2.34 CFC-12(R12)

All equations for CFC-12(R12) are based on the Table from Japanese Association of Refrigeration [1].

2.34.1 Temperature Scale

International practical temperature scale 1968 (IPTS-1968)

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

Name of Substance:	CFC-12, R12, Refrigerant 12, Freon 12, Dichlorodifluoromethane
Library File for UNIX:	libjr12.a
Library File for DOS,Windows95/NT:	JR12.LIB
Single Shot Program for UNIX:	r12-ss
Single Shot Program for DOS,Windows95/NT:	R12–SS.EXE

2.34.3 Important Constants and Others

Molecular Formula:	$CC\ell_2F_2$
Relative Molecular Mass:	120.9138
Gas Constant:	68.7625 J/(kg·K)

Critical Constants:

Critical Pressure:	4.125×10^6Pa (41.25 bar)
Critical Temperature:	384.95 K (111.80°C)
Critical Specific Volume:	1.7921×10^{-3}m^3/kg

Reference State:

At 0°C, 1.0000 kcal(thermochemical)/(kg·K), i.e. 4184.0 J/(kg·K) and 100.00 kcal(thermochemical)/kg, i.e. 0.4184 $\times10^6$J/kg are assigned to the specific entropy and the specific enthalpy, respectively.

2.34.4 Formula

Equation of State:

Equation (II·2·1) in a function form of $Z = Z(\rho, T)$ in reference [1]. Here Z=compressibility, ρ=density and T= temperature. However the temperature scale IPTS-1948 used in the reference has been replaced with terms of IPTS-1968.

Vapor Pressure:

Equation (II·2·3) in reference [1].

Properties at Vapor-Liquid Equilibrium:

saturated liquid: Equations (II·2·3), (II·2·9), (II·2·15) and (II·2·17) for specific volume, specific enthalpy, specific entropy and isobaric specific heat, respectively. However the factor -2.1953×10^{-6} in the 3rd term in right hand side of (II·2·17) has been corrected as -2.1593×10^{-6}.

saturated vapor: Equations (II·2·16) and (II·2·1) for specific volume, (II·2·16) and (II·2·6) for specific enthalpy, and (II·2·16) and (II·2·12) for specific volume. Equations (II·2·16) and (II·2·21) for isobaric specific heat. Equations (II·2·16) and (II·2·26) for isochoric specific heat.

All of these equations have been cited from reference [1].

Transport Properties:

Equations (II·3·8) and (II·3·1) in reference [1] for thermal conductivity and dynamic viscosity of saturated liquid, respectively. However the right hand side of (II·3·1) has been corrected as

$$21.08203 - 2.450974 \times 10^4/T + 9.430266 \times 10^6/T^2 - 1.549714 \times 10^9/T^3 + 9.433612 \times 10^{10}/T^4$$

Equations (II.3.10) and (II.3.3) in reference [1] for thermal conductivity of vapor at the atmospheric pressure and dynamic viscosity of the superheated vapor, respectively.

The Other Properties:
Equation (II·2·37) in reference [1] for surface tension.

References

[1] Japanese Association of Refrigeration, Thermophysical Properties of Refrigerants (R12, Dichlorodifluoromethane), (1981).

