

PROPATH Manual for MS-Excel

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PROPATH Manual for MS-Excel

PROPATH란 PROgram PAckage for THERmophysical properties of fluids 의 약자로써 40여종의 순수물질 및 혼합물질의 물성치를 계산할 수 있다. 이 프로그램을 이용하면 열역학 테이블에서처럼 두 개 혹은 한 개의 물성치만 알고 있으면 다른 물성치들을 쉽게 계산할 수 있다. 여기에서는 MS-Excel을 이용한 물성치 계산 방법을 간략히 소개한다. Fortran, C언어를 이용한 계산은 아래 홈페이지의 Manual을 이용하면 된다. User's Manual 등 기타 자세한 설명은 PROPATH Group 홈페이지 <http://propath.mech.kyushu-u.ac.jp/>를 참고하기 바란다.

1. 단위

temperature	[°C]
pressure	[bar]
specific volume	[m ³ /kg]
specific enthalpy	[J/kg]
specific entropy	[J/kg·K]

2. 엑셀에서 PROPATH 사용하기

2.1 JH2O.DLL, JH2O.BAS 등 필요한 파일들을 홈페이지 <http://ieel.snu.ac.kr/>의 Course에서 다운받아 DLL 파일은 윈도우 디렉토리(C:\Windows or C:\WINNT) 혹은 윈도우 시스템 디렉토리(C:\Windows\System or C:\WINNT\System)에, BAS 파일은 임의의 디렉토리에 복사한다.

2.2 엑셀을 실행한다.

2.3 [도구]-[매크로]-[Visual Basic Editor]를 선택하여 Visual Basic Editor를 실행한다.

2.4 [파일]-[파일 가져오기]에서 하드 디스크에 복사한 JH2O.BAS를 연다.

2.5 [파일]-[닫고 Microsoft Excel로 돌아가기]를 선택하여 엑셀로 돌아온다.

예제) 100°C에서 물의 포화압력을 구하기 위해 “=PST(100)” 을 셀에 입력하여 1.013253 bar가 나오는지 확인해 보자. 만일 “#VALUE”라는 메시지가 출력되면 JH2O.DLL 파일이 지정된 위치에 없기 때문이다.

2.6 두 개 이상의 라이브러리(물질) 사용하기

물과 공기를 동시에 사용하고자 할 경우, JH2O.DLL, JAIR.DLL, JH2O.BAS, JAIR.BAS 파일들을 지정된 디렉토리에 복사하고, 2.2~2.5와 같은 순서를 따른다. 계산하고자 하는 물질들의 BAS 파일 모두를 불러와야 한다. “J+[물질명].[함수명](함수값)”처럼 물질명과 함수명 사이를 마침표로 구분하여 두 개 이상의 라이브러리를 사용할 수 있다.

예제) 1bar, 50°C 에서 물과 공기의 엔탈피(enthalpy)를 구하고자 할 경우 셀에 다음처럼 입력한다.

“=JH2O.HPT(1,50)”, “=JAIR.HPT(1,50)”

3. 함수명에 대한 규칙

PROPATH의 함수명(함수표 참조)은 몇 가지 규칙만 알면 쉽게 적용할 수 있다.

3.1 알고 있는 두 가지 물성치로부터 다른 물성치를 구하는 경우

첫 번째 글자 : 계산되는 물성치

두 번째, 세 번째 글자 : 알고 있는 두 가지 물성치 (H, P, S, T, U, V, X)

HPT(P, T) : 압력과 온도를 주면 엔탈피를 계산하는 함수

SPX(P, X) : 압력과 건도를 주면 엔트로피를 계산하는 함수

3.2 알고 있는 한 가지 물성치로부터 포화액 또는 포화기체의 물성치를 구하는 경우

첫 번째 글자 : 계산되는 물성치

두 번째 글자 : 알고 있는 한 가지 물성치 (P 혹은 T)

세 번째 글자 : 포화액의 경우 D, 포화기체의 경우 DD

HPD(P) : 압력을 주면 포화액의 엔탈피를 계산하는 함수

HPDD(P) : 압력을 주면 포화기체의 엔탈피를 계산하는 함수

3.3 특별한 몇몇 함수

TSP(P) : 압력을 주면 포화온도(TS)를 계산하는 함수

PST(T) : 온도를 주면 포화압력(PS)을 계산하는 함수

4. 예제

교과서 [예제 3-3] 압력 6Mpa, 온도 300℃의 과열수증기가 체적이 일정한 용기에 들어 있다. 용기를 냉각하여 과열수증기가 (1) 포화수증기로 될 때의 수증기의 온도와 압력, (2) 20℃로 될 때의 수증기의 상태를 구하라.

	A	B	C	D
1	Property		State 0	
2	Pressure [bar]		60	
3	Temperature [°C]		300	
4	Specific Volume [m³/kg]	=vpt(C2,C3)	0.03614	
5			Temp. 1	
6	Temperature [°C]		269	
7	Specific Volume [m³/kg]	=vtdd(C6)	0.03619	
8			Temp. 2	
9	Temperature [°C]		270	
10	Specific Volume [m³/kg]	=vtdd(C9)	0.03559	
11	Property		State 1	
12	Temperature [°C]	=C6+(C9-C6)/(C10-C7)*(C4-C7)	269.07468	
13	Pressure [Mpa]	=pst(C12)/10	5.42653	
14	Property		State 2	
15	Temperature [°C]		20	
16	Quality	=(C4-vtd(C15))/(vtdd(C15)-vtd(C15))	0.000608	
18		=vpt(60,300)	0.03614	m3/kg
19		=vtdd(265)	0.03871	m3/kg
20		=vtdd(270)	0.03559	m3/kg
21		=265+(270-265)/(C20-C19)*(C18-C19)	269.11	°C
22		=pst(C21)	54.294	bar
23		=xtv(20,C18)	0.000608	

교과서 [예제 4-7] 압력 2Mpa, 온도 250℃의 수증기 0.5kg이 이상적인 폴리트로픽 과정으로 팽창하여 압력이 0.2Mpa로 변화한다. 수증기의 최종온도, 일과 열전달량을 구하라. 폴리트로픽지수는 1.25이다.

	A	B	C
1	Property		State 1
2	Pressure [bar]		20
3	Temperature [°C]		250
4	Specific Volume [m³/kg]	=vpt(C2,C3)	0.1114
5	Internal Energy [kJ/kg]	=upt(C2,C3)/1000	2679.47
6			
7	Property		State 2
8	Pressure [bar]		2
9	Specific Volume [m³/kg]	=C4*POWER(C2/C8, 1/1.25)	0.70320
10	Quality	=(C9-vpd(C8))/(vpdd(C8)-vpd(C8))	0.79393
11	Temperature [°C]	=tsp(C8)	120.23094
12	Internal Energy [kJ/kg]	=(UPD(C8)+C10*(UPDD(C8)-UPD(C8)))/1000	2111.97
13	Work [kJ]	=0.5*(C8*C9-C2*C4)*100/(1-1.25)	164.52
14	Heat [kJ]	=0.5*(C12-C5)+C13	-119.23

B열은 C열에 입력해야 할 수식을 표현한 것이다. B열에 있는 수식은 꼭 C열에 입력하기 바란다. 혹 B열에 입력하려면 셀 번호를 바꿔주면 된다.

