2.43 HCFC-142b(R142b)

All equations for HCFC-142b(R142b) are based on the Table from Thermodynamic properties of refrigerants by ASHRAE[1],[2].

2.43.1 Temperature Scale

International practical temperature scale 1968 (IPTS-1968)

2.43.2 The Names of Substance, Library File and Single Shot Program

Name of Substance:	HCFC-142b, R142b, Refrigerant 142b, Freon 142b, Chlorodifluoroethane
Library File for UNIX:	libjr142b.a
Library File for DOS,Windows95/NT:	JR142B.LIB
Single Shot Program for UNIX:	r142b-ss
Single Shot Program for DOS,Windows95/NT:	R142B-SS.EXE

2.43.3 Important Constants and Others

Molecular Formula:	$C_2H_3C\ell F_2$
Relative Molecular Mass:	100.496
Gas Constant:	82.7347 J/(kg·K)

Critical Constants:

Critical Pressure:	4.123×10^6Pa (41.23 bar)
Critical Temperature:	410.25 K (137.10 °C)
Critical Specific Volume:	2.2988×10^{-3}m^3/kg

Reference State:

At 0°C, 1.0000 kJ/(kg·K) and 200.00 kJ/kg are assigned to the specific entropy and the specific enthalpy of saturated liquid, respectively.

2.43.4 Formula

Equation of State:

The Martin-Hou equation in reference [1] is used.

Vapor Pressure:

Equation (2.2.2) in reference [1].

Properties at Vapor-Liquid Equilibrium:

The saturated liquid density equation is obtained from Equation (2.2.4.d) in reference [1]. The saturated vapor density is obtained by the compatibility of the equation of state and vapor pressure equation. Isobaric specific heat c_P is obtained from individual in reference [2].

Transport Properties:

Thermal conductivity and viscosity from reference [2].

The Other Properties:

Surface tension from reference [2].

References

[1] Thermodynamic Properties of Refrigerants(1986), 32 ASHRAE
[2] Thermophysical Properties of Refrigerants (Inch-Pound Edition), (1993), 105 ASHRAE

Table II–2.43–1 R142b Function

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
1	AIPPT(P,T)		
94	AJTPT(P,T)		
8A	AKPD(P)		
8B	AKPDD(P)		
82	AKPT(P,T)		
8C	AKTD(T)		
8D	AKTDD(T)		
2	ALAPP(P)	ALAPP: Laplace Coefficient [m] P∗: Pressure [Pa], [bar]	$4.697\times10^3\leq P\leq0.2453\times10^6$ [Pa] $0.04697\leq P\leq2.453$ [bar]
3	ALAPT(T)	ALAPT: Laplace Coefficient [m] T∗: Temperature [K], [°C]	$203.15\leq T\leq288$ [K] $-70\leq T\leq14.85$ [°C]
4	ALHP(P)	ALHP: Latent Heat of Vaporization [J/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3\leq P\leq3.3691\times10^6$ [Pa] $0.04697\leq P\leq33.691$ [bar]
5	ALHT(T)	ALHT: Latent Heat of Vaporization [J/kg] T∗: Temperature [K], [°C]	$203.15\leq T\leq398.15$ [K] $-70\leq T\leq125$ [°C]
6	ALMPD(P)	ALMPD: Thermal Conductivity of Saturated Liquid [W/(m·K)] P∗: Pressure [Pa], [bar]	$15.65\times10^3\leq P\leq1.7409\times10^6$ [Pa] $0.1565\leq P\leq17.409$ [bar]
7	ALMPDD(P)	ALMPDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T∗: Temperature [K], [°C]	$39.37\times10^3\leq P\leq1.7409\times10^6$ [Pa] $0.3937\leq P\leq17.409$ [bar]
8	ALMPT(P,T)	ALMPT: Thermal Conductivity at Ordinary Pressure [W/(m·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	P=Dummy $273\leq T\leq473$ [K] $-0.15\leq T\leq199.85$ [°C]
9	ALMTD(T)	ALMTD: Thermal Conductivity of Saturated Liquid [W/(m·K)] T∗: Temperature [K], [°C]	$223.15\leq T\leq363.15$ [K] $-50\leq T\leq90$ [°C]
10	ALMTDD(T)	ALMTDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T∗: Temperature [K], [°C]	$303.15\leq T\leq363.15$ [K] $30\leq T\leq90$ [°C]
11	AMUPD(P)		
12	AMUPDD(P)		
13	AMUPT(P,T)		
14	AMUTD(T)		
15	AMUTDD(T)		
92	BPPT(P,T)		
90	BSPT(P,T)		
91	BTPT(P,T)		
93	BVPT(P,T)		
16	CPPD(P)	CPPD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] P∗: Pressure [Pa], [bar]	$15.65\times10^3\leq P\leq1.7409\times10^6$ [Pa] $0.1565\leq P\leq17.409$ [bar]
17	CPPDD(P)	CPPDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] P∗: Pressure [Pa], [bar]	$15.65\times10^3\leq P\leq1.7409\times10^6$ [Pa] $0.1565\leq P\leq17.409$ [bar]
18	CPPT(P,T)	CPPT: Isobaric Specific Heat at Ordinary Pressure [J/(kg·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	P=Dummy $263.15\leq T\leq473.15$ [K] $-10\leq T\leq200$ [°C]
19	CPTD(T)	CPTD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] T∗: Temperature [K], [°C]	$223.15\leq T\leq363.15$ [K] $-50\leq T\leq90$ [°C]
20	CPTDD(T)	CPTDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] T∗: Temperature [K], [°C]	$223.15\leq T\leq363.15$ [K] $-50\leq T\leq90$ [°C]

