



Low- and Medium-  
Temperature Refrigeration

Reduced GWP and Discharge Temperature for  
Transport Refrigeration, Plug-Ins and Condensing Units  
**Solstice® 452A (R-452A)**



# Characteristics

Solstice® 452A (R-452A) is a non-ozone-depleting, nonflammable, zeotropic blend designed to serve as a lower global-warming-potential (GWP) alternative to R-404A and R-507 for low- and medium-temperature applications in existing and new systems. A key feature of Solstice 452A is its matched compressor discharge temperature of R-404A and R-507 at both low- and medium-temperature conditions, helping to further minimize application and retrofit costs. Plus, it provides a close capacity match to R-404A and similar energy efficiency.

# Applications

Solstice 452A is an excellent refrigerant option for direct expansion refrigeration low- and medium-temperature applications, including commercial and industrial refrigeration, condensing units, plug-ins and transport refrigeration like trucks and trailers, powered vans or reefer containers. With 45 % GWP reduction (IPCC 4) and close performance to R-404A, end-users can combine the same capacity and efficiency with more sustainable performance and lower environmental impact. In transport refrigeration, according to end users, R-452A has the same cooling capacity, fuel efficiency, reliability and refrigerant charge as R-404A.\*

\*Source: Carrier news, April 14th 2015



## Physical Properties

Class/Type	Zeotropic blend
Formula	30%/11%/59% R-1234yf/R-32/R-125
Kind	HFC/HFO
Appearance	Colorless
ODP (ODP-R11=1)	0
GWP rev/4th IPCC (GWP rev/5th IPCC)	2.140 (1.945)
ASHRAE Std. 34 Safety Class	A1
REACH	Registered
<b>Units</b>	<b>SI</b>
Molecular weight	103.5 g/mol
Boiling temperature	-47.0 °C
Critical temperature	75.1 °C
Critical pressure	40.1 bar
Critical volume	0.00197 m <sup>3</sup> /kg
Critical density	506.66 kg/m <sup>3</sup>
Vapour density at boiling point	4.79 kg/m <sup>3</sup>
Liquid density at 0 °C	1237 kg/m <sup>3</sup>
Liquid density at 25 °C	1125.5 kg/m <sup>3</sup>
Vapor density at 25 °C	64.1 kg/m <sup>3</sup>
Liquid heat capacity at 25 °C	1.47 kJ/kg °K
Vapour heat capacity at 25 °C	1.10 kJ/kg °K
Vapour pressure at 25 °C	1188.0 kPa
Liquid thermal conductivity at 25 °C	66.8 mW/m °K
Vapor thermal conductivity at 25 °C	14.8 mW/m °K
Liquid viscosity at 25 °C	135.9 µPa sec
Vapour viscosity at 25 °C	12.8 µPa sec



## Pressure and temperature

Pressure (kPa)	Liquid (Bubble) Temperature (°C)	Vapor (Dew) Temperature (°C)
100	-47.20	-43.41
150	-38.52	-34.67
200	-31.87	-27.99
250	-26.40	-22.50
300	-21.72	-17.81
350	-17.60	-13.68
400	-13.91	-9.99
450	-10.55	-6.63
500	-7.46	-3.54
550	-4.60	-0.68
600	-1.92	1.98
650	0.59	4.49
700	2.97	6.85
750	5.22	9.09
800	7.36	11.22
850	9.40	13.24
900	11.36	15.18
950	13.24	17.04
1000	15.05	18.83
1050	16.79	20.55
1100	18.47	22.21
1150	20.09	23.82
1200	21.67	25.37
1250	23.19	26.87
1300	24.68	28.33
1350	26.12	29.75
1400	27.52	31.12
1450	28.89	32.46
1500	30.22	33.77
1550	31.52	35.04
1600	32.79	36.28
1650	34.03	37.49
1700	35.24	38.68
1750	36.43	39.83
1800	37.59	40.96
1850	38.73	42.07
1900	39.84	43.16
1950	40.94	44.22
2000	42.01	45.26
2050	43.07	46.28

Pressure (kPa)	Liquid (Bubble) Temperature (°C)	Vapor (Dew) Temperature (°C)
2100	44.10	47.28
2150	45.12	48.27
2200	46.12	49.23
2250	47.11	50.18
2300	48.08	51.11
2350	49.03	52.03
2400	49.97	52.93
2450	50.89	53.81
2500	51.80	54.68
2550	52.70	55.54
2600	53.58	56.38
2650	54.45	57.21
2700	55.31	58.02
2750	56.16	58.82
2800	57.00	59.61
2850	57.82	60.39
2900	58.64	61.16
2950	59.44	61.91
3000	60.24	62.66
3050	61.02	63.39
3100	61.80	64.11
3150	62.56	64.82
3200	63.32	65.52
3250	64.07	66.21
3300	64.81	66.89
3350	65.54	67.56
3400	66.27	68.22
3450	66.98	68.86
3500	67.69	69.50
3550	68.39	70.12
3600	69.09	70.74
3650	69.78	71.34
3700	70.47	71.93
3750	71.15	72.51
3800	71.83	73.07
3850	72.51	73.62
3900	73.19	74.14
3950	73.88	74.63
4000	74.65	75.04

## Safety and storage

Honeywell recommends reading the Safety Data Sheet (SDS) before using the product. Solstice 452A is a nonflammable refrigerant (ASHRAE class A1). Solstice 452A has similar storage and handling requirements to R-404A in bulk and cylinder, since according to the compressed gas classification it is nonflammable.