지금까지 엑셀에서의 PROPATH 사용에 대해서 알아보았다. 엑셀 사용에 능숙하지 않아서 이해가 잘 안되거나, 함수 사용 등에 의문사항이 있으면 1401(880-1646)로 문의하기 바란다. 아래는 Fortran에서의 간단한 사용법을 교과서 예제와 함께 나타내었다.

5. Fortran 프로그램을 이용할 경우

5.1 단위설정

만드시 자신이 작성한 main program안에 다음의 3줄을 첫번째 실행문 이전에 첨가하여(예제 참조) 압력과 온도의 단위를 설정한다.

```
COMMON /UNIT/ KPA, MESS
```

```
KPA=M
```

```
MESS=N
```

KPA	unit of pressure	unit of temperature	MESS	error message
0	Pa	K	0	No
1	bar	°C	others	Yes
2	bar	K		
3	Pa	°C		
others	Pa	K		

압력과 온도를 제외한 나머지 물성치의 단위들은 아래 함수표를 참조한다.

5.2 예제

교과서 [예제 8-5] : 4 MPa, 400 °C와 10 kPa 사이에서 작동하는 Rankine사이클이 작동한다. 터빈 효율이 85%, 펌프 효율이 80%일 때 사이클 효율을 구하여라.

```

c234567
common /unit/ kpa, mess
kpa=3
mess=1
c=====
c    P3 = 4MPa, T3 = 400 deg.
c=====
    p3 = 4.e6
    t3 = 400.
    h3 = hpt(p3,t3)
    s3 = spt(p3,t3)
c=====
c    P1 = 10kPa, sat. liq.
c=====
    p1 = 10.e3
    h1 = hpd(p1)
    s1 = spd(p1)
c=====
c    eta_pump = Wps/Wp, Wps=h2s-h1, Wp=h2-h1, Q_boiler=h3-h2
c=====
    eta_p = 0.8
    h2s = hps(p3,s1)
    wps = h2s - h1
    wp = wps/eta_p
    h2 = h1 + wp
    qb = h3 - h2
c=====
c    eta_turb = Wt/Wts, Wts=h3-h4s, Wt=h3-h4
c=====
    eta_t = 0.85
    h4s = hps(p1,s3)
    wts = h3 - h4s
    wt = eta_t * wts
    h4 = h3 - wt
    x4 = xph(p1,h4)
    x4s = xph(p1,h4s)
c=====
c    eta_rankin = Wnet/Q_boiler, Wnet=Wt-Wp
c=====
    wnet = wt - wp
    eta_r = wnet/qb
    qb_ideal = h3 - h2s
    wnet_ideal = wts - wps
    eta_ideal = wnet_ideal/qb_ideal
c    or Wp = v*(P2-P1)
    v1=vpd(p1)
    wpc = v1*(p3-p1)
    print*, 'x4 =',x4, '          x4s =',x4s
    print*, 'wp =',wp, '          wps =',wps, '          wpc =',wpc
    print*, 'wt =',wt, '          wts =',wts
    print*, 'qb =',qb, '          wnet =',wnet
    print*, 'eff =', eta_r, '      eta_ideal =',eta_ideal
c=====
c    h, w, q : J/kg
c    s : J/kgK, v : m³/kg
c=====
    stop
end

```

6. PROPATH 함수들 - (1) H2O

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
1	AIPPT(P,T)	AIPPT: Ion Product [(mol/kg) ²] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
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]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
8C	AKTD(T)		
8D	AKTDD(T)		
2	ALAPP(P)	ALAPP: Laplace Coefficient [m] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
3	ALAPT(T)	ALAPT: Laplace Coefficient [m] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
4	ALHP(P)	ALHP: Latent Heat of Vaporization [J/kg] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
5	ALHT(T)	ALHT: Latent Heat of Vaporization [J/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
6	ALMPD(P)	ALMPD: Thermal Conductivity of Saturated Liquid [W/(m·K)] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
7	ALMPDD(P)	ALMPDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T*: Temperature [K], [°C]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
8	ALMPT(P,T)	ALMPT: Thermal Conductivity [W/(m·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
9	ALMTD(T)	ALMTD: Thermal Conductivity of Saturated Liquid [W/(m·K)] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
10	ALMTDD(T)	ALMTDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
11	AMUPD(P)	AMUPD: Coefficient of Viscosity of Saturated Liquid [Pa·s] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
12	AMUPDD(P)	AMUPDD: Coefficient of Viscosity of Saturated Vapor [Pa·s] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
13	AMUPT(P,T)	AMUPT: Coefficient of Viscosity [Pa·s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
14	AMUTD(T)	AMUTD: Coefficient of Viscosity of Saturated Liquid [Pa·s] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]

H2O

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
15	AMUTDD(T)	AMUTDD: Coefficient of Viscosity of Saturated Vapor [Pa·s] T*: Temperature [K], [°C]	273.15≤T≤647.3 [K] 0≤T≤374.15 [°C]
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]	611.2≤P≤22.12×10 ⁶ [Pa] 6.112×10 ⁻³ ≤P≤221.2 [bar]
17	CPPDD(P)	CPPDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	611.2≤P≤22.12×10 ⁶ [Pa] 6.112×10 ⁻³ ≤P≤221.2 [bar]
18	CPPT(P,T)	CPPT: Isobaric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	611.2≤P≤100×10 ⁶ [Pa] 273.15≤T≤1073.15 [K] 6.112×10 ⁻³ ≤P≤1000 [bar] 0≤T≤800 [°C]
19	CPTD(T)	CPTD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	273.15≤T≤647.3 [K] 0≤T≤374.15 [°C]
20	CPTDD(T)	CPTDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	273.15≤T≤647.3 [K] 0≤T≤374.15 [°C]
21	CRP('A')	CRP: Critical Constants H: 'A'='H': 2.1074×10 ⁶ [J/kg] Specific Enthalpy P*: 'A'='P': 22.12×10 ⁶ [Pa], 221.2 [bar] Pressure S: 'A'='S': 4.4429×10 ³ [J/(kg·K)] Specific Entropy T*: 'A'='T': 647.3 [K], 374.15 [°C] Temperature V: 'A'='V': 3.17×10 ⁻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)	EPSPT: Static Dielectric Constant [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	611.2≤P≤100×10 ⁶ [Pa] 273.15≤T≤1073.15 [K] 6.112×10 ⁻³ ≤P≤1000 [bar] 0≤T≤800 [°C]
2C	EPSTD(T)		
2D	EPSTDD(T)		
89	FC('A')	FC: Fundamental Constants M: 'A'='M': 18.0153 Relative Molecular Mass R: 'A'='R': 461.51 [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]	611.2≤P≤22.12×10 ⁶ [Pa] 6.112×10 ⁻³ ≤P≤221.2 [bar]
24	HPDD(P)	HPDD: Specific Enthalpy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	611.2≤P≤22.12×10 ⁶ [Pa] 6.112×10 ⁻³ ≤P≤221.2 [bar]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
71	HPS(P,S)	HPS: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $SPT(P, 273.16K) \leq S \leq SPT(P, 1073.15K)$ [J/(kg·K)] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $SPT(P, 0.01^\circ C) \leq S \leq SPT(P, 800^\circ C)$ [J/(kg·K)]
25	HPT(P,T)	HPT: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
26	HPX(P,X)	HPX: Specific Enthalpy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar] $0 \leq X \leq 1.0$ [-]
27	HTD(T)	HTD: Specific Enthalpy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
28	HTDD(T)	HTDD: Specific Enthalpy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
29	HTX(T,X)	HTX: Specific Enthalpy of Mixture [J/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C] $0 \leq X \leq 1.0$ [-]
84	IDENTF('A')	IDENTF: CHARACTER TYPE FUNCTION for Package Identification (Length 20) C: 'A'='C': 'H2O' Molecular Formula S: 'A'='S': 'WATER(IFC1967-IPTS1968)' 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)	PRPD: Prandtl Number of Saturated Liquid [-] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
86	PRPDD(P)	PRPDD: Prandtl Number of Saturated Vapor [-] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
81	PRPT(P,T)	PRPT: Prandtl Number [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
87	PRTD(T)	PRTD: Prandtl Number of Saturated Liquid [-] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
88	PRTDD(T)	PRTDD: Prandtl Number of Saturated Vapor [-] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
99	PSBT(T)		
30	PST(T)	PST*: Saturation Pressure [Pa], [bar] T*: Temperature [K], [°C]	$173.15 \leq T \leq 647.3$ [K] $-100 \leq T \leq 374.15$ [°C]
72	PSTD(T)		
73	PSTDD(T)		
31	SIGP(P)	SIGP: Surface Tension [N/m] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
32	SIGT(T)	SIGT: Surface Tension [N/m] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
33	SPD(P)	SPD: Specific Entropy of Saturated Liquid [J/(kg·K)] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
34	SPDD(P)	SPDD: Specific Entropy of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]