Table II–2.34–1 CFC-12 (R12) 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)	AKPT: Isentropic Exponent [–] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3 \le P \le 8.0\times10^6$ [Pa] $183.15 \le T \le 473.15$ [K] $0.02 \le P \le 80$ [bar] $-90 \le T \le 200$ [°C] see Fig.II-2.34-1
8C	AKTD(T)		
8D	AKTDD(T)		
2	ALAPP(P)	ALAPP: Laplace Coefficient [m] P∗: Pressure [Pa], [bar]	$22.59\times10^3 \le P \le 4.02\times10^6$ [Pa] $0.2259 \le P \le 40.2$ [bar]
3	ALAPT(T)	ALAPT: Laplace Coefficient [m] T∗: Temperature [K], [°C]	$213.15 \le T \le 383.15$ [K] $-60 \le T \le 110$ [°C]
4	ALHP(P)	ALHP: Latent Heat of Vaporization [J/kg] P∗: Pressure [Pa], [bar]	$1.2\times10^3 \le P \le 4.02\times10^6$ [Pa] $0.012 \le P \le 40.2$ [bar]
5	ALHT(T)	ALHT: Latent Heat of Vaporization [J/kg] T∗: Temperature [K], [°C]	$173.15 \le T \le 383.15$ [K] $-100 \le T \le 110$ [°C]
6	ALMPD(P)	ALMPD: Thermal Conductivity of Saturated Liquid [W/(m·K)] P∗: Pressure [Pa], [bar]	PST(173.15K)≤P≤PST(333.15K) [Pa] ($\sim1.17\times10^3$) ($\sim1.52\times10^6$) PST(−100°C)≤P≤PST(60°C) [bar] (∼0.0117) (∼15.2)
7	ALMPDD(P)		
8	ALMPT(P,T)	ALMPT: Thermal Conductivity at Ordinary Pressure [W/(m·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	P=Dummy $253.15 \le T \le 363.15$ [K] $-20 \le T \le 90$ [°C]
9	ALMTD(T)	ALMTD: Thermal Conductivity of Saturated Liquid [W/(m·K)] T∗: Temperature [K], [°C]	$173.15 \le T \le 333.15$ [K] $-100 \le T \le 60$ [°C]
10	ALMTDD(T)		
11	AMUPD(P)	AMUPD: Coefficient of Viscosity of Saturated Liquid [Pa·s] P∗: Pressure [Pa], [bar]	PST(203.15K)≤P≤PST(311.15K) [Pa] ($\sim12.2\times10^3$) ($\sim0.913\times10^6$) PST(−70°C)≤P≤PST(38°C) [bar] (∼0.122) (∼9.13)
12	AMUPDD(P)		
13	AMUPT(P,T)	AMUPT: Coefficient of Viscosity [Pa·s] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$100\times10^3 \le P \le 4.0\times10^6$ [Pa] $298.15 \le T \le 398.15$ [K] $1.0 \le P \le 40$ [bar] $25 \le T \le 125$ [°C]
14	AMUTD(T)	AMUTD: Coefficient of Viscosity of Saturated Liquid [Pa·s] T∗: Temperature [K], [°C]	$203.15 \le T \le 311.15$ [K] $-70 \le T \le 38$ [°C]
15	AMUTDD(T)		
92	BPPT(P,T)		
90	BSPT(P,T)		
91	BTPT(P,T)		
93	BVPT(P,T)		