Table II–2.43–1 R142b Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
21	CRP('A')	CRP: Critical Constants H: 'A'='H': 0.4309×10^6 [J/kg] Specific Enthalpy P∗: 'A'='P': 4.123×10^6 [Pa], 41.23 [bar] Pressure S: 'A'='S': 1.6464×10^3 [J/(kg·K)] Specific Entropy T∗: 'A'='T': 410.25 [K], 137.10 [°C] Temperature V: 'A'='V': 2.2988×10^{-3} [m^3/kg] Specific Volume	one of 'H', 'P', 'S', 'T' and 'V'
7A	CVPD(P)		
76	CVPDD(P)		
77	CVPT(P,T)		
7B	CVTD(T)		
78	CVTDD(T)		
2A	EPSPD(P)		
2B	EPSPDD(P)		
22	EPSPT(P,T)		
2C	EPSTD(T)		
2D	EPSTDD(T)		
89	FC('A')	FC: Fundamental Constants M: 'A'='M': 100.496 Relative Molecular Mass R: 'A'='R': 82.7347 [J/(kg·K)] Gas Constant	one of 'M' and 'R'
9A	GAMPD(P)		
96	GAMPDD(P)		
95	GAMPT(P,T)		
9B	GAMTD(T)		
97	GAMTDD(T)		
23	HPD(P)	HPD: Specific Enthalpy of Saturated Liquid [J/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3\leq P\leq3.3691\times10^6$ [Pa] $0.04697\leq P\leq33.691$ [bar]
24	HPDD(P)	HPDD: Specific Enthalpy of Saturated Vapor [J/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3\leq P\leq3.3691\times10^6$ [Pa] $0.04697\leq P\leq33.691$ [bar]
71	HPS(P,S)	HPS: Specific Enthalpy [J/kg] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$10\times10^3\leq P\leq3.50\times10^6$ [Pa] SPDD(P)≤S≤ SPT(P,453.15K) [J/(kg·K)] $0.1\leq P\leq35$ [bar] SPDD(P)≤S≤ SPT(P,180°C) [J/(kg·K)] see Fig.II-2.43-3 for S
25	HPT(P,T)	HPT: Specific Enthalpy [J/kg] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$10\times10^3\leq P\leq3.50\times10^6$ [Pa] TSP(P)≤T≤453.15 [K] $0.1\leq P\leq35$ [bar] TSP(P)≤T≤180 [°C] see Fig.II-2.43-1
26	HPX(P,X)	HPX: Specific Enthalpy of Mixture [J/kg] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$4.697\times10^3\leq P\leq3.3691\times10^6$ [Pa] $0.04697\leq P\leq33.691$ [bar] $0\leq X\leq1.0$ [–]
27	HTD(T)	HTD: Specific Enthalpy of Saturated Liquid [J/kg] T∗: Temperature [K], [°C]	$203.15\leq T\leq398.15$ [K] $-70\leq T\leq125$ [°C]
28	HTDD(T)	HTDD: Specific Enthalpy of Saturated Vapor [J/kg] T∗: Temperature [K], [°C]	$203.15\leq T\leq398.15$ [K] $-70\leq T\leq125$ [°C]
29	HTX(T,X)	HTX: Specific Enthalpy of Mixture [J/kg] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	$203.15\leq T\leq398.15$ [K] $-70\leq T\leq125$ [°C] $0\leq X\leq1.0$ [–]
84	IDENTF('A')	IDENTF: CHARACTER TYPE FUNCTION for Package Identification (Length 20) C: 'A'='C': 'C2H3ClF2' Molecular Formula S: 'A'='S': 'R142B' Name of Substance V: 'A'='V': '10.1' Version Number	one of 'C', 'S' and 'V'