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]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
36	SPX(P,X)	SPX: Specific Entropy of Mixture [J/(kg·K)] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar] $0 \leq X \leq 1.0$ [-]
37	STD(T)	STD: Specific Entropy of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
38	STDD(T)	STDD: Specific Entropy of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
39	STX(T,X)	STX: Specific Entropy of Mixture [J/(kg·K)] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C] $0 \leq X \leq 1.0$ [-]
67	TLDP(P)		
69	TMLP(P)		
64	TPH(P,H)	TPH*: Temperature [K], [°C] P*: Pressure [Pa], [bar] H: Specific Enthalpy [J/kg]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $HPT(P, 273.16K) \leq H \leq HPT(P, 1073.15K)$ [J/kg] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $HPT(P, 0.01^\circ C) \leq H \leq HPT(P, 800^\circ C)$ [J/kg]
6H	TPH2(P,H)		
65	TPS(P,S)	TPS*: Temperature [K], [°C] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $SPT(P, 273.16K) \leq S \leq SPT(P, 1073.15K)$ [J/(kg·K)] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $SPT(P, 0.01^\circ C) \leq S \leq SPT(P, 800^\circ C)$ [J/(kg·K)]
6S	TPS2(P,S)		
98	TPSEUP(P)	TPSEUP: Pseudo Boiling Point [K], [°C] P*: Pressure [Pa], [bar]	$22.12 \times 10^6 < P \leq 100 \times 10^6$ [Pa] $221.2 < P \leq 1000$ [bar]
70	TPV(P,V)	TPV*: Temperature [K], [°C] P*: Pressure [Pa], [bar] V: Specific Volume [m³/kg]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $VPT(P, 273.16K) \leq V \leq VPT(P, 1073.15K)$ [m³/kg] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $VPT(P, 0.01^\circ C) \leq V \leq VPT(P, 800^\circ C)$ [m³/kg]
41	TRPL('A')	TRPL*: Properties at Triple Point P*: 'A'='P': 611.20 [Pa], 6.112×10^{-3} [bar] Pressure T*: 'A'='T': 273.16 [K], 0.01 [°C] Temperature	one of 'P' and 'T'
100	TSBP(P)		
40	TSP(P)	TSP*: Saturation Temperature [K], [°C] P*: Pressure [Pa], [bar]	$1.40749 \times 10^{-3} \leq P \leq 22.12 \times 10^6$ [Pa] $14.0749 \times 10^{-9} \leq P \leq 221.2$ [bar]
74	TSPD(P)		
75	TSPDD(P)		
42	UPD(P)	UPD: Specific Internal Energy of Saturated Liquid [J/kg] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
43	UPDD(P)	UPDD: Specific Internal Energy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]

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)]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $SPT(P, 273.16K) \leq S \leq SPT(P, 1073.15K)$ [J/(kg·K)] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $SPT(P, 0.01^\circ C) \leq S \leq SPT(P, 800^\circ C)$ [J/(kg·K)]
44	UPT(P,T)	UPT: Specific Internal Energy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
45	UPX(P,X)	UPX: Specific Internal Energy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar] $0 \leq X \leq 1.0$ [-]
46	UTD(T)	UTD: Specific Internal Energy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
47	UTDD(T)	UTDD: Specific Internal Energy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
48	UTX(T,X)	UTX: Specific Internal Energy of Mixture [J/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C] $0 \leq X \leq 1.0$ [-]
49	VPD(P)	VPD: Specific Volume of Saturated Liquid [m³/kg] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
50	VPDD(P)	VPDD: Specific Volume of Saturated Vapor [m³/kg] P*: Pressure [Pa], [bar]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar]
80	VPS(P,S)	VPS: Specific Volume [m³/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $SPT(P, 273.16K) \leq S \leq SPT(P, 1073.15K)$ [J/(kg·K)] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $SPT(P, 0.01^\circ C) \leq S \leq SPT(P, 800^\circ C)$ [J/(kg·K)]
51	VPT(P,T)	VPT: Specific Volume [m³/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]
52	VPX(P,X)	VPX: Specific Volume of Mixture [m³/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$611.2 \leq P \leq 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P \leq 221.2$ [bar] $0 \leq X \leq 1.0$ [-]
53	VTD(T)	VTD: Specific Volume of Saturated Liquid [m³/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
54	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m³/kg] T*: Temperature [K], [°C]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C]
55	VTX(T,X)	VTX: Specific Volume of Mixture [m³/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$273.15 \leq T \leq 647.3$ [K] $0 \leq T \leq 374.15$ [°C] $0 \leq X \leq 1.0$ [-]
8E	WPD(P)		
8F	WPDD(P)		
83	WPT(P,T)	WPT: Velocity of Sound [m/s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$611.2 \leq P \leq 100 \times 10^6$ [Pa] $273.15 \leq T \leq 1073.15$ [K] $6.112 \times 10^{-3} \leq P \leq 1000$ [bar] $0 \leq T \leq 800$ [°C]