Table II–2.34–1 CFC-12 (R12) Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
16	CPPD(P)	CPPD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] P∗: Pressure [Pa], [bar]	PST(173.15K)≤P≤PST(363.15K) [Pa] ($\sim 1.17\times10^3$) ($\sim 2.77\times10^6$) PST(−100°C)≤P≤PST(90°C) [bar] ($\sim$0.0117) ($\sim$27.7)
17	CPPDD(P)	CPPDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] P∗: Pressure [Pa], [bar]	PST(173.15K)≤P≤PST(363.15K) [Pa] ($\sim 1.17\times10^3$) ($\sim 2.77\times10^6$) PST(−100°C)≤P≤PST(90°C) [bar] ($\sim$0.0117) ($\sim$27.7)
18	CPPT(P,T)	CPPT: Isobaric Specific Heat [J/(kg·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq 8.0\times10^6$ [Pa] 183.15≤T≤473.15 [K] 0.02≤P≤80 [bar] −90≤T≤200 [°C] see Fig.II-2.34-1
19	CPTD(T)	CPTD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] T∗: Temperature [K], [°C]	173.15≤T≤363.15 [K] −100≤T≤90 [°C]
20	CPTDD(T)	CPTDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] T∗: Temperature [K], [°C]	173.15≤T≤363.15 [K] −100≤T≤90 [°C]
21	CRP('A')	CRP: Critical Constants H: 'A'='H': 0.56681×10^6 [J/kg] Specific Enthalpy P∗: 'A'='P': 4.125×10^6 [Pa], 41.25 [bar] Pressure S: 'A'='S': 4.6140×10^3 [J/(kg·K)] Specific Entropy T∗: 'A'='T': 384.95 [K], 111.80 [°C] Temperature V: 'A'='V': 1.7921×10^{-3} [m^3/kg] Specific Volume	one of 'H', 'P', 'S', 'T' and 'V'
7A	CVPD(P)		
76	CVPDD(P)	CVPDD: Isochoric Specific Heat of Saturated Vapor [J/(kg·K)] P∗: Pressure [Pa], [bar]	PST(173.15K)≤P≤PST(363.15K) [Pa] ($\sim 1.17\times10^3$) ($\sim 2.77\times10^6$) PST(−100°C)≤P≤PST(90°C) [bar] ($\sim$0.0117) ($\sim$27.7)
77	CVPT(P,T)	CVPT: Isochoric Specific Heat [J/(kg·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq 8.0\times10^6$ [Pa] 183.15≤T≤473.15 [K] 0.02≤P≤80 [bar] −90≤T≤200 [°C] see Fig.II-2.34-1
7B	CVTD(T)		
78	CVTDD(T)	CVTDD: Isochoric Specific Heat of Saturated Vapor [J/(kg·K)] T∗: Temperature [K], [°C]	173.15≤T≤363.15 [K] −100≤T≤90 [°C]
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': 120.9138 Relative Molecular Mass R: 'A'='R': 68.7625 [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]	$1.2\times10^3\leq P\leq 4.02\times10^6$ [Pa] 0.012≤P≤40.2 [bar]

Table II–2.34–1 CFC-12 (R12) Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
24	HPDD(P)	HPDD: Specific Enthalpy of Saturated Vapor [J/kg] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]
71	HPS(P,S)	HPS: Specific Enthalpy [J/kg] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1.2\times10^3\leq P\leq8.0\times10^6$ [Pa] $0.012\leq P\leq80$ [bar] see Fig.II-2.34-3 for S
25	HPT(P,T)	HPT: Specific Enthalpy [J/kg] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq8.0\times10^6$ [Pa] $183.15\leq T\leq473.15$ [K] $0.02\leq P\leq80$ [bar] $-90\leq T\leq200$ [°C] see Fig.II-2.34-1
26	HPX(P,X)	HPX: Specific Enthalpy of Mixture [J/kg] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar] $0\leq X\leq1.0$ [–]
27	HTD(T)	HTD: Specific Enthalpy of Saturated Liquid [J/kg] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
28	HTDD(T)	HTDD: Specific Enthalpy of Saturated Vapor [J/kg] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
29	HTX(T,X)	HTX: Specific Enthalpy of Mixture [J/kg] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C] $0\leq X\leq1.0$ [–]
84	IDENTF('A')	IDENTF: CHARACTER TYPE FUNCTION for Package Identification (Length 20) C: 'A'='C': 'CCL2F2' Molecular Formula S: 'A'='S': 'CFC-12(R12)' Name of Substance V: 'A'='V': '10.1' Version Number	one of 'C', 'S' and 'V'
66	PLDT(T)		
68	PMLT(T)		
85	PRPD(P)		
86	PRPDD(P)		
81	PRPT(P,T)	PRPT: Prandtl Number at Ordinary Pressure [–] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	P=Dummy $253.15\leq T\leq363.15$ [K] $-20\leq T\leq90$ [°C]
87	PRTD(T)		
88	PRTDD(T)		
99	PSBT(T)		
30	PST(T)	PST∗: Saturation Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$173.15\leq T\leq384.95$ [K] $-100\leq T\leq111.8$ [°C]
72	PSTD(T)		
73	PSTDD(T)		
31	SIGP(P)	SIGP: Surface Tension [N/m] P∗: Pressure [Pa], [bar]	PST(213.15K)$\leq P\leq4.125\times10^6$ [Pa] ($\sim22.59\times10^3$) PST(-60°C)$\leq P\leq41.25$ [bar] (~0.2259)
32	SIGT(T)	SIGT: Surface Tension [N/m] T∗: Temperature [K], [°C]	$213.15\leq T\leq384.95$ [K] $-60\leq T\leq111.8$ [°C]
33	SPD(P)	SPD: Specific Entropy of Saturated Liquid [J/(kg·K)] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]
34	SPDD(P)	SPDD: Specific Entropy of Saturated Vapor [J/(kg·K)] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]

