



## TECHNICAL DATA SHEET

## R-456A

### Features

R-456A refrigerant gas is a non-flammable, zeotropic HFC+HFO mixture, an alternative to R-134a for existing installations in the automotive sector. Like the entire HFC+HFO refrigerant family, it is ozone friendly. Its safety classification is A1 group L1, i.e. it has low toxicity and is non-flammable.

- High efficiency, high critical temperature, and low critical pressure.
- The mass flow of R-456A is very similar to that of R-134a.
- Safety classification: A1 / Low toxicity - Non-flammable.
- It has an Ozone Depletion Potential (ODP) equal to 0.
- The Global Warming Potential (GWP) is 687.
- Heating capacity similar to R-134a.
- Discharge temperature similar to R-134a.
- It is compatible with PAG and POE oils.

### Applications

- It is an alternative to R-134a either for **new installations** or as a direct drop-in replacement for **existing automotive air conditioning installations**.
- Eventually, it can be used as a top up gas in any proportion without the need to completely replace R-134a, although the exact proportions of the resulting mixture inside the circuit will make it impossible to accurately assess the operating parameters of the system.
- When R-456A is used as a full replacement for R-134a, improvements in cooling capacity in the order of 10% are achieved.

### Working and service conditions

- **Because R-456A is a zeotropic gas mixture, the transfer must always be done in the liquid phase.**
- Its glide is 4.8 °C. In case of major leaks, it is recommended to recover the remaining gas in the circuit before recharging.
- R-134a detectors are also useful for R-456A as it contains about 45% of R-134a itself.

## Lubricants

R-456A is designed to work with the same lubricants as R-134a and R-1234ze, so there is no need for an oil change when the system is converted to R-456A. In case the system requires additional lubrication, THUNDER® PAG or THUNDER® POE are the recommended options.

Typically, automotive systems use PAG oils, although some modern car types may use POE oils, in these cases use THUNDER® POE. Always check the original oil type of the equipment and use one from the THUNDER® range of the same type and viscosity.

In any case, always check with the manufacturer for the recommended viscosity.

## Environmental data

- R-456A contains no chlorine, so its ODP (Ozone Depleting Potential) equals 0.
- R-456A has a GWP (Global Warming Potential) equal to 687. a reduction of more than 50% compared to R-134a with a GWP equal to 1.430.
- This product has no potential for bioaccumulation.
- It is also considered a product with low toxicity to aquatic organisms, be they invertebrates, fish, or algae.

## Toxicity, safety, and storage

R-456A is a very low toxicity substance.

Animal studies of its components have shown that repeated exposure does not produce teratogenic (reproductive) effects. Furthermore, it is unlikely to present a carcinogenic risk to man.

R-456A containers should be stored in cool, ventilated places below 50°C, away from open flames, sparks, and heat sources. Avoid storage near the intake of air conditioning units, boilers, or open drains.

## Components

Chemical name	% by weight	CAS Number	EC Number
1.3.3.3-Tetrafluoroprop-1-ene (R-1234ze-E)	49	29118-24-9	471-480-0
1.1.1.2-Tetrafluoroethane (R-134a)	45	811-97-2	212-377-0
Difluoromethane (R-32)	6	75-10-5	200-839-4

## Physical properties

Property	Units	R-456A	R-134a
Molecular weight	g/mol	101.42	102
Liquid density (at 25°C)	Kg/l	1.164	1.206
Liquid density (at 0°C)	Kg/l	1.250	1.293
Boiling point (at 1 atm)	°C	-30.8	-26.1
Glide	K	4.8	0
Liquid viscosity (25°C)	cP	0.18	0.202
Vapour viscosity (25°C)	cP	0.012	-
Surface tension	mN/m	8.20	8.09
Vapour pressure (25°C)	bar	7	6.66
Specific heat of liquid (25°C)	kJ/kg·K	1.434	1.44
Specific heat of vapour (25°C)	kJ/kg·K	1.020	0.85
Freezing point	°C	< -100	-103
Critical pressure	bara	41.7	40.67
Critical density	Kg/l	0.475	0.508
Heat of vaporisation at boiling point (25°C)	kJ/kg	176.2	217.2
Vapour density at boiling point	Kg/l	0.514	0.528
Thermal conductivity in liquid phase (25°C)	W/m·K	0.080	
Thermal conductivity in vapour phase (25°C)	W/m·K	0.014	
Toxicity limit ATEL/ODL	Kg/m <sup>3</sup>	0.320	
LFL (Low Flammable Limit)	% v/v	Non-flammable	Non-flammable
ODP		0	0
GWP		687*	1,430*
Toxicity		No	No