Table II–2.43–1 R142b Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
66	PLDT(T)		
68	PMLT(T)		
85	PRPD(P)		
86	PRPDD(P)		
81	PRPT(P,T)		
87	PRTD(T)		
88	PRTDD(T)		
99	PSBT(T)		
30	PST(T)	PST∗: Saturation Pressure [Pa], [bar] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
72	PSTD(T)		
73	PSTDD(T)		
31	SIGP(P)	SIGP: Surface Tension [N/m] P∗: Pressure [Pa], [bar]	4.697×10^3≤P≤0.2453×10^6 [Pa] 0.04697≤P≤2.543 [bar]
32	SIGT(T)	SIGT: Surface Tension [N/m] T∗: Temperature [K], [°C]	203.15≤T≤288 [K] −70≤T≤14.85 [°C]
33	SPD(P)	SPD: Specific Entropy of Saturated Liquid [J/(kg·K)] P∗: Pressure [Pa], [bar]	4.697×10^3≤P≤3.3691×10^6 [Pa] 0.04697≤P≤33.691 [bar]
34	SPDD(P)	SPDD: Specific Entropy of Saturated Vapor [J/(kg·K)] P∗: Pressure [Pa], [bar]	4.697×10^3≤P≤3.3691×10^6 [Pa] 0.04697≤P≤33.691 [bar]
35	SPT(P,T)	SPT: Specific Entropy [J/(kg·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	10×10^3≤P≤3.50×10^6 [Pa] TSP(P)≤T≤453.15 [K] 0.1≤P≤35 [bar] TSP(P)≤T≤180 [°C] see Fig.II-2.43-1
36	SPX(P,X)	SPX: Specific Entropy of Mixture [J/(kg·K)] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	4.697×10^3≤P≤3.3691×10^6 [Pa] 0.04697≤P≤33.691 [bar] 0≤X≤1.0 [–]
37	STD(T)	STD: Specific Entropy of Saturated Liquid [J/(kg·K)] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
38	STDD(T)	STDD: Specific Entropy of Saturated Vapor [J/(kg·K)] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
39	STX(T,X)	STX: Specific Entropy of Mixture [J/(kg·K)] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	203.15≤T≤398.15 [K] −70≤T≤125 [°C] 0≤X≤1.0 [–]
67	TLDP(P)		
69	TMLP(P)		
64	TPH(P,H)	TPH∗: Temperature [K], [°C] P∗: Pressure [Pa], [bar] H: Specific Enthalpy [J/kg]	10×10^3≤P≤3.50×10^6 [Pa] HPDD(P)≤H≤ HPT(P,453.15K) [J/kg] 0.1≤P≤35 [bar] HPDD(P)≤H≤ HPT(P,180°C) [J/kg] see Fig.II-2.43-2 for H