Table II–2.34–1 CFC-12 (R12) Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
35	SPT(P,T)	SPT: Specific Entropy [J/(kg·K)] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq8.0\times10^6$ [Pa] $183.15\leq T\leq473.15$ [K] $0.02\leq P\leq80$ [bar] $-90\leq T\leq200$ [°C] see Fig.II-2.34-1
36	SPX(P,X)	SPX: Specific Entropy of Mixture [J/(kg·K)] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar] $0\leq X\leq1.0$ [–]
37	STD(T)	STD: Specific Entropy of Saturated Liquid [J/(kg·K)] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
38	STDD(T)	STDD: Specific Entropy of Saturated Vapor [J/(kg·K)] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
39	STX(T,X)	STX: Specific Entropy of Mixture [J/(kg·K)] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C] $0\leq X\leq1.0$ [–]
67	TLDP(P)		
69	TMLP(P)		
64	TPH(P,H)	TPH∗: Temperature [K], [°C] P∗: Pressure [Pa], [bar] H: Specific Enthalpy [J/kg]	$1.2\times10^3\leq P\leq8.0\times10^6$ [Pa] $0.012\leq P\leq80$ [bar] see Fig.II-2.34-2 for H
65	TPS(P,S)	TPS∗: Temperature [K], [°C] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1.2\times10^3\leq P\leq8.0\times10^6$ [Pa] $0.012\leq P\leq80$ [bar] see Fig.II-2.34-3 for S
98	TPSEUP(P)		
70	TPV(P,V)	TPV∗: Temperature [K], [°C] P∗: Pressure [Pa], [bar] V: Specific Volume [m^3/kg]	$1.2\times10^3\leq P\leq4.125\times10^6$ [Pa] VPD(P)≤V≤ VPT(P,473.15K) [m^3/kg] $4.125\times10^6<P\leq8.0\times10^6$ [Pa] 0.0017921≤V≤ VPT(P,473.15K) [m^3/kg] $0.012\leq P\leq41.25$ [bar] VPD(P)≤V≤ VPT(P,200°C) [m^3/kg] $41.25<P\leq80$ [bar] 0.0017921≤V≤ VPT(P,200°C) [m^3/kg]
41	TRPL('A')		
100	TSBP(P)		
40	TSP(P)	TSP∗: Saturation Temperature [K], [°C] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.125\times10^6$ [Pa] $0.012\leq P\leq41.25$ [bar]
74	TSPD(P)		
75	TSPDD(P)		
42	UPD(P)	UPD: Specific Internal Energy of Saturated Liquid [J/kg] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]
43	UPDD(P)	UPDD: Specific Internal Energy of Saturated Vapor [J/kg] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]

