

# ISO 17584:2022-08 (E)

## Refrigerant properties

---

<b>Contents</b>		<b>Page</b>
Foreword .....		vi
Introduction .....		vii
<b>1</b>	<b>Scope .....</b>	<b>1</b>
<b>2</b>	<b>Normative references .....</b>	<b>1</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>1</b>
<b>4</b>	<b>Calculation of refrigerant properties .....</b>	<b>2</b>
4.1	General .....	2
4.2	Pure-fluid equations of state .....	3
4.3	Mixture equation of state .....	5
4.4	Implementation .....	7
4.5	Alternative implementation .....	7
4.6	Testing implementations against requirements .....	7
<b>5</b>	<b>Specifications for individual refrigerants .....</b>	<b>7</b>
5.1	General .....	7
5.2	R744 -- Carbon dioxide .....	7
5.2.1	Range of validity .....	7
5.2.2	Reducing parameters, molar mass, and gas constant .....	9
5.2.3	Reference state parameters .....	9
5.3	R717 -- Ammonia .....	10
5.3.1	Range of validity .....	10
5.3.2	Coefficients and exponents of the ideal-gas part [Formulae (3) to (5)] .....	10
5.3.3	Coefficients and exponents of the real-gas part [Formula (2)] .....	10
5.3.4	Reducing parameters, molar mass, and gas constant .....	11
5.3.5	Reference state parameters .....	11
5.4	R12 -- Dichlorodifluoromethane .....	14
5.4.1	Range of validity .....	14
5.4.2	Reducing parameters, molar mass, and gas constant .....	15
5.4.3	Reference state parameters .....	15
5.5	R22 -- Chlorodifluoromethane .....	18
5.5.1	Range of validity .....	18
5.5.2	Reducing parameters, molar mass, and gas constant .....	19
5.5.3	Reference state parameters .....	20
5.6	R32 -- Difluoromethane .....	22
5.6.1	Range of validity .....	22
5.6.2	Reducing parameters, molar mass, and gas constant .....	23
5.6.3	Reference state parameters .....	23
5.7	R123 -- 2,2-dichloro-1,1,1-trifluoroethane .....	26
5.7.1	Range of validity .....	26
5.7.2	Reducing parameters, molar mass, and gas constant .....	27
5.7.3	Reference state parameters .....	27
5.8	R125 -- Pentafluoroethane .....	30
5.8.1	Range of validity .....	30
5.8.2	Reducing parameters, molar mass, and gas constant .....	31
5.8.3	Reference state parameters .....	31
5.9	R134a -- 1,1,1,2-tetrafluoroethane .....	33
5.9.1	Range of validity .....	33

5.9.2	Reducing parameters, molar mass, and gas constant .....	34
5.9.3	Reference state parameters .....	34
5.10	R143a -- 1,1,1-trifluoroethane .....	37
5.10.1	Range of validity .....	37
5.10.2	Reducing parameters, molar mass, and gas constant .....	38
5.10.3	Reference state parameters .....	38
5.11	R152a -- 1,1-difluoroethane .....	40
5.11.1	Range of validity .....	40
5.11.2	Reducing parameters, molar mass, and gas constant .....	41
5.11.3	Reference state parameters .....	41
5.12	R404A -- R125/143a/134a (44/52/4) .....	44
5.12.1	Composition of R404A .....	44
5.12.2	Range of validity .....	44
5.12.3	Interaction parameters (Formulae 19 and 20) .....	44
5.12.4	Coefficients and exponents of the excess functions (Formula 21) .....	44
5.12.5	Reference state parameters .....	45
5.13	R407C -- R32/125/134a (23/25/52) .....	47
5.13.1	Range of validity .....	47
5.13.2	Interaction parameters (Formulae 19 and 20) .....	47
5.13.3	Reference state parameters .....	48
5.14	R410A -- R32/125 (50/50) .....	51
5.14.1	Range of validity .....	51
5.14.2	Interaction parameters (Formulae 9 and 20) .....	51
5.14.3	Reference state parameters .....	51
5.15	R507A -- R125/143a (50/50) .....	54
5.15.1	Range of validity .....	54
5.15.2	Interaction parameters [Formulae (19) and (20)] .....	54
5.15.3	Reference state parameters .....	55
5.16	R290 -- Propane .....	57
5.16.1	Range of validity .....	57
5.16.2	Coefficients and exponents of the ideal-gas part (Formulae 3 to 5) .....	57
5.16.3	Coefficients and exponents of the real-gas part (Formula 2) .....	57
5.16.4	Reducing parameters, molar mass, and gas constant .....	58
5.16.5	Reference state parameters .....	58
5.17	R600a - Isobutane .....	61
5.17.1	Range of validity .....	61
5.17.2	Coefficients and exponents of the ideal-gas part (Formulae 3 to 5) .....	61
5.17.3	Coefficients and exponents of the real-gas part (Formula 2) .....	62
5.17.4	Reducing parameters, molar mass, and gas constant .....	62
5.17.5	Reference state parameters .....	63
5.18	R1336mzz(Z) - (cis-1,1,1,4,4,4-hexafluorobutene) .....	66
5.18.1	Range of validity .....	66
5.18.2	Coefficients and exponents of the ideal-gas part (Formulae 3 to 5) .....	66
5.18.3	Coefficients and exponents of the real-gas part (Formula 2) .....	66
5.18.4	Reducing parameters, molar mass, and gas constant .....	67
5.18.5	Reference state parameters .....	67
5.19	R1234ze(E) -- trans-1,3,3,3-tetrafluoropropene .....	69
5.19.1	Range of validity .....	69
5.19.2	Coefficients and exponents of the ideal-gas part (Formulae 3 to 5) .....	69
5.19.3	Coefficients and exponents of the real-gas part (Formula 2) .....	70
5.19.4	Reducing parameters, molar mass, and gas constant .....	70
5.19.5	Reference state parameters .....	70
5.20	R1234yf -- 2,3,3,3-tetrafluoropropene .....	73
5.20.1	Range of validity .....	73
5.20.2	Coefficients and exponents of the ideal-gas part (Formulae 3 to 5) .....	73
5.20.3	Coefficients and exponents of the real-gas part (Formula 2) .....	73
5.20.4	Reducing parameters, molar mass, and gas constant .....	74
5.20.5	Reference state parameters .....	74
5.21	R1233zd(E) -- trans-1-chloro-3,3,3-trifluoropropene .....	76
5.21.1	Range of validity .....	76
5.21.2	Coefficients and exponents of the ideal-gas part (Formulae 3 to 5) .....	76

5.21.3	Coefficients and exponents of the real-gas part (Formula 2)	77
5.21.4	Reducing parameters, molar mass, and gas constant	77
5.21.5	Reference state parameters	77
Annex A (normative) Requirements for implementation of equations of state		81
Annex B (informative) Calculation of pure-fluid thermodynamic properties from an equation of state		83
Annex C (informative) Calculation of mixture thermodynamic properties from an equation of state		86
Annex D (informative) Literature citations for equations of state and verification values		88
Annex E (informative) Variation of mixture properties due to composition tolerance		96
Bibliography		98