H2O

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
8G	WTD(T)		
8H	WTDD(T)		
56	XPB(P,H)	XPB: Dryness Fraction [-] P*: Pressure [Pa], [bar] H: Specific Enthalpy of Mixture [J/kg]	$611.2 \leq P < 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P < 221.2$ [bar] $HPD(P) \leq H \leq HPDD(P)$ [J/kg]
57	XPS(P,S)	XPS: Dryness Fraction [-] P*: Pressure [Pa], [bar] S: Specific Entropy of Mixture [J/(kg·K)]	$611.2 \leq P < 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P < 221.2$ [bar] $SPD(P) \leq S \leq SPDD(P)$ [J/(kg·K)]
58	XPU(P,U)	XPU: Dryness Fraction [-] P*: Pressure [Pa], [bar] U: Specific Internal Energy of Mixture [J/kg]	$611.2 \leq P < 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P < 221.2$ [bar] $UPD(P) \leq U \leq UPDD(P)$ [J/kg]
59	XPV(P,V)	XPV: Dryness Fraction [-] P*: Pressure [Pa], [bar] V: Specific Volume of Mixture [m ³ /kg]	$611.2 \leq P < 22.12 \times 10^6$ [Pa] $6.112 \times 10^{-3} \leq P < 221.2$ [bar] $VPD(P) \leq V \leq VPDD(P)$ [m ³ /kg]
60	XTH(T,H)	XTH: Dryness Fraction [-] T*: Temperature [K], [°C] H: Specific Enthalpy of Mixture [J/kg]	$273.15 \leq T < 647.3$ [K] $0 \leq T < 374.15$ [°C] $HPD(T) \leq H \leq HPDD(T)$ [J/kg]
61	XTS(T,S)	XTS: Dryness Fraction [-] T*: Temperature [K], [°C] S: Specific Entropy of Mixture [J/(kg·K)]	$273.15 \leq T < 647.3$ [K] $0 \leq T < 374.15$ [°C] $SPD(T) \leq S \leq SPDD(T)$ [J/(kg·K)]
62	XTU(T,U)	XTU: Dryness Fraction [-] T*: Temperature [K], [°C] U: Specific Internal Energy of Mixture [J/kg]	$273.15 \leq T < 647.3$ [K] $0 \leq T < 374.15$ [°C] $UPD(T) \leq U \leq UPDD(P)$ [J/kg]
63	XTV(T,V)	XTV: Dryness Fraction [-] T*: Temperature [K], [°C] V: Specific Volume of Mixture [m ³ /kg]	$273.15 \leq T < 647.3$ [K] $0 \leq T < 374.15$ [°C] $VPD(T) \leq V \leq VPDD(T)$ [m ³ /kg]

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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]	$0 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
8C	AKTD(T)		
8D	AKTDD(T)		
2	ALAPP(P)		
3	ALAPT(T)		
4	ALHP(P)	ALHP: Latent Heat of Vaporization [J/kg] P*: Pressure [Pa], [bar]	$40 \times 10^8 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar]
5	ALHT(T)		
6	ALMPD(P)		
7	ALMPDD(P)		
8	ALMPT(P,T)	ALMPT: Thermal Conductivity [W/(m·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 \leq P \leq 100 \times 10^6$ [Pa] $85 \leq T \leq 2000$ [K] $0 \leq P \leq 1000$ [bar] $-188.15 \leq T \leq 1726.85$ [°C] see Fig.II-2-1
9	ALMTD(T)		
10	ALMTDD(T)		
11	AMUPD(P)		
12	AMUPDD(P)		
13	AMUPT(P,T)	AMUPT: Coefficient of Viscosity [Pa·s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 \leq P \leq 100 \times 10^6$ [Pa] $85 \leq T \leq 2000$ [K] $0 \leq P \leq 1000$ [bar] $-188.15 \leq T \leq 1726.85$ [°C] see Fig.II-2-2
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)		
17	CPPDD(P)	CPPDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
18	CPPT(P,T)	CPPT: Isobaric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
19	CPTD(T)		
20	CPTDD(T)	CPTDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
21	CRP('A')	CRP: Critical Constants H: 'A'='H': 34.248×10^3 [J/kg] Specific Enthalpy P*: 'A'='P': 3.76625×10^6 [Pa], 37.6625 [bar] Pressure S: 'A'='S': 4.3843×10^3 [J/(kg·K)] Specific Entropy T*: 'A'='T': 132.52 [K], -140.63 [°C] Temperature V: 'A'='V': 3.19489×10^{-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]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
77	CVPT(P,T)	CVPT: Isochoric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
7B	CVTD(T)		
78	CVTDD(T)	CVTDD: Isochoric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]
2A	EPSPD(P)		
2B	EPSPDD(P)		
22	EPSPPT(P,T)		
2C	EPSTD(T)		
2D	EPSTDD(T)		
89	FC('A')	FC: Fundamental Constants M: 'A'='M': 28.96 Relative Molecular Mass R: 'A'='R': 287.22 [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]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar]
24	HPDD(P)	HPDD: Specific Enthalpy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
71	HPS(P,S)	HPS: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $0.01 \leq P \leq 4500$ [bar] see Fig.II-2-5 for S
25	HPT(P,T)	HPT: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0.01 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
26	HPX(P,X)	HPX: Specific Enthalpy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $0 \leq X \leq 1.0$ [-]
27	HTD(T)	HTD: Specific Enthalpy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$68 \leq T \leq 132$ [K] $-205.15 \leq T \leq -141.15$ [°C]
28	HTDD(T)	HTDD: Specific Enthalpy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]
29	HTX(T,X)		