Table II–2.34–1 CFC-12 (R12) Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
79	UPS(P,S)	UPS: Specific Internal Energy [J/kg] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1.2\times10^3\leq P\leq8.0\times10^6$ [Pa] $0.012\leq P\leq80$ [bar] see Fig.II-2.34-3 for S
44	UPT(P,T)	UPT: Specific Internal Energy [J/kg] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq8.0\times10^6$ [Pa] $183.15\leq T\leq473.15$ [K] $0.02\leq P\leq80$ [bar] $-90\leq T\leq200$ [°C] see Fig.II-2.34-1
45	UPX(P,X)	UPX: Specific Internal Energy of Mixture [J/kg] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar] $0\leq X\leq1.0$ [–]
46	UTD(T)	UTD: Specific Internal Energy of Saturated Liquid [J/kg] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
47	UTDD(T)	UTDD: Specific Internal Energy of Saturated Vapor [J/kg] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
48	UTX(T,X)	UTX: Specific Internal Energy of Mixture [J/kg] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C] $0\leq X\leq1.0$ [–]
49	VPD(P)	VPD: Specific Volume of Saturated Liquid [m^3/kg] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]
50	VPDD(P)	VPDD: Specific Volume of Saturated Vapor [m^3/kg] P∗: Pressure [Pa], [bar]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar]
80	VPS(P,S)	VPS: Specific Volume [m^3/kg] P∗: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1.2\times10^3\leq P\leq8.0\times10^6$ [Pa] $0.012\leq P\leq80$ [bar] see Fig.II-2.34-3 for S
51	VPT(P,T)	VPT: Specific Volume [m^3/kg] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq8.0\times10^6$ [Pa] $183.15\leq T\leq473.15$ [K] $0.02\leq P\leq80$ [bar] $-90\leq T\leq200$ [°C] see Fig.II-2.34-1
52	VPX(P,X)	VPX: Specific Volume of Mixture [m^3/kg] P∗: Pressure [Pa], [bar] X: Dryness Fraction [–]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar] $0\leq X\leq1.0$ [–]
53	VTD(T)	VTD: Specific Volume of Saturated Liquid [m^3/kg] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
54	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m^3/kg] T∗: Temperature [K], [°C]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C]
55	VTX(T,X)	VTX: Specific Volume of Mixture [m^3/kg] T∗: Temperature [K], [°C] X: Dryness Fraction [–]	$173.15\leq T\leq383.15$ [K] $-100\leq T\leq110$ [°C] $0\leq X\leq1.0$ [–]
8E	WPD(P)		
8F	WPDD(P)		
83	WPT(P,T)	WPT: Velocity of Sound [m/s] P∗: Pressure [Pa], [bar] T∗: Temperature [K], [°C]	$2.0\times10^3\leq P\leq8.0\times10^6$ [Pa] $183.15\leq T\leq473.15$ [K] $0.02\leq P\leq80$ [bar] $-90\leq T\leq200$ [°C] see Fig.II-2.34-1
8G	WTD(T)		
8H	WTDD(T)		
56	XPH(P,H)	XPH: Dryness Fraction [–] P∗: Pressure [Pa], [bar] H: Specific Enthalpy of Mixture [J/kg]	$1.2\times10^3\leq P\leq4.02\times10^6$ [Pa] $0.012\leq P\leq40.2$ [bar] HPD(P)≤H≤HPDD(P) [J/kg]

Table II–2.34–1 CFC-12 (R12) Function (cont'd)

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
57	XPS(P,S)	XPS: Dryness Fraction [–] P∗: Pressure [Pa], [bar] S: Specific Entropy of Mixture [J/(kg·K)]	$1.2\times10^3 \le P \le 4.02\times10^6$ [Pa] $0.012 \le P \le 40.2$ [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]	$1.2\times10^3 \le P \le 4.02\times10^6$ [Pa] $0.012 \le P \le 40.2$ [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]	$1.2\times10^3 \le P \le 4.02\times10^6$ [Pa] $0.012 \le P \le 40.2$ [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]	$173.15 \le T \le 383.15$ [K] $-100 \le T \le 110$ [°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)]	$173.15 \le T \le 383.15$ [K] $-100 \le T \le 110$ [°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]	$173.15 \le T \le 383.15$ [K] $-100 \le T \le 110$ [°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]	$173.15 \le T \le 383.15$ [K] $-100 \le T \le 110$ [°C] VTD(T)≤V≤VTDD(T) [m^3/kg]