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

## Packaging for R-456A

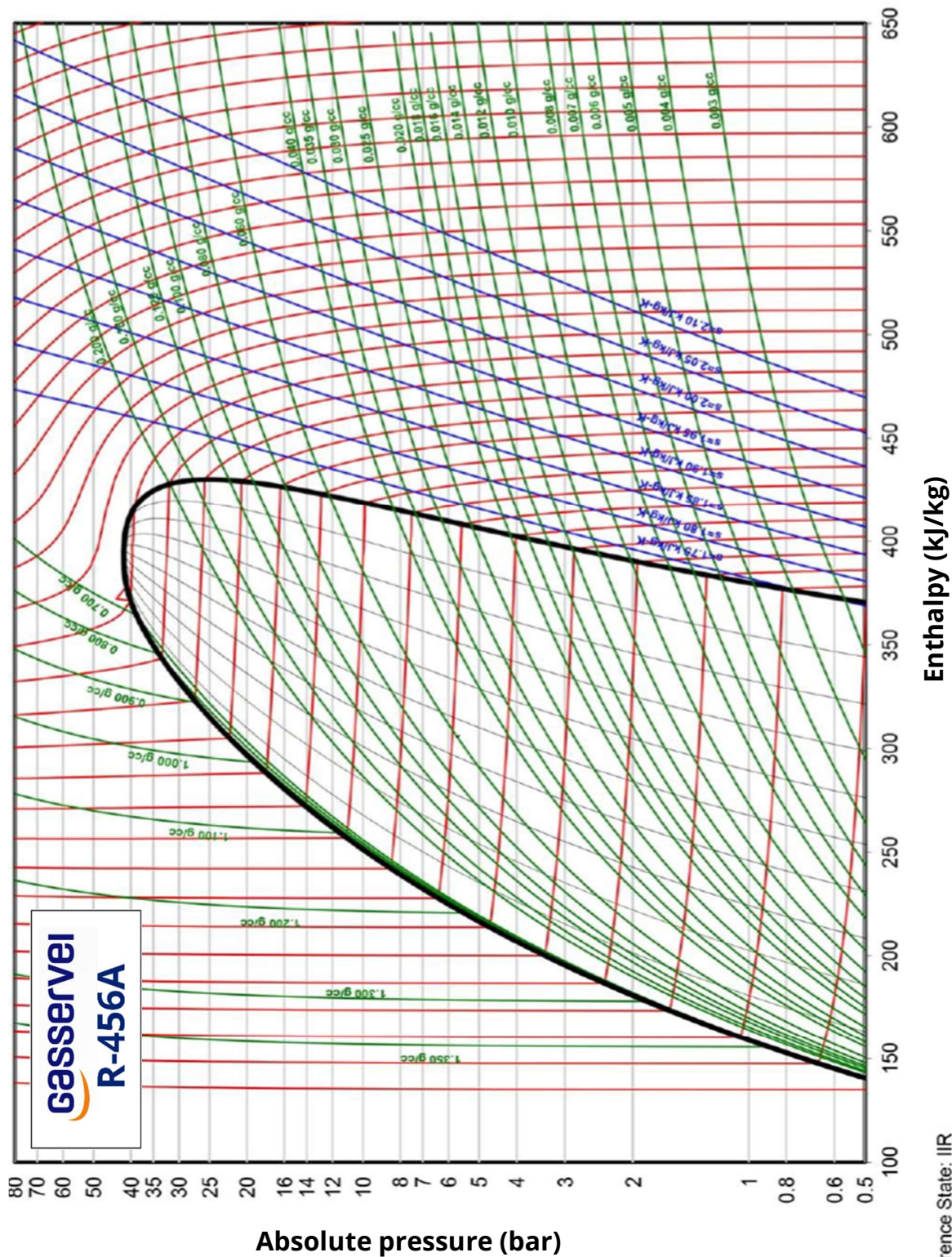
Refillable R-456A containers must comply with the following specifications:

- Green warhead.
- Right-hand thread.
- Minimum test pressure: 32 bar

**Pressure/Temperature tables**

Temperature °C	Absolute pressure		Density		Enthalpy		Entropy	
	Bubble bar	Dew bar	Liquid Kg/m <sup>3</sup>	Vapour Kg/m <sup>3</sup>	Liquid kJ/Kg	Vapour kJ/Kg	Liquid kJ/Kg-K	Vapour kJ/Kg-K
-20	1.60	1.29	1.310	6.52	173.4	383.7	0.899	1.737
-18	1.74	1.40	1.304	7.07	176.0	385.0	0.910	1.735
-16	1.88	1.52	1.298	7.65	178.6	386.3	0.920	1.734
-14	2.03	1.66	1.292	8.27	181.3	387.6	0.930	1.732
-12	2.19	1.80	1.296	8.94	183.9	388.9	0.940	1.731
-10	2.36	1.94	1.280	9.64	186.6	390.1	0.950	1.730
-8	2.55	2.10	1.274	10.39	189.2	391.4	0.960	1.728
-6	2.74	2.27	1.268	11.18	191.9	392.7	0.970	1.727
-4	2.94	2.45	1.262	12.02	194.6	393.9	0.980	1.726
-2	3.15	2.64	1.255	12.90	197.3	395.2	0.990	1.725
0	3.38	2.84	1.249	13.84	200.0	396.4	1.000	1.724
2	3.62	3.05	1.243	14.83	202.7	397.7	1.010	1.723
4	3.87	3.28	1.236	15.88	205.4	398.9	1.020	1.723
6	4.13	3.51	1.230	16.99	208.2	400.1	1.029	1.722
8	4.40	3.76	1.223	18.16	210.9	401.3	1.039	1.721
10	4.69	4.02	1.217	19.39	213.7	402.5	1.049	1.720
12	5.00	4.30	1.210	20.68	216.5	403.7	1.058	1.720
14	5.32	4.59	1.203	22.05	219.2	404.8	1.068	1.719
16	5.65	4.89	1.196	23.49	222.0	406.0	1.078	1.718
18	6.00	5.21	1.189	25.01	224.9	407.1	1.087	1.718
20	6.37	5.55	1.182	26.60	227.7	408.3	1.097	1.717
22	6.75	5.90	1.175	28.28	230.5	409.4	1.106	1.717
24	7.15	6.27	1.168	30.05	233.4	410.5	1.116	1.716
26	7.57	6.66	1.161	31.90	236.2	411.6	1.125	1.715
28	8.00	7.06	1.153	33.86	239.1	412.7	1.135	1.715
30	8.45	7.48	1.146	35.91	242.0	413.7	1.144	1.714
32	8.93	7.92	1.138	38.07	245.0	414.8	1.154	1.714
34	9.42	8.38	1.131	40.33	247.9	415.8	1.163	1.713
36	9.93	8.86	1.123	42.72	250.8	416.8	1.173	1.713
38	10.46	9.36	1.115	45.22	253.8	417.8	1.182	1.712
40	11.01	9.88	1.107	47.85	256.8	418.7	1.192	1.712
42	11.59	10.43	1.098	50.62	259.8	419.7	1.201	1.711
44	12.18	10.99	1.090	53.54	262.9	420.6	1.211	1.711
46	12.80	11.58	1.082	56.60	265.9	421.5	1.220	1.710
48	13.44	12.19	1.073	59.82	269.0	422.3	1.229	1.710
50	14.10	12.83	1.064	63.22	272.1	423.1	1.239	1.709
52	14.79	13.49	1.055	66.80	275.2	423.9	1.248	1.708
54	15.51	14.17	1.046	70.57	278.4	424.7	1.258	1.708
56	16.24	14.89	1.036	74.54	281.6	425.4	1.267	1.707
58	17.01	15.63	1.027	78.74	284.8	426.1	1.277	1.706
60	17.80	16.39	1.017	83.18	288.1	426.8	1.286	1.705

**Mollier diagram**



Reference State: IIR  
 $h = 200 \text{ kJ/kg}$ ,  $s = 1.0 \text{ kJ/kg-K}$   
 @ sat. liq at  $0^\circ\text{C}$

## Q&A about R-456A

### *What is R-456A?*

R-456A is a drop-in replacement for R-134a for automotive air conditioning applications, with no ozone impact (ODP=0) and lower GWP.