## Leaks and leak detection

If a large release of Solstice 452A vapour occurs, take the same measures as you would with R-404A. Hand-held leak detectors can be used for pinpointing leaks. For monitoring an entire room on a continual basis, leak monitors are available. Leak detection is important for protection of those in proximity of the system, refrigerant conservation, equipment protection and performance, and reduction of emissions. Customers should consult the equipment manufacturer for appropriate detectors.

## Key benefits of Solstice 452A

- GWP of 2.140 (IPCC 4), more than 45 % reduction compared to R-404A
- Mimics R-404A performance
- Similar discharge temperature to R-404A/R-507
- Similar mass flow to R-404A/R-507
- Direct replacement for R-404A/R-507
- Known system technology
- Similar service standards as R-404A
- Same skills for technicians
- Similar storage and handling requirements to R-404A
- Approved and adopted by major components and equipment manufacturers

## Material compatibility

Honeywell does not recommend the use of traditional chlorinated solvents, such as trichloroethylene, dichloroethylene, etc., to clean refrigeration systems or components. Honeywell strongly recommends the use of either Solstice® EZ Flush or Solstice® PF-C/ Ekoflush™ system for this job. More information regarding Honeywell's flush solutions can be found at [www.honeywell-solvents.com](http://www.honeywell-solvents.com)

## Desiccants

Desiccant driers compatible with Solstice 452A are commercially available. Contact individual drier manufacturers for specific recommendations.

## Lubricants

POE (polyolester) oil is recommended for use with Solstice 452A. Compressor manufacturers typically qualify specific lubricants for use with their products. Users should check with the equipment manufacturer for the recommended lubricants for their system.

## Plastics and elastomers

Solstice 452A is compatible with most common materials. Since there are many different grades and formulations of these materials, we recommend that compatibility testing be performed on the specific grade of materials under consideration and at the conditions of use when designing new systems. Customers should consult the manufacturer or conduct further independent testing.