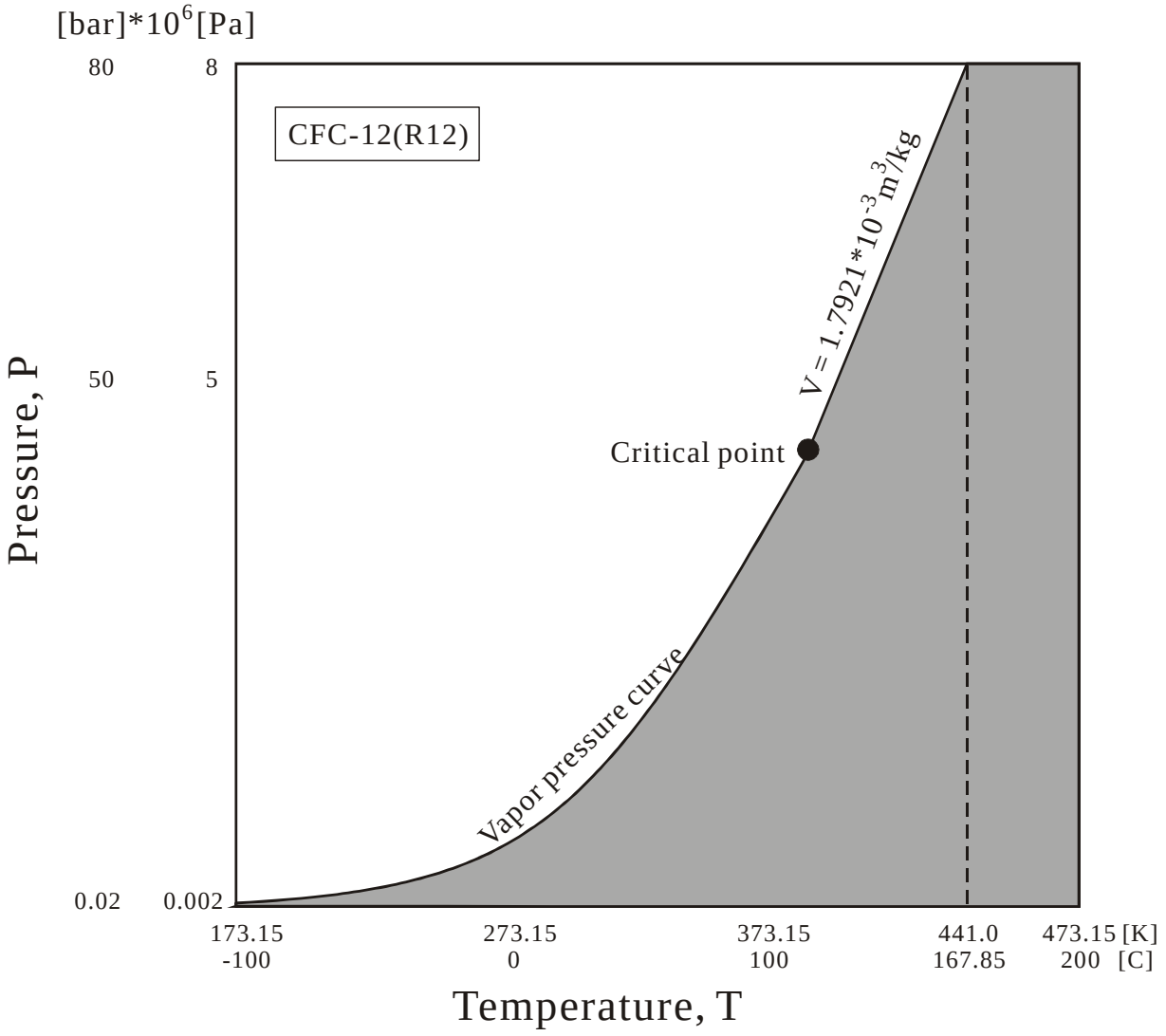

Fig.II–2.34–1 Range of Arguments(P,T) for AKPT(P,T),CPPT(P,T),CVPT(P,T),HPT(P,T), SPT(P,T),UPT(P,T),VPT(P,T) and WPT(P,T).

