



R-600a (Isobutane)

Characteristics and applications

Isobutane, or R-600a, is a hydrocarbon that is used in some refrigeration equipment, such as domestic fridges or small commercial refrigerated appliances. The volumetric capacity of R-600a is approximately 50% less than that of R-12 and R-134a, so it cannot be used a replacement for them.

When working with hydrocarbon refrigerants, it is very important that they are very pure, as if there are any impurities present (sulphur, water, etc.) it could cause the oil lubricants in the system to degrade and damage the compressors, among other things. Furthermore, if the hydrocarbon is not very pure it can sometimes be mixed with other hydrocarbons, which can drastically alter the physical and thermodynamic properties of the original hydrocarbon.

The isobutane that is used in refrigeration applications is not odourised, as it is when used for domestic purposes (domestic hydrocarbons are odourised so they a leak can be detected quickly). It is therefore not easily detectable when there is a leak.

Physical properties

MOLECULAR WEIGHT	BOILING TEMPERATURE (°C)	CRITICAL TEMPERATURE (°C)	CRITICAL PRESSURE (BAR. ABS.)	GLIDE TEMPERATURE (°C)	LATENT HEAT AT 25°C (KJ/KG)
58.1	-11.7	135	36.45	0	332

Compatible oils

As is the case with all other kinds of hydrocarbon refrigerants, isobutane is generally highly miscible with all types of lubricants. As mineral oils and these refrigerants are highly soluble together, it may be necessary with some systems to use more viscous oils to compensate for this increased solubility.

Lubricants that contain silicone or silicates are not recommended. We would recommend that you follow the instructions in any case, or that you use the lubricants recommended by the compressor manufacturer.

LUBRICANT	COMPATIBILITY
MINERAL (M)	Compatible with hydrocarbon type refrigerants. They have excessive solubility in high temperature applications. This situation can be compensated by using higher viscosity mineral oils.
ALKYBENZENIC (AB)	Fully compatible.
SEMI-SYNTHETIC (M+AB)	The mixture of mineral and alkybenzene oil is the most appropriate to work with this type of refrigerant.
POLYOLESTER (POE)	Too much solubility with hydrocarbons. May require using POE of higher viscosities.
POLYALKYLENEGLYCOLS (PAG)	Soluble, depending on working conditions.
POLYALPHAOLEFINES (PAO)	Soluble, recommended for low temperature applications.

In any event, our advice is to always check with the compressor manufacture to determine the type and viscosity of oil that you should use.



Compatibility with materials

Almost all elastomers and plastomers that can be found in refrigeration systems are compatible with hydrocarbons. The non-compatible materials that should be avoided are EPDM rubber, natural rubber and silicones.

Flammability of isobutane

REFRIGERANT	LOWER FLAMMABILITY LIMIT		AUTOIGNITION TEMPERATURE (°C)
	% BY VOLUME	WEIGH (Kg/m3)	
R-600a (Isobutane)	1.8	0.043	460

Pressure / temperature table

TEMP. (°C)	ABSOLUTE PRESSURE (bar)	DENSITY (Kg/m3)		ENTHALPY (kJ/Kg)		ENTROPY (kJ/Kg.K)	
		BUBBLE	DEW	BUBBLE	DEW	BUBBLE	DEW
-40	0.29	624.12	0.88	112.51	501.35	0.65	2.32
-35	0.37	618.89	1.10	123.04	507.85	0.70	2.32
-30	0.47	613.61	1.37	133.68	514.40	0.74	2.31
-25	0.58	608.27	1.69	144.43	520.99	0.79	2.30
-20	0.72	602.88	2.07	155.30	527.61	0.83	2.30
-15	0.89	597.41	2.51	166.29	534.26	0.87	2.30
-10	1.08	591.88	3.01	177.40	540.93	0.92	2.30
-5	1.31	586.27	3.59	188.63	547.63	0.96	2.30
0	1.57	580.58	4.26	200.00	554.34	1.00	2.30
5	1.87	574.80	5.01	211.50	561.06	1.04	2.30
10	2.21	568.92	5.87	223.15	567.78	1.08	2.30
15	2.59	562.95	6.83	234.94	574.50	1.12	2.30
20	3.02	556.86	7.91	246.88	581.21	1.16	2.31
25	3.51	550.65	9.13	258.98	587.90	1.21	2.31
30	4.05	544.31	10.48	271.24	594.57	1.25	2.31
35	4.65	537.83	11.99	283.67	601.21	1.29	2.32
40	5.31	531.19	13.67	296.28	607.80	1.33	2.32
45	6.04	524.37	15.53	309.07	614.34	1.37	2.33
50	6.85	517.37	17.60	322.06	620.82	1.41	2.33