HARP INTERNATIONAL

HARP® 408A

The production of chlorofluorocarbons (CFCs) in the European Union ceased at the end of 1994 and, with the exception of a certain limited amount of reclaimed product, R-502 will no longer be available. However, it is impossible, and indeed unnecessary, to change all existing equipment currently using this refrigerant. There is both an economic and logistic need to extend the life of installed plant beyond the date of CFC phase-out. **HARP® 408A** has been specifically developed to solve this problem in low temperature refrigeration systems.

BASIC PROPERTIES

HARP® 408A is a non-flammable, near-azeotropic blend of R-22, R-125 and R-143a which has been specifically formulated for retrofit use. Its properties closely match those of R-502 which make it useful for a variety of medium and low temperature refrigeration applications. Being HCFC based, **HARP® 408A** is compatible with both mineral and alkylbenzene oils, commonly found in R-502 equipment and polyolesters. As a result **HARP® 408A** can be retrofitted into both semi-hermetic and hermetic compressor systems. The bubble point of **HARP® 408A** is very similar to the boiling point of R-502 and the vapour pressures are almost identical. Most of the other refrigeration-specific properties such as critical temperature, critical pressure and vapour density are also similar, indicating that in retrofit applications the operating conditions will be almost identical. With a temperature glide of only 0.5 K, **HARP® 408A** will behave no differently to R-502.

ENVIRONMENTAL PROPERTIES

Possessing an ozone depletion potential (ODP) of only 0.02, **HARP® 408A** offers a 95% reduction in ODP compared to R-502. In addition, its direct halocarbon global warming potential (HGWP) is 0.54, which is over seven times lower than that of R-502. This, combined with excellent overall energy efficiency, can result in a significantly reduced system Total Equivalent Warming Impact (TEWI).

HARP® 408A: BASIC PROPERTY COMPARISON WITH R-502

	HARP® 408A	R-502
Bubble/boiling point at 1 atmosphere (°C):	-44.4	-45.4
Bubble/vapour pressure at 25°C (bara):	11.6	11.6
Density of saturated vapour at boiling point (g/cm³):	0.0048	0.0048
Density of saturated liquid at 25°C (g/cm³):	1.06	1.22
Critical temperature (°C):	83.5	82
Critical pressure (bara):	43.4	40.7
Latent heat of vapourisation at boiling point (kJ/kg):	227	172
Specific heat of liquid at 25°C (kJ/kg.°C):	1.53	1.25
Specific heat of vapour at 1 atmosphere, 25°C (kJ/kg.°C):	0.798	0.703
Temperature glide (K):	0.6	0
Flammability limits in air:	None	None
Ozone Depletion Potential (ODP):	0.02	0.34
Halocarbon global warming potential (HGWP):	0.75	4.01

RETROFIT

HARP® 408A is a "drop-in" replacement for R-502 and maybe used in hermetic and semi-hermetic systems. No hardware changes are necessary and only a minor adjustment to the expansion valve is usually required. In common with all refrigerant blends, **HARP® 408A** should always be charged into systems in the liquid phase. An approximate 15% reduction in charge, on a weight basis, is obtained on filling to a specific volume of liquid refrigerant. **HARP® 408A** will not significantly change in composition due to fractionation. **HARP® 408A** will facilitate acceptable oil return to the compressor with lubricants traditionally found in installed R-502 plant. Compressor manufacturers' recommendations regarding lubricity should be followed where possible. Please consult specific **HARP® 408A** conversion guidelines for full retrofit information.

PERFORMANCE

Laboratory testing and field experience with **HARP® 408A** in applications ranging from supermarkets to display cases and cold stores, have shown between a 15 and 50% reduction in equipment pull-down time, and reduced compressor run times over extended operational periods, compared to R-502. In terms of efficiency, **HARP® 408A** exhibits up to an 8% improvement in refrigeration capacity and coefficient of performance in optimised systems, which will result in significantly reduced levels of energy consumption.

HARP® 408A: ENGINEERING DATA

Absolute pressure (bar)	Dew Temperature (°C)	Bubble Temperature (°C)	Density		Enthalpy (kJ/kg)	
			Liquid (kg/dm³)	Vapour (kg/m³)	Liquid	Vapour
0.5	-58.5	-57.8	1.334	2.473	130.7	364.9
0.6	-55.0	-54.3	1.324	2.930	134.4	367.0
0.7	-52.0	-51.3	1.315	3.381	137.7	398.8
0.8	-49.3	-48.7	1.308	3.628	140.7	370.4
0.9	-46.9	-46.2	1.301	4.271	143.4	371.8
1.0	-44.7	-44.0	1.294	4.711	145.9	373.1
2.0	-28.7	-28.1	1.247	9.011	164.2	382.4
3.0	-18.2	-17.7	1.215	13.22	176.8	388.4
4.0	-10.2	-9.6	1.189	17.41	186.9	392.8
5.0	-3.5	-3.0	1.167	21.60	195.4	396.2
6.0	2.2	2.6	1.147	25.81	202.9	399.1
7.0	7.2	7.6	1.130	30.06	209.6	401.5
8.0	11.7	12.1	1.113	34.36	215.9	403.5
9.0	15.8	16.2	1.098	38.71	221.6	405.3
10	19.5	19.9	1.084	43.12	227.1	406.8
11	23.0	23.4	1.070	47.61	232.2	408.1
12	26.3	26.7	1.056	52.16	237.1	409.3
13	29.3	29.7	1.044	56.80	241.8	410.3
14	32.2	32.6	1.031	61.53	246.3	411.2
15	34.9	35.3	1.019	66.35	250.7	412.0
16	37.6	37.9	1.007	71.27	255.0	412.6
17	40.0	40.4	0.995	76.30	259.1	413.2
18	42.4	42.8	0.984	81.45	263.2	413.6
19	44.7	45.0	0.972	86.72	267.1	414.0
20	46.9	47.2	0.961	92.12	271.0	414.2
21	49.0	49.3	0.949	97.67	274.8	414.4
22	51.0	51.4	0.938	103.4	278.6	414.5
23	53.0	53.3	0.927	109.2	282.3	414.6
24	54.9	55.2	0.915	115.3	286.0	414.5

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