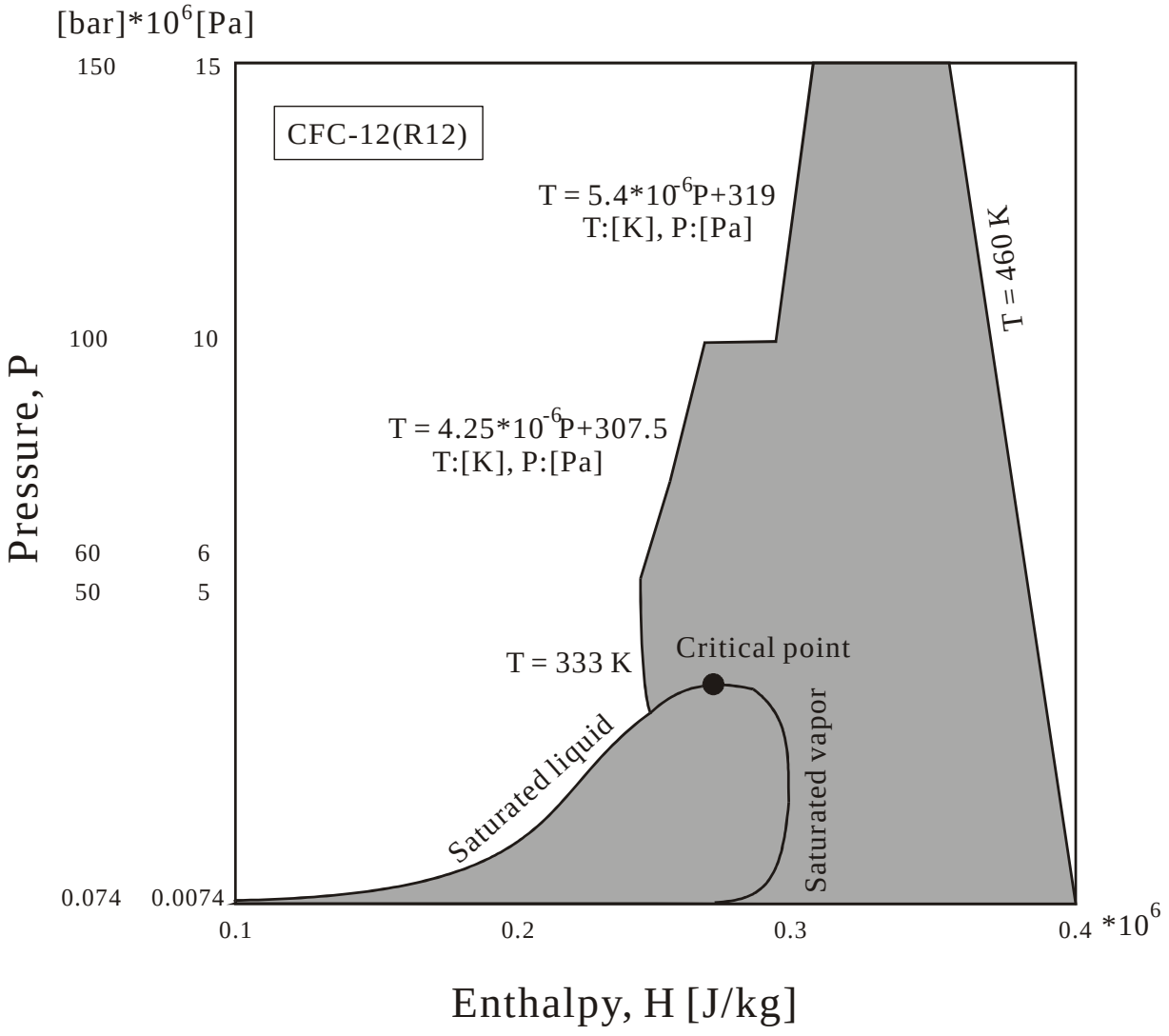

Fig.II–2.34–2 Range of Arguments(P,H) for TPH(P,H).

