.100	1.757.200	1015.9	865.420	277.52	425.46	135.930	18.214
51	2.038.500	1.803.700	1010.3	890.870	279.24	425.61	136.440	18.202
52	2.087.800	1.851.200	1004.6	917.110	280.96	425.74	136.960	18.190
53	2.137.900	1.899.500	998.8	944.190	282.69	425.85	137.470	18.177
54	2.188.900	1.948.800	993.0	972.140	284.44	425.95	137.990	18.164
55	2.240.700	1.999.100	987.0	1.001.000	286.19	426.03	138.510	18.151
56	2.293.400	2.050.300	981.0	1.030.800	287.96	426.10	139.030	18.138
57	2.347.000	2.102.400	974.8	1.061.600	289.75	426.14	139.560	18.124
58	2.401.400	2.155.600	968.5	1.093.500	291.55	426.17	140.090	18.110
59	2.456.700	2.209.800	962.1	1.126.500	293.36	426.17	140.620	18.095
60	2.512.900	2.265.000	955.6	1.160.700	295.19	426.15	141.150	18.080

Mollier Diagram



Questions and answers about R-453A (RS-70)

1 Q: What is RS-70?
A: RS-70 is a direct substitute (drop-in) for R-22 in most applications, without effect on ozone layer (ODP= 0) and with a low global warming potential (GWP).

2 Q: What does RS-70 contain?
A: RS-70 is a blend of HFC 134a, HFC 125, R-32, R-227ea, HC iso-pentane (R-601a) and n-butane (R-600).

3 Q: Has RS-70 an ASHRAE number and which is its classification?
A: Yes, RS-70 has been assigned the ASHRAE number R-453A with an A1 classification, which indicates low toxicity and non-flammability in all fractionation conditions.

4 Q: Is RS-70 subject to a phase-out according to regulations, such as CFC and HCFC
A: No, none of RS-70 components is subject to a gradual elimination schedule under Montreal Protocol or European regulations.

5 Q: Is RS-70 non flammable and non toxic?
A: Yes, RS-70 is non toxic and non flammable under fragmentation conditions according to the norm ASTM 681-98. It belongs to group L1.

6 Q: Can RS-70 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. 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 to replace all or part (approximately 25%) of the oil quantity in the compressor with POE. See guidelines for conversion.

7 Q: What is the main advantage of RS-70?
A: RS-70 is the direct replacement for R-22 with the lowest Global Warming Potential (GWP) on the market. RS-70 is one product to replace R-22 in all installations, except for flooded evaporators, which can only be substituted with RS-45. With RS-70 there is no need to change the original mineral lubricant and it operates satisfactorily in the full range of temperatures commonly found in R-22, both in high and low. Pressures allow operating with elements from the existing installation, without having to change anything. RS-70 is suitable with expansion valves (TXV) and with capillary (fixed orifice) systems. Because RS-70 is a direct replacement (Drop-In), it is the perfect solution for food industries that cannot stop their production to replace R-22 for R-404A.

8 Q: Can RS-70 be used to recharge an installation containing R-22?
A: The standard recommendation is not to mix refrigerants. Adding RS-70 to a R-22 system will not form an azeotropic blend thus will not generate higher pressures.
Not only theoretical tests but also trials carried out in existing installations suggest that RS-70 may be used to top up R-22 leaks in any proportion without affecting the performance of the equipment.

9 Q: Which is the compression ratio of RS-70?
A: Having high compression ratios could result in increased energy expenditure and damages to the compressor; RS-70 has a compression ratio equal to R-22.

10 Q: Is RS-70 as efficient as R-22?
A: Tests show that RS-70 has a higher coefficient of performance than R-22 and therefore, it is more efficient energetically.