Table II–2.43–1 R142b Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
6H	TPH2(P,H)		
65	TPS(P,S)	TPS∗: Temperature [K], [°C] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$10\times10^3 \le P \le 3.50\times10^6$ [Pa] SPDD(P)≤S≤ SPT(P,453.15K) [J/(kg·K)] 0.1≤P≤35 [bar] SPDD(P)≤S≤ SPT(P,180°C) [J/(kg·K)] see Fig.II-2.43-3 for S
6S	TPS2(P,S)		
98	TPSEUP(P)		
70	TPV(P,V)	TPV∗: Temperature [K], [°C] P∗: Pressure [Pa], [bar] V: Specific Volume [m^3/kg]	$10\times10^3 \le P \le 3.50\times10^6$ [Pa] VPDD(P)≤V≤ VPT(P,453.15K) [m^3/kg] 0.1≤P≤35 [bar] VPDD(P)≤V≤ VPT(P,180°C) [m^3/kg]
41	TRPL('A')		
100	TSBP(P)		
40	TSP(P)	TSP∗: Saturation Temperature [K], [°C] P∗: Pressure [Pa], [bar]	$4.697\times10^3 \le P \le 3.3691\times10^6$ [Pa] 0.04697≤P≤33.691 [bar]
74	TSPD(P)		
75	TSPDD(P)		
42	UPD(P)	UPD: Specific Internal Energy of Saturated Liquid [J/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3 \le P \le 3.3691\times10^6$ [Pa] 0.04697≤P≤33.691 [bar]
43	UPDD(P)	UPDD: Specific Internal Energy of Saturated Vapor [J/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3 \le P \le 3.3691\times10^6$ [Pa] 0.04697≤P≤33.691 [bar]
79	UPS(P,S)	UPS: Specific Internal Energy [J/kg] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$10\times10^3 \le P \le 3.50\times10^6$ [Pa] SPDD(P)≤S≤ SPT(P,453.15K) [J/(kg·K)] 0.1≤P≤35 [bar] SPDD(P)≤S≤ SPT(P,180°C) [J/(kg·K)] see Fig.II-2.43-3 for S
44	UPT(P,T)	UPT: Specific Internal Energy [J/kg] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$10\times10^3 \le P \le 3.50\times10^6$ [Pa] TSP(P)≤T≤453.15 [K] 0.1≤P≤35 [bar] TSP(P)≤T≤180 [°C] see Fig.II-2.43-1
45	UPX(P,X)	UPX: Specific Internal Energy of Mixture [J/kg] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$4.697\times10^3 \le P \le 3.3691\times10^6$ [Pa] 0.04697≤P≤33.691 [bar] 0≤X≤1.0 [–]
46	UTD(T)	UTD: Specific Internal Energy of Saturated Liquid [J/kg] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
47	UTDD(T)	UTDD: Specific Internal Energy of Saturated Vapor [J/kg] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
48	UTX(T,X)	UTX: Specific Internal Energy of Mixture [J/kg] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	203.15≤T≤398.15 [K] −70≤T≤125 [°C] 0≤X≤1.0 [–]
49	VPD(P)	VPD: Specific Volume of Saturated Liquid [m^3/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3 \le P \le 3.3691\times10^6$ [Pa] 0.04697≤P≤33.691 [bar]