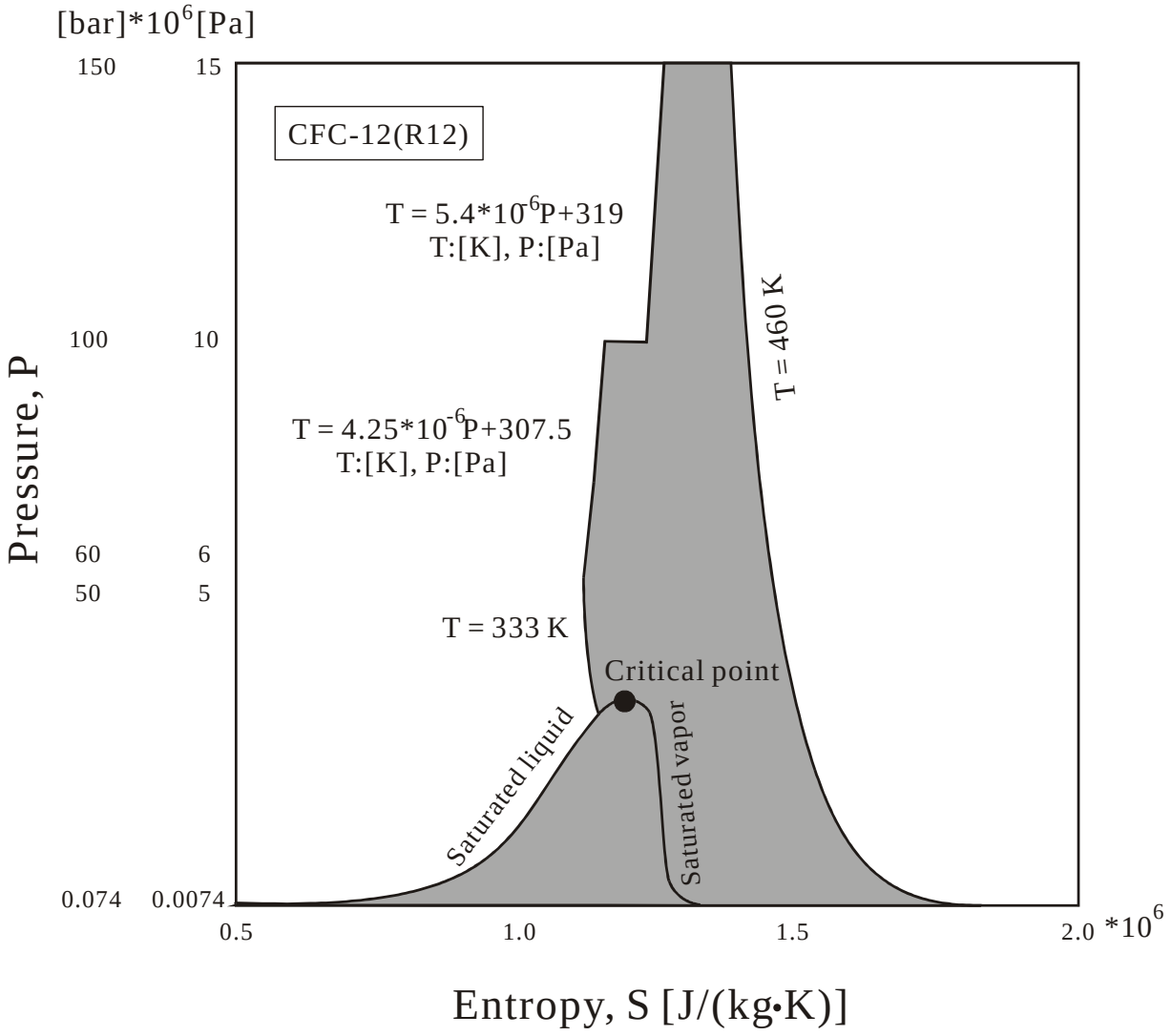

Fig.II–2.34–3 Range of Arguments(P,S) for HPS(P,S),TPS(P,S),UPS(P,S) and VPS(P,S).