11 Q: What tests have been carried out with RS-70, and what are the results?
A: In conversions from R-22 to RS-70, it has been verified that RS-70 is a direct replacement (Drop-In) and that no oil change or any other modifications are needed in the installation

12 Q: What is the RS-70 glide?
A: 4,2ºC approximately.

13 Q: Should RS-70 be charged in liquid or gas form?
A: Because RS-70 is a blend, it is recommended 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: Have containers of RS-70 dip tube?
A: It depends on the type of container. All blue containers of Gas Servei S.A. have it. In the case of not having it, it is recommended to reverse container.

15 Q: Is RS-70 included in Significant New Alternatives Policy Program (SNAP)?
A: Not yet, but the process has been initiated.

16 Q: How are RS-70 pressures compared to R-22?
A: The RS-70 pressure discharge is about 0,5bar higher than R-22.

17 Q: What is RS-70 capacity compared to R-22?
A: The capacity of RS-70 matches R-22 from high to low temperatures across the temperature range where R-22 is commonly found.

18 Q: How are the RS-70 operating temperatures compared to R-22?
A: RS-70 discharges temperature are lower than those of R-22.

19 Q: What are RS-70 flammability characteristics?
A: RS-70 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 RS-70 combustion?
A: The decomposition products resulting from RS-70 exposure to a high temperature source are similar to those formed by R-22 when exposed to fire. The decomposition products in each case are irritating and toxic, and self-contained breathing equipment should be used if such a possibility exists.

21 Q: Must any special precaution be taken when using RS-70?
A: No special precautions should be taken with RS-70. 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-70, so there is no need to take special care with moisture even though, the ingress of moisture is to be avoided at all times.

22 Q: Is RS-70 compatible with refrigeration and air conditioning systems designed for R-22?
A: Yes, RS-70 is compatible with all materials commonly used in systems that were designed and charged with R-22. As with R-22, magnesium and zinc alloys should be avoided.

23 Q: Can RS-70 be recovered and recycled?
A: Yes, RS-70 can be recovered and reused after a cleaning process, and delivered to an authorized waste manager for further regeneration.

24 Q: Which are the guidelines to change R-22 to RS-70?
A: The procedure to replace R-22 with RS-70 is simple. After recovering R-22 and fully evacuating, use the same type of lubricant, replace the filter / drier and introduce around the same amount of RS-70 as the original R-22 charge. See guidelines for conversion.

25 Q: What is the price of RS-70 compared to other alternatives?
A: RS-70 is competitive in price with regard to other R-22 substitutes.

26 Q: Is RS-70 approved by compressor manufacturers?
A: The individual components of RS-70 are widely used in compressors produced by the main manufacturers.

27 Q: What is the coefficient of performance (COP) of RS-70 compared to R-22?
A: Tests show that RS-70 provides higher COP than R-22, depending on the application and equipment.

28 Q: What is the specification of RS-70?
A: RS-70 complies with the specification of refrigerants ARI-700-04 for all the fluorocarbon refrigerants.

29 Q: What are the effects of high exposure by inhalation of RS-70?
A: As with all CFC, HCFC and HFC that are the base of refrigerants, high exposure to RS-70 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 and ignition temperature of RS-70?
A: RS-70 is listed as a non-flammable refrigerant, as defined in ASHRAE test EN 681-98 and therefore, has no flash point or explosion limits. The ignition temperature of RS-70 has not been determined, but is expected to exceed 750 ° C.

31 Q: Can RS-70 be used in flooded evaporator systems?
A: No.

32 Q: What kind of leak detectors should be used with RS-70?
A: You can use the same leak detectors as in HFC.

33 Q: What would be the effect of a RS-70 large release?
A: As with other refrigerants of the same kind, the area should be evacuated immediately. The vapour can concentrate at ground level and at poorly ventilated low areas so the dispersion can be slow. You must proceed to ventilate the area before entering it.

34 Q: Is RS-70 available in disposable bottles?
A: Yes, but only for export outside Europe.

35 Q: Can RS-70 be employed in systems originally designed for R-22 and then used with hydrocarbons (HC)?
A: Although there are not tests conducted with hydrocarbon systems intended to replace R-22, we believe that RS-70 would be appropriate for this, even though the mass of the refrigerant charge should be larger.