

HARP® 409A

The production of chlorofluorocarbons (CFCs) in the European Union ceased at the end of 1994 and, with the exception of a certain amount of reclaimed product, R-12 will no longer be available. Some years ago, **HARP® 134a** was identified as a long term replacement refrigerant in direct expansion high/medium temperature applications. However, technical difficulties can preclude its use at medium/low evaporating temperatures, due to a loss in refrigeration capacity, and in hermetic systems where a change in lubricant is not possible.

HARP® 409A is a non-flammable, zeotropic refrigerant blend of HCFC-22, HCFC-124 and HCFC-142b which has been specifically formulated as a “drop-in” retrofit replacement for R-12 in applications where conversion to R-134a is impractical. Being HCFC based, **HARP® 409A** is compatible with both mineral and alkylbenzene oils, commonly found in R-12 systems, and polyolesters. Therefore, no lubricant change is necessary, although compressor manufacturers’ recommendations regarding lubricity should be followed where possible. As a result, **HARP® 409A** can be retrofitted into both hermetic and semi-hermetic compressor systems. In addition, there are no system hardware changes and only a minor adjustment to the expansion valve, if fitted, is usually required. In common with all refrigerant blends, **HARP® 409A** should always be charged into systems in the liquid phase. An approximate 7% reduction in charge, on a weight basis is obtained on filling to a specific volume of liquid refrigerant. Please consult specific **HARP® 409A** conversion guidelines detailing full retrofit information for hermetic and semi-hermetic systems.

ENVIRONMENTAL PROPERTIES

Possessing an ozone depletion potential (ODP) of only 0.04, **HARP® 409A** offers a 96% reduction in ODP compared to R-12. In addition, its direct halocarbon global warming potential (HGWP) is 0.28, which is over ten times lower than that of R-12. This, combined with good energy efficiency, can result in a reduced system Total Equivalent Warming Impact (TEWI).

HARP® 409A: BASIC PROPERTY COMPARISON WITH R-12

	Harp® 409A	R-12
Bubble/boiling point at 1 atmosphere (°C):	-34.2	-29.8
Bubble/vapour pressure at 25°C (bara):	8.2	6.5
Density of saturated vapour at boiling point (g/cm³):	0.0049	0.0063
Density of saturated liquid at 25°C (g/cm³):	1.22	1.31
Critical temperature (°C):	107	112
Critical pressure (bara):	46	41
Latent heat of vapourisation at boiling point (kJ/kg):	226	165
Specific heat of liquid at 25°C (kJ/kg.°C):	1.23	1.0
Specific heat of vapour at 1 atmosphere, 25°C (kJ/kg.°C):	0.700	0.606
Temperature glide (K):	8.1	0
Flammability limits in air:	None	None
Ozone Depletion Potential (ODP):	0.04	1.0
Halocarbon global warming potential (HGWP):	0.28	3.0



System Operation and Performance

Detailed applications testing has shown that at low temperature, **HARP® 409A** will have similar operating pressures to R-12, whereas at high temperature, the refrigerant exhibits slightly higher pressures than R-12. **HARP® 409A** has demonstrated equal or better heat transfer characteristics and an increase in refrigeration capacity over R-12 and R-134a. Temperature glide along the evaporator is not a problem for intended applications. The use of **HARP® 409A** in mobile (automotive) air conditioning applications is not recommended.

HARP® 409A: ENGINEERING DATA

Temperature (°C)	Bubble Pressure (bara)	Dew Pressure (bara)	Density		Enthalpy (kJ/kg)	
			Liquid (kg/dm ³)	Vapour (kg/m ³)	Liquid	Vapour
-40	0.771	0.509	1.422	2.603	156.1	379.8
-38	0.848	0.565	1.416	2.867	157.2	380.9
-36	0.930	0.626	1.411	3.163	159.4	382.1
-34	1.02	0.691	1.405	3.451	161.5	383.2
-32	1.11	0.763	1.400	3.792	163.7	384.3
-30	1.22	0.839	1.394	4.147	165.9	385.4
-28	1.33	0.922	1.388	4.528	168.0	386.5
-26	1.44	1.01	1.383	4.936	170.2	387.6
-24	1.57	1.11	1.377	5.372	172.5	388.7
-22	1.70	1.21	1.371	5.838	174.7	389.8
-20	1.84	1.32	1.366	6.335	176.9	390.9
-18	1.99	1.44	1.360	6.865	179.2	392.0
-16	2.16	1.57	1.354	7.428	181.4	393.1
-14	2.32	1.70	1.348	8.028	183.7	394.2
-12	2.50	1.84	1.342	9.664	186.0	395.3
-10	2.69	2.00	1.336	9.339	188.3	396.3
-8	2.89	2.16	1.330	10.08	190.6	397.4
-6	3.10	2.33	1.324	10.81	192.8	398.5
-4	3.33	2.52	1.318	11.62	195.3	399.6
-2	3.68	2.71	1.312	12.46	197.8	400.6
0	3.81	2.92	1.306	13.36	200.0	401.6
2	4.07	3.13	1.299	14.31	202.4	402.7
4	4.35	3.36	1.293	15.31	204.8	403.7
6	4.64	3.61	1.287	16.36	207.2	404.8
8	4.94	3.86	1.280	17.47	209.6	405.8
10	5.25	4.13	1.274	18.64	212.1	406.8
12	5.59	4.42	1.267	19.87	214.6	407.8
14	5.93	4.71	1.281	21.16	217.0	408.8
16	6.30	5.03	1.254	22.52	219.6	409.7
18	6.68	5.36	1.247	23.95	222.1	410.7
20	7.07	5.70	1.241	25.45	224.6	411.7
22	7.49	6.06	1.234	27.03	227.2	412.8
24	7.92	6.44	1.227	28.69	229.7	413.5
26	8.37	6.84	1.220	30.43	232.3	414.4
28	8.83	7.25	1.212	32.25	235.0	415.3
30	9.32	7.69	1.205	34.17	237.6	416.2
32	9.83	8.14	1.198	36.18	240.3	417.1
34	10.4	8.61	1.191	38.29	242.8	417.9
36	10.9	9.10	1.183	40.50	245.7	418.7
38	11.5	9.62	1.176	42.82	248.4	419.6
40	12.1	10.2	1.168	45.25	251.1	420.3
50	15.3	13.2	1.127	59.31	266.3	423.9
60	19.2	16.8	1.083	77.24	280.4	426.8

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