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
84	IDENTF('A')	IDENTF : CHARACTER TYPE FUNCTION for Package Identification (Length 20) C: 'A'='C': 'AIR' Molecular Formula S: 'A'='S': 'AIR' 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 [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 \leq P \leq 0.1473 \times 10^6$ [Pa] $85 \leq T \leq 1523.15$ [K] $0.1473 \times 10^6 < P \leq 3.3 \times 10^6$ [Pa] $TSPDD(P) \leq T \leq 1523.15$ [K] $3.3 \times 10^6 < P \leq 42.791 \times 10^6$ [Pa] $159 \leq T \leq 1523.15$ [K] $42.791 \times 10^6 < P \leq 92.72 \times 10^6$ [Pa] $TPV(P, 1.42 \times 10^{-3} \text{ m}^3/\text{kg})$ $\leq T \leq 1523.15$ [K] $92.72 \times 10^6 < P \leq 100 \times 10^6$ [Pa] $223.15 \leq T \leq 1523.15$ [K] $0 \leq P \leq 1.473$ [bar] $-188.15 \leq T \leq 1250$ [°C] $1.473 < P < 33$ [bar] $TSPDD(P) \leq T \leq 1250$ [°C] $33 < P \leq 427.91$ [bar] $-78.15 \leq T \leq 1250$ [°C] $427.91 < P \leq 927.2$ [bar] $TPV(P, 1.42 \times 10^{-3} \text{ m}^3/\text{kg})$ $\leq T \leq 1250$ [°C] $927.2 < P \leq 1000$ [bar] $-40 \leq T \leq 1250$ [°C]
87	PRTD(T)		
88	PRTDD(T)		
99	PSBT(T)		
30	PST(T)		
72	PSTD(T)	PSTD*: Pressure [Pa], [bar] on Bubble-Point Curve (Saturated Liquid) T*: Temperature [K], [°C]	$68 \leq T \leq 132.42$ [K] $-205.15 \leq T \leq -140.73$ [°C]
73	PSTDD(T)	PSTDD*: Pressure [Pa], [bar] on Dew-Point Curve (Saturated Vapor) T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]
31	SIGP(P)		
32	SIGT(T)		
33	SPD(P)	SPD: Specific Entropy of Saturated Liquid [J/(kg·K)] P*: Pressure [Pa], [bar]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar]
34	SPDD(P)	SPDD: Specific Entropy of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
35	SPT(P,T)	SPT: Specific Entropy [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0.01 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
36	SPX(P,X)	SPX: Specific Entropy of Mixture [J/(kg·K)] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$40 \times 10^9 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $0 \leq X \leq 1.0$ [-]
37	STD(T)	STD: Specific Entropy of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	$68 \leq T \leq 132$ [K] $-205.15 \leq T \leq -141.15$ [°C]
38	STDD(T)	STDD: Specific Entropy of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]
39	STX(T,X)		
67	TLDP(P)		
69	TMLP(P)		
64	TPH(P,H)	TPH*: Temperature [K], [°C] P*: Pressure [Pa], [bar] H: Specific Enthalpy [J/kg]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $0.01 \leq P \leq 4500$ [bar] see Fig.II-2-4 for H
6H	TPH2(P,H)		
65	TPS(P,S)	TPS*: Temperature [K], [°C] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $0.01 \leq P \leq 4500$ [bar] see Fig.II-2-5 for S
6S	TPS2(P,S)		
98	TPSEUP(P)		
70	TPV(P,V)	TPV*: Temperature [K], [°C] P*: Pressure [Pa], [bar] V: Specific Volume [m³/kg]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $0.01 \leq P \leq 4500$ [bar] see Fig.II-2-6 for V
41	TRPL('A')		
100	TSBP(P)		
40	TSP(P)		
74	TSPD(P)	TSPD*: Temperature [K], [°C] on Bubble-Point Curve (Saturated Liquid) P*: Pressure [Pa], [bar]	$40 \times 10^9 \leq P \leq 3.77434 \times 10^6$ [Pa] $0.4 \leq P \leq 37.7434$ [bar]
75	TSPDD(P)	TSPDD*: Temperature [K], [°C] on Dew-Point Curve (Saturated Vapor) P*: Pressure [Pa], [bar]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
42	UPD(P)	UPD: Specific Internal Energy of Saturated Liquid [J/kg] P*: Pressure [Pa], [bar]	$40 \times 10^9 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar]
43	UPDD(P)	UPDD: Specific Internal Energy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
79	UPS(P,S)	UPS: Specific Internal Energy [J/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $0.01 \leq P \leq 4500$ [bar] see Fig.II-2-5 for S
44	UPT(P,T)	UPT: Specific Internal Energy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0.01 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
45	UPX(P,X)	UPX: Specific Internal Energy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$40 \times 10^9 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $0 \leq X \leq 1.0$ [-]
46	UTD(T)	UTD: Specific Internal Energy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$68 \leq T \leq 132$ [K] $-205.15 \leq T \leq -141.15$ [°C]
47	UTDD(T)	UTDD: Specific Internal Energy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
48	UTX(T,X)		
49	VPD(P)	VPD: Specific Volume of Saturated Liquid [m ³ /kg] P*: Pressure [Pa], [bar]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar]
50	VPDD(P)	VPDD: Specific Volume of Saturated Vapor [m ³ /kg] P*: Pressure [Pa], [bar]	$1000 \leq P \leq 3.76625 \times 10^6$ [Pa] $0.01 \leq P \leq 37.6625$ [bar]
80	VPS(P,S)	VPS: Specific Volume [m ³ /kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $0.01 \leq P \leq 4500$ [bar] see Fig.II-2-5 for S
51	VPT(P,T)	VPT: Specific Volume [m ³ /kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$1000 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0.01 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
52	VPX(P,X)	VPX: Specific Volume of Mixture [m ³ /kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $0 \leq X \leq 1.0$ [-]
53	VTD(T)	VTD: Specific Volume of Saturated Liquid [m ³ /kg] T*: Temperature [K], [°C]	$68 \leq T \leq 132.52$ [K] $-205.15 \leq T \leq -140.63$ [°C]
54	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m ³ /kg] T*: Temperature [K], [°C]	$60 \leq T \leq 132.52$ [K] $-213.15 \leq T \leq -140.63$ [°C]
55	VTX(T,X)		
8E	WPD(P)		
8F	WPDD(P)		
83	WPT(P,T)	WPT: Velocity of Sound [m/s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 \leq P \leq 450 \times 10^6$ [Pa] $60 \leq T \leq 1523.15$ [K] $0 \leq P \leq 4500$ [bar] $-213.15 \leq T \leq 1250$ [°C] see Fig.II-2-3
8G	WTD(T)		
8H	WTDD(T)		
56	XPH(P,H)	XPH: Dryness Fraction [-] P*: Pressure [Pa], [bar] H: Specific Enthalpy of Mixture [J/(kg·K)]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $HPD(P) \leq H \leq HPDD(P)$ [J/kg]
57	XPS(P,S)	XPS: Dryness Fraction [-] P*: Pressure [Pa], [bar] S: Specific Entropy of Mixture [J/(kg·K)]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $SPD(P) \leq S \leq SPDD(P)$ [J/(kg·K)]
58	XPU(P,U)	XPU: Dryness Fraction [-] P*: Pressure [Pa], [bar] U: Specific Internal Energy of Mixture [J/kg]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $UPD(P) \leq U \leq UPDD(P)$ [J/kg]
59	XPV(P,V)	XPV: Dryness Fraction [-] P*: Pressure [Pa], [bar] V: Specific Volume of Mixture [m ³ /kg]	$40 \times 10^3 \leq P \leq 3.6 \times 10^6$ [Pa] $0.4 \leq P \leq 36$ [bar] $VPD(P) \leq V \leq VPDD(P)$ [m ³ /kg]
60	XTH(T,H)		
61	XTS(T,S)		
62	XTU(T,U)		
63	XTV(T,V)		