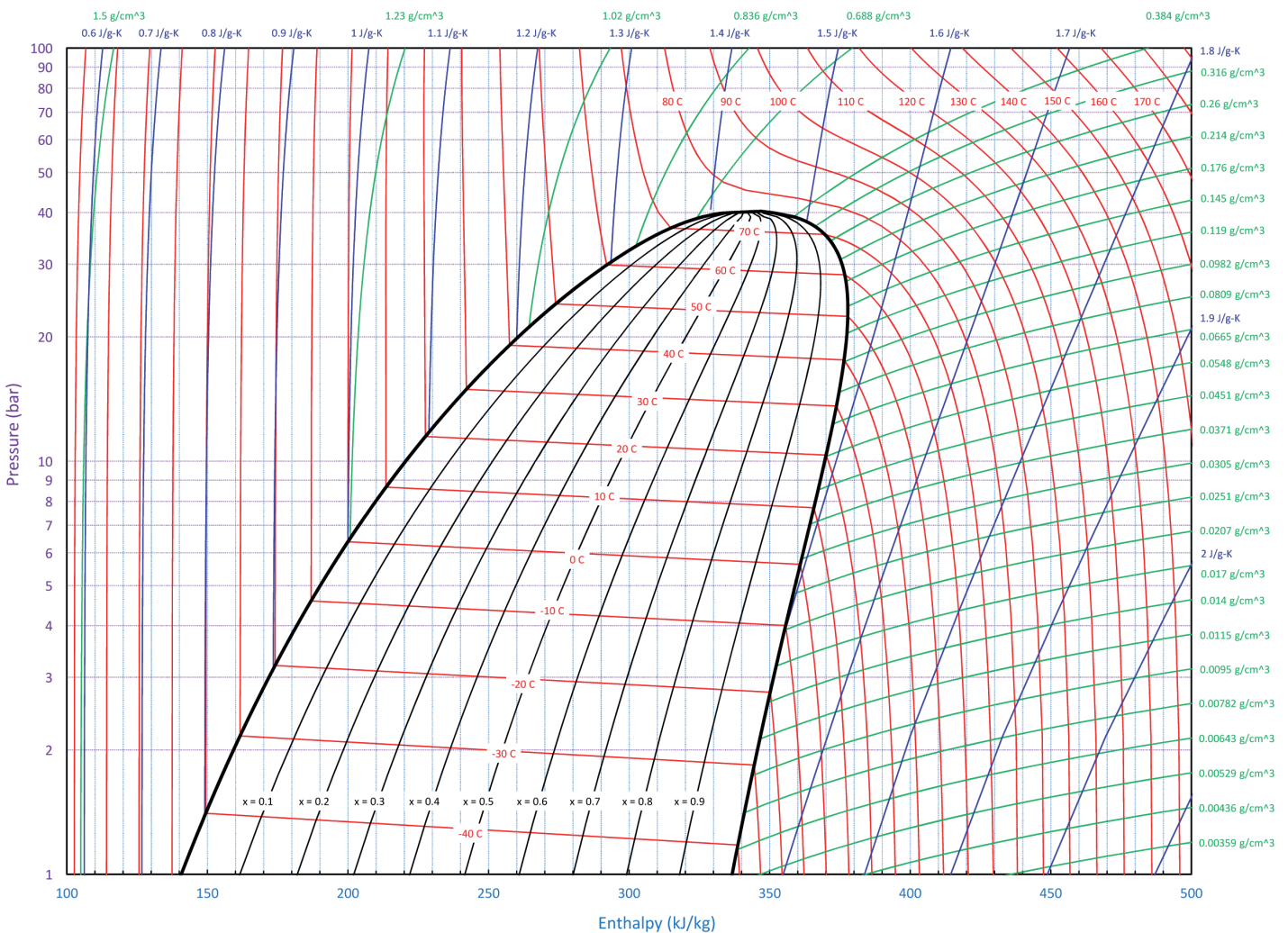
## Independent verification

Solstice® 452A has been extensively tested by components and equipment manufacturers. Equipment trailer refrigeration units and condensing units have been launched with R-452A. The use as direct drop-in to R-404A or R-507-based systems in direct expansion has been endorsed by several compressors manufacturers, whose tests have demonstrated similar capacity, efficiency and discharge temperature to R-404A.

## Retrofit guidelines

Solstice 452A has similar capacity, efficiency, mass flow and discharge temperature to R-404A. It can be retrofitted to direct expansion systems using R-404A/R-507 without change of components and without expansion valves adjustment. As it closely matches characteristics and performance of R-404A/R-507, using Solstice 452A as a replacement for R-404A/R-507 results in time and cost savings during a retrofit. Solstice 452A has a moderate temperature glide between about 3 °K and 4 °K, depending upon pressure. When dealing with blends, pressure-temperature tables are presented with two pressures listed for each temperature: the dew pressure and the bubble pressure. The dew pressure is used for determining the system pressure when the refrigerant is in a saturated vapour or superheated condition (i.e., on the suction and discharge sides of the compressor). The bubble pressure is used for determining the system pressure when the refrigerant is in a saturated liquid or subcooled condition (i.e., at the inlet to the expansion valve or capillary tube). Solstice 452A must be only liquid charged into a system to ensure proper refrigerant composition and system performance.

## Pressure and enthalpy



Reference State:  $h = 200 \text{ kJ/kg}$ ,  $s = 1.00 \text{ kJ/kg-K}$ , sat. liq. at  $0^\circ\text{C}$

## Solstice® Family of Refrigerants

Solstice® HFO molecules			
Low and medium pressure applications			
Legend: GWP (IPCC AR4/IPCC AR5)	Nonflammable (ASHRAE A1)	Mildly flammable (ASHRAE A2L)	Examples of potential applications
R-134a GWP 1430/1300	-	Solstice® yf GWP 4/<1	Auto A/C, Vending, Refrigerators
	-	Solstice® ze GWP 7/<1	Chillers, CO <sub>2</sub> Cascades, Refrigerators
R-123 GWP 77/79	Solstice® zd GWP 5/1	-	Centrifugal Chillers, High-Temperature Heatpumps

Solstice® blends			
Medium and high pressure applications			
Legend: GWP (IPCC AR4/IPCC AR5)	Nonflammable (ASHRAE A1)	Mildly flammable (ASHRAE A2L)	Examples of potential applications
R-134a GWP 1430/1300	Solstice® N13 (R-450A) GWP 605/547	-	Chillers, Medium-Temperature Refrigeration, Appliances
R-404A GWP 3922/3943	Solstice® N40 (R-448A) GWP 1387/1273	Solstice® L40X (R-455A) GWP 148/146	Low-Temperature Refrigeration, Transport
	Solstice® 452A (R-452A) GWP 2140/1945	-	
R-22 GWP 1810/1760	-	Solstice® L20 (R-444B)* GWP 296/295	Stationary A/C, Refrigeration
R-410A GWP 2088/1924	-	Solstice® L41y (R-452B)* GWP 698/676	Stationary A/C, Heatpumps

\* Coming soon

### For more information

[www.honeywell-refrigerants.com/europe](http://www.honeywell-refrigerants.com/europe)

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