Table II–2.43–1 R142b Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
50	VPDD(P)	VPDD: Specific Volume of Saturated Vapor [m^3/kg] P∗: Pressure [Pa], [bar]	$4.697\times10^3\leq P\leq3.3691\times10^6$ [Pa] $0.04697\leq P\leq33.691$ [bar]
80	VPS(P,S)	VPS: Specific Volume [m^3/kg] P∗: Pressure [Pa], [bar] S: Specific Entropy[J/(kg·K)]	$10\times10^3\leq P\leq3.50\times10^6$ [Pa] SPDD(P)≤S≤ SPT(P,453.15K) [J/(kg·K)] $0.1\leq P\leq35$ [bar] SPDD(P)≤S≤ SPT(P,180°C) [J/(kg·K)] see Fig.II-2.43-3 for S
51	VPT(P,T)	VPT: Specific Volume [m^3/kg] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$10\times10^3\leq P\leq3.50\times10^6$ [Pa] TSP(P)≤T≤453.15 [K] $0.1\leq P\leq35$ [bar] TSP(P)≤T≤180 [°C] see Fig.II-2.43-1
52	VPX(P,X)	VPX: Specific Volume of Mixture [m^3/kg] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$4.697\times10^3\leq P\leq3.3691\times10^6$ [Pa] $0.04697\leq P\leq33.691$ [bar] 0≤X≤1.0 [–]
53	VTD(T)	VTD: Specific Volume of Saturated Liquid [m^3/kg] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
54	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m^3/kg] T∗: Temperature [K], [°C]	203.15≤T≤398.15 [K] −70≤T≤125 [°C]
55	VTX(T,X)	VTX: Specific Volume of Mixture [m^3/kg] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	203.15≤T≤398.15 [K] −70≤T≤125 [°C] 0≤X≤1.0 [–]
8E	WPD(P)		
8F	WPDD(P)		
83	WPT(P,T)		
8G	WTD(T)		
8H	WTDD(T)		
56	XPH(P,H)	XPH: Dryness Fraction [–] P∗: Pressure [Pa], [bar] H: Specific Enthalpy of Mixture [J/kg]	$4.697\times10^3\leq P<3.3691\times10^6$ [Pa] $0.04697\leq P<33.691$ [bar] HPD(P)≤H≤HPDD(P) [J/kg]
57	XPS(P,S)	XPS: Dryness Fraction [–] P∗: Pressure [Pa], [bar] S: Specific Entropy of Mixture [J/(kg·K)]	$4.697\times10^3\leq P<3.3691\times10^6$ [Pa] $0.04697\leq P<33.691$ [bar] SPD(P)≤S≤SPDD(P) [J/(kg·K)]
58	XPU(P,U)	XPU: Dryness Fraction [–] P∗: Pressure [Pa], [bar] U: Specific Internal Energy of Mixture [J/kg]	$4.697\times10^3\leq P<3.3691\times10^6$ [Pa] $0.04697\leq P<33.691$ [bar] UPD(P)≤U≤UPDD(P) [J/kg]
59	XPV(P,V)	XPV: Dryness Fraction [–] P∗: Pressure [Pa], [bar] V: Specific Volume of Mixture [m^3/kg]	$4.697\times10^3\leq P<3.3691\times10^6$ [Pa] $0.04697\leq P<33.691$ [bar] VPD(P)≤V≤VPDD(P) [m^3/kg]
60	XTH(T,H)	XTH: Dryness Fraction [–] T∗: Temperature [K], [°C] H: Specific Enthalpy of Mixture [J/kg]	203.15≤T<398.15 [K] −70≤T<125 [°C] HTD(T)≤H≤HTDD(T) [J/kg]
61	XTS(T,S)	XTS: Dryness Fraction [–] T∗: Temperature [K], [°C] S: Specific Entropy of Mixture [J/(kg·K)]	203.15≤T<398.15 [K] −70≤T<125 [°C] STD(T)≤S≤STDD(T) [J/(kg·K)]
62	XTU(T,U)	XTU: Dryness Fraction [–] T∗: Temperature [K], [°C] U: Specific Internal Energy of Mixture [J/kg]	203.15≤T<398.15 [K] −70≤T<125 [°C] UTD(T)≤U≤UTDD(T) [J/kg]
63	XTV(T,V)	XTV: Dryness Fraction [–] T∗: Temperature [K], [°C] V: Specific Volume of Mixture [m^3/kg]	203.15≤T<398.15 [K] −70≤T<125 [°C] VTD(T)≤V≤VTDD(T) [m^3/kg]