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
1	AIPPT(P,T)		
94	AJTPT(P,T)	AJTPT: Joule-Thomson Coefficient [K/Pa] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
8A	AKPD(P)		
8B	AKPDD(P)		
82	AKPT(P,T)	AKPT: Aidabatic Exponent [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
8C	AKTD(T)		
8D	AKTDD(T)		
2	ALAPP(P)	ALAPP: Laplace Coefficient [m] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar]
3	ALAPT(T)	ALAPT: Laplace Coefficient [m] T*: Temperature [K], [°C]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C]
4	ALHP(P)	ALHP: Latent Heat of Vaporization [J/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
5	ALHT(T)	ALHT: Latent Heat of Vaporization [J/kg] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
6	ALMPD(P)	ALMPD: Thermal Conductivity of Saturated Liquid [W/(m·K)] P*: Pressure [Pa], [bar]	$1.286 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $12.86 \leq P < 73.825$ [bar]
7	ALMPDD(P)	ALMPDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T*: Temperature [K], [°C]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
8	ALMPT(P,T)	ALMPT: Thermal Conductivity [W/(m·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq \text{PST}(240\text{K})$ [Pa] $\text{TSP}(P) \leq T \leq 1100$ [K] $\text{PST}(240\text{K}) < P \leq 60 \times 10^6$ $240 \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $240 \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq \text{PST}(-33.15^\circ\text{C})$ [bar] $\text{TSP}(P) \leq T \leq 826.85$ [°C] $\text{PST}(-33.15^\circ\text{C}) < P \leq 600$ [bar] $-33.15 \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $-33.15 \leq T \leq 426.85$ [°C]
9	ALMTD(T)	ALMTD: Thermal Conductivity of Saturated Liquid [W/(m·K)] T*: Temperature [K], [°C]	$240 \leq T < 304.21$ [K] $-33.15 \leq T < 31.06$ [°C]
10	ALMTDD(T)	ALMTDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T*: Temperature [K], [°C]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C]
11	AMUPD(P)	AMUPD: Coefficient of Viscosity of Saturated Liquid [Pa·s] P*: Pressure [Pa], [bar]	$1.286 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $12.86 \leq P \leq 73.825$ [bar]
12	AMUPDD(P)	AMUPDD: Coefficient of Viscosity of Saturated Vapor [Pa·s] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
13	AMUPT(P,T)	AMUPT: Coefficient of Viscosity [Pa·s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq \text{PST}(240\text{K})$ [Pa] $\text{TSP}(P) \leq T \leq 1100$ [K] $\text{PST}(240\text{K}) < P \leq 60 \times 10^6$ $240 \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $240 \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq \text{PST}(-33.15^\circ\text{C})$ [bar] $\text{TSP}(P) \leq T \leq 826.85$ [°C] $\text{PST}(-33.15^\circ\text{C}) < P \leq 600$ [bar] $-33.15 \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $-33.15 \leq T \leq 426.85$ [°C]
14	AMUTD(T)	AMUTD: Coefficient of Viscosity of Saturated Liquid [Pa·s] T*: Temperature [K], [°C]	$240 \leq T < 304.21$ [K] $-33.15 \leq T \leq 31.06$ [°C]
15	AMUTDD(T)	AMUTDD: Coefficient of Viscosity of Saturated Vapor [Pa·s] T*: Temperature [K], [°C]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
92	BPPT(P,T)	BPPT: Volumetric Coefficient of Expansion [1/K] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
90	BSPT(P,T)	BSPT: Isentropic Compressibility [1/Pa] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
91	BTPT(P,T)	BTPT: Isothermal Compressibility [1/Pa] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
93	BVPT(P,T)	BVPT: Pressure Coefficient [1/K] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
16	CPPD(P)	CPPD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar]
17	CPPDD(P)	CPPDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
18	CPPT(P,T)	CPPT: Isobaric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $\text{TMLP}(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $\text{TMLP}(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $\text{TMLP}(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $\text{TMLP}(P) \leq T \leq 426.85$ [°C]
19	CPTD(T)	CPTD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C]
20	CPTDD(T)	CPTDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C]
21	CRP('A')	CRP: Critical Constants H: 'A'='H': 636.64×10^3 [J/kg] Specific Enthalpy P*: 'A'='P': 7.3825×10^6 [Pa], 73.825 [bar] Pressure S: 'A'='S': 3.5579×10^3 [J/(kg·K)] Specific Entropy T*: 'A'='T': 304.21 [K], 31.06 [°C] Temperature V: 'A'='V': 2.1459×10^{-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]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
77	CVPT(P,T)	CVPT: Isochoric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $\text{TMLP}(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $\text{TMLP}(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $\text{TMLP}(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $\text{TMLP}(P) \leq T \leq 426.85$ [°C]
7B	CVTD(T)		
78	CVTDD(T)	CVTDD: Isochoric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°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': 44.009 Relative Molecular Mass R: 'A'='R': 188.92 [J/(kg·K)] Gas Constant	one of 'M' and 'R'
9A	GAMPD(P)		
96	GAMPDD(P)	GAMPDD: Ratio of Specific Heats of Saturated Vapor [-] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
95	GAMPT(P,T)	GAMPT: Ratio of Specific Heats [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
9B	GAMTD(T)		
97	GAMTDD(T)	GAMTDD: Ratio of Specific Heats of Saturated Vapor [-] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
23	HPD(P)	HPD: Specific Enthalpy of Saturated Liquid [J/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
24	HPDD(P)	HPDD: Specific Enthalpy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
71	HPS(P,S)	HPS: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $SPT(P, 220K) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 700K)$ [J/(kg·K)] $0.1 \leq P < 5.185$ [bar] $SPT(P, -53.15^\circ C) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $5.185 \leq P \leq 600$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $600 < P < 1000$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 426.85^\circ C)$ [J/(kg·K)]
25	HPT(P,T)	HPT: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
26	HPX(P,X)	HPX: Specific Enthalpy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar] $0 \leq X \leq 1.0$ [-]
27	HTD(T)	HTD: Specific Enthalpy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
28	HTDD(T)	HTDD: Specific Enthalpy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	216.58 ≤ T ≤ 304.21 [K] −56.57 ≤ T ≤ 31.06 [°C]
29	HTX(T,X)	HTX: Specific Enthalpy of Mixture [J/kg] T*: Temperature [K], [°C] X: Dryness Fraction [−]	216.58 ≤ T ≤ 304.21 [K] −56.57 ≤ T ≤ 31.06 [°C] 0 ≤ X ≤ 1.0 [−]
84	IDENTF('A')	IDENTF: CHARACTER TYPE FUNCTION for Package Identification (Length 20) C: 'A'='C': 'CO2' Molecular Formula S: 'A'='S': 'CARBON DIOXIDE' Name of Substance V: 'A'='V': '10.1' Version Number	one of 'C', 'S' and 'V'
66	PLDT(T)		
68	PMLT(T)	PMLT*: Pressure on Melting Curve [Pa], [bar] T*: Temperature [K], [°C]	216.58 ≤ T ≤ 237 [K] −56.57 ≤ T ≤ −36.15 [°C]
85	PRPD(P)	PRPD: Prandtl Number of Saturated Liquid [−] P*: Pressure [Pa], [bar]	1.286 × 10 ⁶ ≤ P < 7.3825 × 10 ⁶ [Pa] 12.86 ≤ P < 73.825 [bar]
86	PRPDD(P)	PRPDD: Prandtl Number of Saturated Vapor [−] P*: Pressure [Pa], [bar]	0.5185 × 10 ⁶ ≤ P < 7.3825 × 10 ⁶ [Pa] 5.185 ≤ P < 73.825 [bar]
81	PRPT(P,T)	PRPT: Prandtl Number [−] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	10000 ≤ P < 0.5185 × 10 ⁶ [Pa] 220 ≤ T ≤ 1100 [K] 0.5185 × 10 ⁶ ≤ P ≤ PST(240K) [Pa] TSP(P) ≤ T ≤ 1100 [K] PST(240K) < P ≤ 60 × 10 ⁶ 240 ≤ T ≤ 1100 [K] 60 × 10 ⁶ < P < 100 × 10 ⁶ [Pa] 240 ≤ T ≤ 700 [K] 0.1 ≤ P < 5.185 [bar] −53.15 ≤ T ≤ 826.85 [°C] 5.185 ≤ P ≤ PST(−33.15°C) [bar] TSP(P) ≤ T ≤ 826.85 [°C] PST(−33.15°C) < P ≤ 600 [bar] −33.15 ≤ T ≤ 826.85 [°C] 600 < P < 1000 [bar] −33.15 ≤ T ≤ 426.85 [°C]
87	PRTD(T)	PRTD: Prandtl Number of Saturated Liquid [−] T*: Temperature [K], [°C]	240 ≤ T < 304.21 [K] −33.15 ≤ T < 31.06 [°C]
88	PRTDD(T)	PRTDD: Prandtl Number of Saturated Vapor [−] T*: Temperature [K], [°C]	216.58 ≤ T < 304.21 [K] −56.57 ≤ T < 31.06 [°C]
99	PSBT(P)		
30	PST(T)	PST*: Saturation Pressure [Pa], [bar] T*: Temperature [K], [°C]	216.58 ≤ T ≤ 304.21 [K] −56.57 ≤ T ≤ 31.06 [°C]
72	PSTD(P)		
73	PSTDD(P)		
31	SIGP(P)	SIGP: Surface Tension [N/m] P*: Pressure [Pa], [bar]	0.5185 × 10 ⁶ ≤ P ≤ 7.3825 × 10 ⁶ [Pa] 5.185 ≤ P ≤ 73.825 [bar]
32	SIGT(T)	SIGT: Surface Tension [N/m] T*: Temperature [K], [°C]	216.58 ≤ T ≤ 304.21 [K] −56.57 ≤ T ≤ 31.06 [°C]
33	SPD(P)	SPD: Specific Entropy of Saturated Liquid [J/(kg·K)] P*: Pressure [Pa], [bar]	0.5185 × 10 ⁶ ≤ P ≤ 7.3825 × 10 ⁶ [Pa] 5.185 ≤ P ≤ 73.825 [bar]
34	SPDD(P)	SPDD: Specific Entropy of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	0.5185 × 10 ⁶ ≤ P ≤ 7.3825 × 10 ⁶ [Pa] 5.185 ≤ P ≤ 73.825 [bar]