### *Yes, but what does R-456A contain?*

R-456A is a mixture of HFOs and HFCs (R-1234ze-E, R-134a, R-32).

### *Is R-456A non-flammable and non-toxic?*

R-456A is non-toxic and non-flammable under all conditions of fractionation according to ASTM 681-98. It belongs to group L1.

### *What is the main advantage of R-456A?*

R-456A is the direct replacement for R-134a for the automotive sector, with a lower GWP. R-456A can be used in R-134a equipment without the need to change the original oil and works satisfactorily over the entire temperature range common in this type of equipment, at both high and low pressures.

### *Can R-456A be used to recharge an installation containing R-134a?*

The standard recommendation is not to mix refrigerants, although general knowledge and experience suggests that R-456A can be used to recharge R-134a leaks without affecting system performance.

### *What happens if there is still a small amount of R-134a left in the recharging station after a recovery and vacuum?*

As R-456A contains 45 % R-134a in its formulation, it is not a problem that small quantities remain.

### *How stable is the composition of R-456A?*

The composition remains stable and within specification as long as the internal cylinder of the refuelling station maintains a minimum of 40 % of the fill.

### *What happens if the internal cylinder of the refuelling station equipment is below 40 % of its filling capacity?*

If it falls below the 40 % level, there is a possibility that the composition of R-456A will be out of specification, however, no significant deviations in performance are to be expected.

### *Is it necessary to flush the system when retrofitting to R-456A?*

No, if the equipment to be converted is in good condition.

### *Is there a difference between charging with R-456A and R-134a?*

It should never be recharged with any refrigerant, as this does not allow the total amount of refrigerant charge in the vehicle to be measured. Preferably, the gas contained in the vehicle system should be drained and recovered and recharged with the correct amount of R-456A according to the guidelines.

Remember that it is mandatory to comply with applicable laws and regulations when servicing air conditioning systems.

### *What is the technical guidance for switching from R-134a to R-456A?*

The procedure for conversion from R-134a to R-456A is simple. After recovering the R-134a and vacuuming, use the same type of lubricant, change the filter/dryer, and introduce approximately the same amount of R-456A as the original R-134a. See conversion guidelines.

### *What should be done with the oil that comes out with the (recovered) R-134a charge?*

If the oil in the system is unknown and for safety, it is recommended that any oil be recovered and discarded, and then replaced with THUNDER® PAG or POE. Consult the manufacturer for recommended oil type and viscosity.

### *Is there a different oil recovery rate?*

The oil recovery rate shall be similar to that of R-134a.

### *What to do in case of leakage?*

Equipment can be refilled in case of leakage.

*Can the same leak detection devices be used as with R-134a?*

Yes, as R-456A contains a percentage of R-134a, therefore, leak detection equipment suitable for R-134a is also suitable for use with R-456A.

*Is R-456A compatible with tracer additives?*

Yes, additives are compatible.

*What is the compression ratio of R-456A?*

Higher compression ratios may lead to increased energy consumption and damage to the compressor. R-456A has a similar compression ratio to R-134a.

*What is the COP and overall performance of R-456A compared to R-134a?*

The COP is comparable and even slightly higher than that obtained with R-134a. Although it is true that the system can absorb slightly more power in the compressor with R-456A, it also cools down faster thanks to its higher cooling capacity, which results in an overall performance on the test bench (Climatic Wind Tunnel) equal to or even better than that of R-134a.

*What to do if there is suspicion that R-456A does not meet specifications or is mixed with R-134a?*

Recover the gas in a recovery container and contact Gas Servei to analyse it and evaluate the possibility of regenerating it or, if this is not possible, send it for destruction.