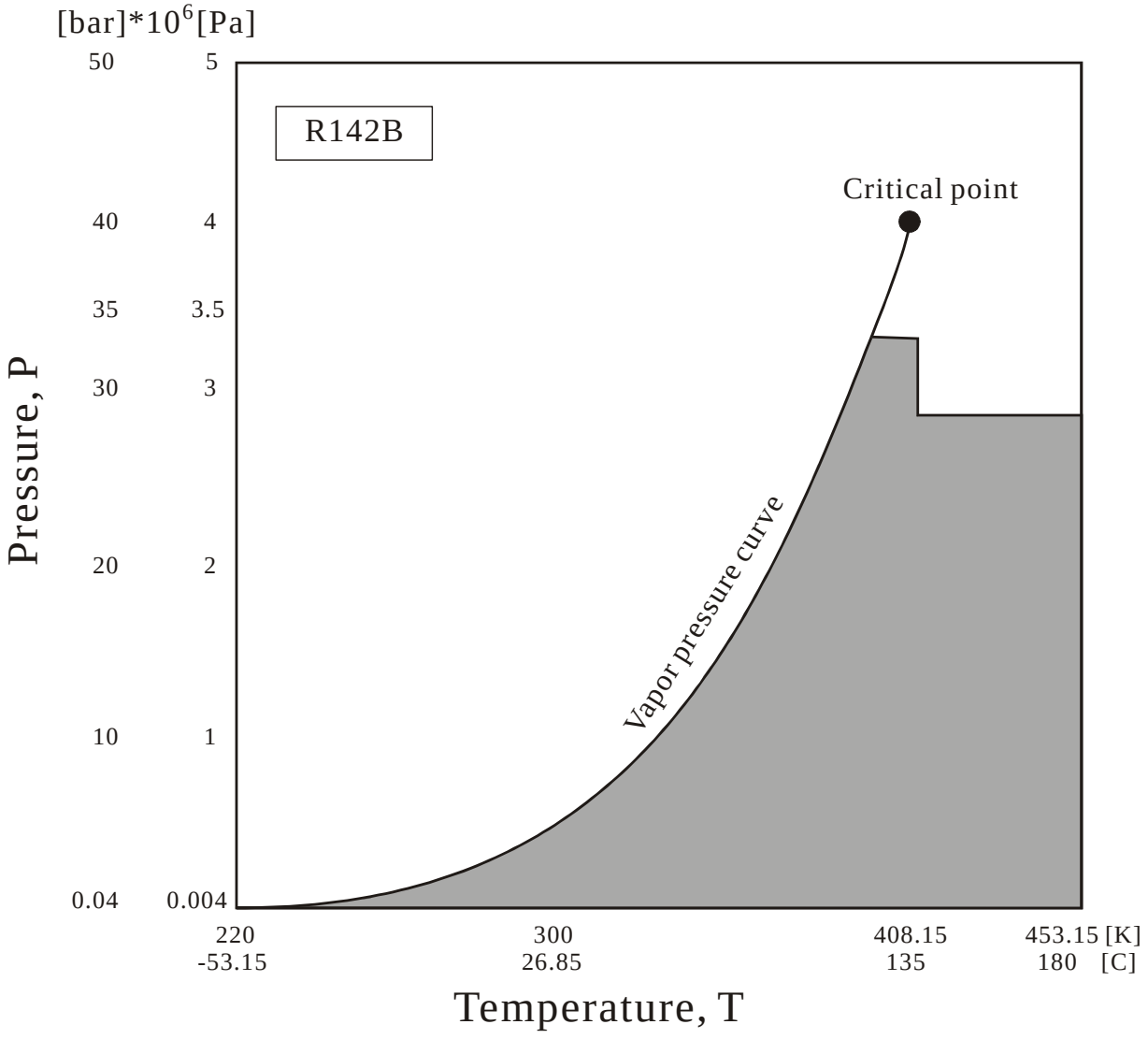

Fig.II–2.43–1 Range of Arguments(P,T) for AKPT(P,T),CPPT(P,T),CVPT(P,T),HPT(P,T), SPT(P,T),UPT(P,T) and VPT(P,T).