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]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
36	SPX(P,X)	SPX: Specific Entropy of Mixture [J/(kg·K)] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar] $0 \leq X \leq 1.0$ [-]
37	STD(T)	STD: Specific Entropy of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
38	STDD(T)	STDD: Specific Entropy of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
39	STX(T,X)	STX: Specific Entropy of Mixture [J/(kg·K)] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C] $0 \leq X \leq 1.0$ [-]
67	TLDP(P)		
69	TMLP(P)	TMLP*: Temperature on Melting Curve [K], [°C] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 100 \times 10^6$ [Pa] $5.185 \leq P \leq 1000$ [bar]
64	TPH(P,H)	TPH*: Temperature [K], [°C] P*: Pressure [Pa], [bar] H: Specific Enthalpy [J/kg]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $HPT(P, 220K) \leq H \leq HPT(P, 1100K)$ [J/kg] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $HPT(P, TMLP(P)) \leq H \leq HPT(P, 1100K)$ [J/kg] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $HPT(P, TMLP(P)) \leq H \leq HPT(P, 700K)$ [J/kg] $0.1 \leq P < 5.185$ [bar] $HPT(P, -53.15^\circ C) \leq H \leq HPT(P, 826.85^\circ C)$ [J/kg] $5.185 \leq P \leq 600$ [bar] $HPT(P, TMLP(P)) \leq H \leq HPT(P, 826.85^\circ C)$ [J/kg] $600 < P < 1000$ [bar] $HPT(P, TMLP(P)) \leq H \leq HPT(P, 426.85^\circ C)$ [J/kg]
6H	TPH2(P,H)		

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
65	TPS(P,S)	TPS*: Temperature [K], [°C] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $SPT(P, 220K) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 700K)$ [J/(kg·K)] $0.1 \leq P < 5.185$ [bar] $SPT(P, -53.15^\circ C) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $5.185 \leq P \leq 600$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $600 < P < 1000$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 426.85^\circ C)$ [J/(kg·K)]
6S	TPS2(P,S)		
98	TPSEUP(P)	TPSEUP: Pseudo Boiling Point [K], [°C] P*: Pressure [Pa], [bar]	$7.3825 \times 10^6 < P \leq 30 \times 10^6$ [Pa] $73.825 < P \leq 300$ [bar]
70	TPV(P,V)	TPV*: Temperature [K], [°C] P*: Pressure [Pa], [bar] V: Specific Volume [m³/kg]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $VPT(P, 220K) \leq V \leq$ $VPT(P, 1100K)$ [m³/kg] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $VPT(P, TMLP(P)) \leq V \leq$ $VPT(P, 1100K)$ [m³/kg] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $VPT(P, TMLP(P)) \leq V \leq$ $VPT(P, 700K)$ [m³/kg] $0.1 \leq P < 5.185$ [bar] $VPT(P, -53.15^\circ C) \leq V \leq$ $VPT(P, 826.85^\circ C)$ [m³/kg] $5.185 \leq P \leq 600$ [bar] $VPT(P, TMLP(P)) \leq V \leq$ $VPT(P, 826.85^\circ C)$ [m³/kg] $600 < P < 1000$ [bar] $VPT(P, TMLP(P)) \leq V \leq$ $VPT(P, 426.85^\circ C)$ [m³/kg]
41	TRPL('A')	TRPL*: Properties at Triple Point P*: 'A'='P': 0.5185×10^6 [Pa], 5.185 [bar] Pressure T*: 'A'='T': 216.58 [K], -56.57 [°C] Temperature	one of 'P' and 'T'
100	TSBP(P)		
40	TSP(P)	TSP*: Saturation Temperature [K], [°C] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
74	TSPD(P)		
75	TSPDD(P)		
42	UPD(P)	UPD: Specific Internal Energy of Saturated Liquid [J/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
43	UPDD(P)	UPDD: Specific Internal Energy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]