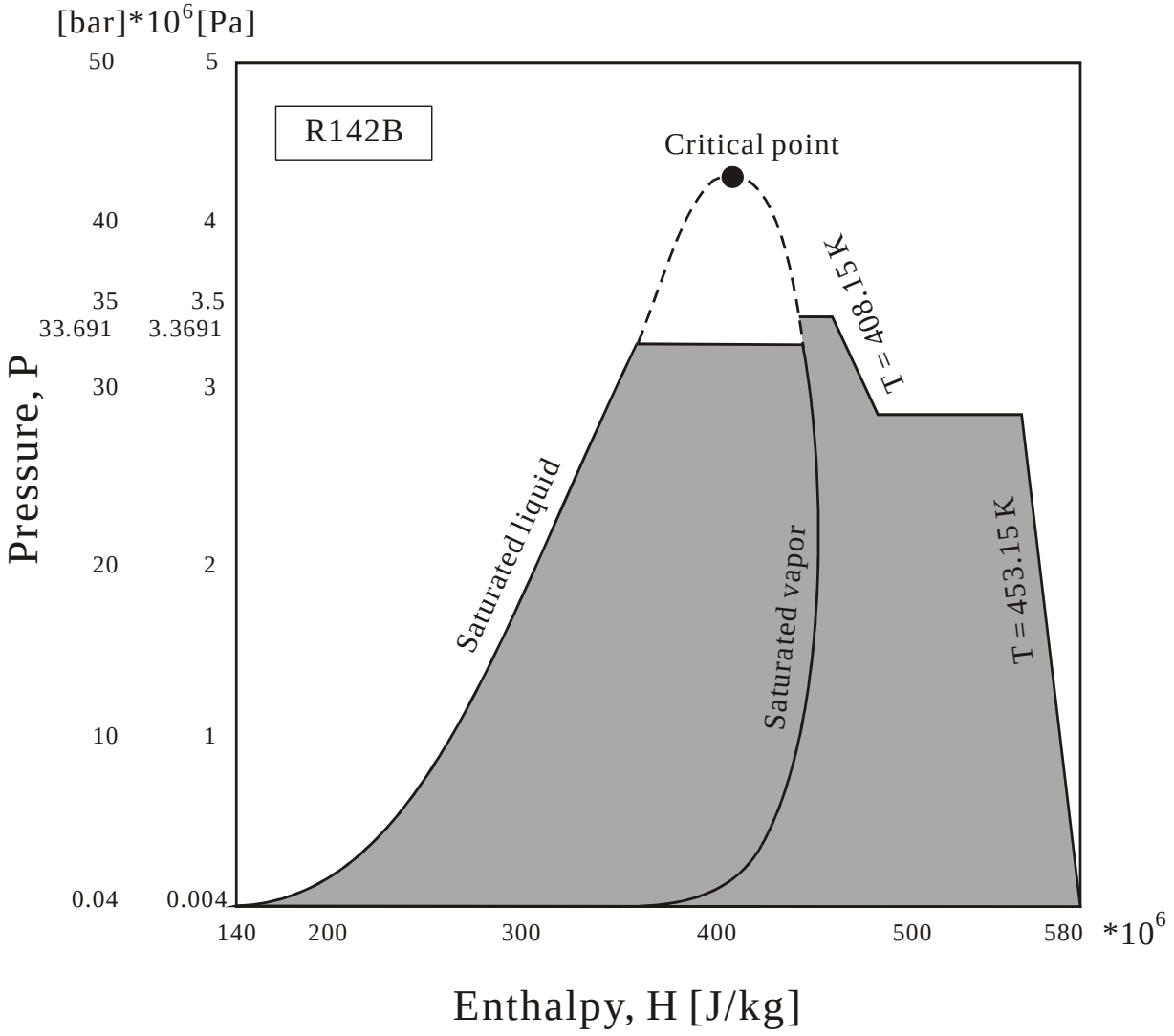

Fig.II–2.43–2 Range of Arguments(P,H) for TPH(P,H).

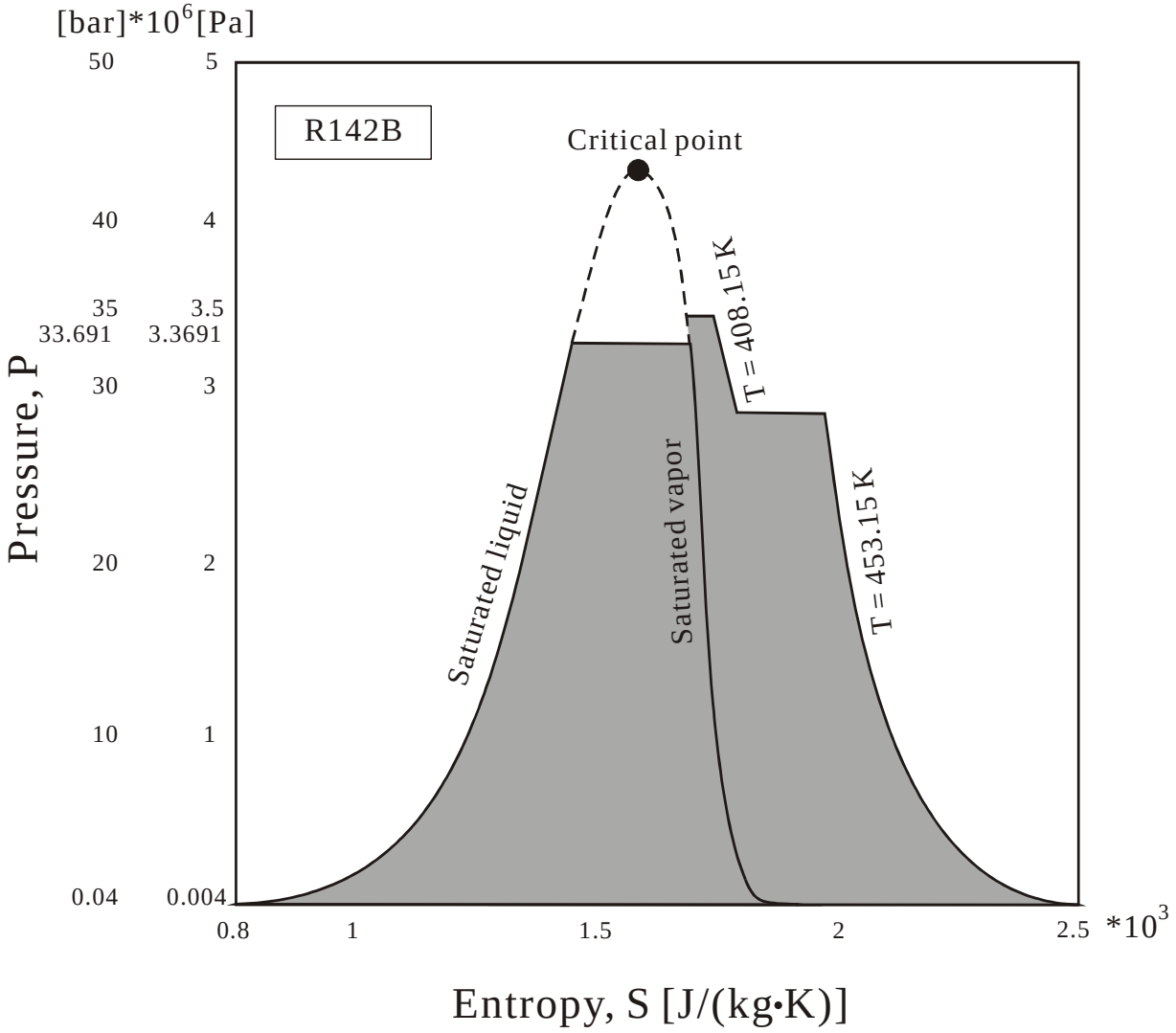

Fig.II–2.43–3 Range of Arguments(P,S) for HPS(P,S),TPS(P,S),UPS(P,S) and VPS(P,S).