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)]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $SPT(P, 220K) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 700K)$ [J/(kg·K)] $0.1 \leq P < 5.185$ [bar] $SPT(P, -53.15^\circ C) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $5.185 \leq P \leq 600$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $600 < P < 1000$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 426.85^\circ C)$ [J/(kg·K)]
44	UPT(P,T)	UPT: Specific Internal Energy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMPLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMPLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMPLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMPLP(P) \leq T \leq 426.85$ [°C]
45	UPX(P,X)	UPX: Specific Internal Energy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar] $0 \leq X \leq 1.0$ [-]
46	UTD(T)	UTD: Specific Internal Energy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
47	UTDD(T)	UTDD: Specific Internal Energy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
48	UTX(T,X)	UTX: Specific Internal Energy of Mixture [J/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C] $0 \leq X \leq 1.0$ [-]
49	VPD(P)	VPD: Specific Volume of Saturated Liquid [m³/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]
50	VPDD(P)	VPDD: Specific Volume of Saturated Vapor [m³/kg] P*: Pressure [Pa], [bar]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
80	VPS(P,S)	VPS: Specific Volume [m ³ /kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $SPT(P, 220K) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 1100K)$ [J/(kg·K)] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 700K)$ [J/(kg·K)] $0.1 \leq P < 5.185$ [bar] $SPT(P, -53.15^\circ C) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $5.185 \leq P \leq 600$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 826.85^\circ C)$ [J/(kg·K)] $600 < P < 1000$ [bar] $SPT(P, TMLP(P)) \leq S \leq$ $SPT(P, 426.85^\circ C)$ [J/(kg·K)]
51	VPT(P,T)	VPT: Specific Volume [m ³ /kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
52	VPX(P,X)	VPX: Specific Volume of Mixture [m ³ /kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.5185 \times 10^6 \leq P \leq 7.3825 \times 10^6$ [Pa] $5.185 \leq P \leq 73.825$ [bar] $0 \leq X \leq 1.0$ [-]
53	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m ³ /kg] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
54	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m ³ /kg] T*: Temperature [K], [°C]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C]
55	VTX(T,X)	VTX: Specific Volume of Mixture [m ³ /kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$216.58 \leq T \leq 304.21$ [K] $-56.57 \leq T \leq 31.06$ [°C] $0 \leq X \leq 1.0$ [-]
8E	WPD(P)		
8F	WPDD(P)		
83	WPT(P,T)	WPT: Velocity of Sound [m/s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$10000 \leq P < 0.5185 \times 10^6$ [Pa] $220 \leq T \leq 1100$ [K] $0.5185 \times 10^6 \leq P \leq 60 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 1100$ [K] $60 \times 10^6 < P < 100 \times 10^6$ [Pa] $TMLP(P) \leq T \leq 700$ [K] $0.1 \leq P < 5.185$ [bar] $-53.15 \leq T \leq 826.85$ [°C] $5.185 \leq P \leq 600$ [bar] $TMLP(P) \leq T \leq 826.85$ [°C] $600 < P < 1000$ [bar] $TMLP(P) \leq T \leq 426.85$ [°C]
8G	WTD(T)		
8H	WTDD(T)		

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
56	XPB(P,H)	XPB: Dryness Fraction [-] P*: Pressure [Pa], [bar] H: Specific Enthalpy of Mixture [J/kg]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar] $HPD(P) \leq H \leq HPDD(P)$ [J/kg]
57	XPS(P,S)	XPS: Dryness Fraction [-] P*: Pressure [Pa], [bar] S: Specific Entropy of Mixture [J/(kg·K)]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar] $SPD(P) \leq S \leq SPDD(P)$ [J/(kg·K)]
58	XPU(P,U)	XPU: Dryness Fraction [-] P*: Pressure [Pa], [bar] U: Specific Internal Energy of Mixture [J/kg]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar] $UPD(P) \leq U \leq UPDD(P)$ [J/kg]
59	XPV(P,V)	XPV: Dryness Fraction [-] P*: Pressure [Pa], [bar] V: Specific Volume of Mixture [m ³ /kg]	$0.5185 \times 10^6 \leq P < 7.3825 \times 10^6$ [Pa] $5.185 \leq P < 73.825$ [bar] $VPD(P) \leq V \leq VPDD(P)$ [m ³ /kg]
60	XTH(T,H)	XTH: Dryness Fraction [-] T*: Temperature [K], [°C] H: Specific Enthalpy of Mixture [J/kg]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C] $HTD(T) \leq H \leq HTDD(T)$ [J/kg]
61	XTS(T,S)	XTS: Dryness Fraction [-] T*: Temperature [K], [°C] S: Specific Entropy of Mixture [J/(kg·K)]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C] $STD(T) \leq S \leq STDD(T)$ [J/(kg·K)]
62	XTU(T,U)	XTU: Dryness Fraction [-] T*: Temperature [K], [°C] U: Specific Internal Energy of Mixture [J/kg]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C] $UTD(T) \leq U \leq UTDD(T)$ [J/kg]
63	XTV(T,V)	XTV: Dryness Fraction [-] T*: Temperature [K], [°C] V: Specific Volume of Mixture [m ³ /kg]	$216.58 \leq T < 304.21$ [K] $-56.57 \leq T < 31.06$ [°C] $VTD(T) \leq V \leq VTDD(T)$ [m ³ /kg]

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
1	AIPPT(P,T)		
94	AJTPT(P,T)	AJTPT: Joule-Thomson Coefficient [K/Pa] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
8A	AKPD(P)		
8B	AKPDD(P)		
82	AKPT(P,T)	AKPT: Isentropic Exponent [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
8C	AKTD(T)		
8D	AKTDD(T)		
2	ALAPP(P)	ALAPP: Laplace Coefficient [m] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
3	ALAPT(T)	ALAPT: Laplace Coefficient [m] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
4	ALHP(P)	ALHP: Latent Heat of Vaporization [J/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
5	ALHT(T)	ALHT: Latent Heat of Vaporization [J/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
6	ALMPD(P)	ALMPD: Thermal Conductivity of Saturated Liquid [W/(m·K)] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 3.04 \times 10^6$ [Pa] $0.7 \leq P \leq 30.4$ [bar]
7	ALMPDD(P)	ALMPDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T*: Temperature [K], [°C]	$0.07 \times 10^6 \leq P \leq 3.04 \times 10^6$ [Pa] $0.7 \leq P \leq 30.4$ [bar]
8	ALMPT(P,T)	ALMPT: Thermal Conductivity [W/(m·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0.07 \times 10^6 \leq P \leq 20 \times 10^6$ [Pa] $240 \leq T \leq 360$ [K] $0.7 \leq P \leq 200$ [bar] $-33.15 \leq T \leq 86.85$ [°C]
9	ALMTD(T)	ALMTD: Thermal Conductivity of Saturated Liquid [W/(m·K)] T*: Temperature [K], [°C]	$240 \leq T \leq 360$ [K] $-33.15 \leq T \leq 86.85$ [°C]
10	ALMTDD(T)	ALMTDD: Thermal Conductivity of Saturated Vapor [W/(m·K)] T*: Temperature [K], [°C]	$240 \leq T \leq 360$ [K] $-33.15 \leq T \leq 86.85$ [°C]
11	AMUPD(P)	AMUPD: Coefficient of Viscosity of Saturated Liquid [Pa·s] P*: Pressure [Pa], [bar]	$0.117 \times 10^6 \leq P \leq 2.061 \times 10^6$ [Pa] $1.17 \leq P \leq 20.61$ [bar]
12	AMUPDD(P)		
13	AMUPT(P,T)	AMUPT: Coefficient of Viscosity [Pa·s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$298.15 \leq T \leq 370.208$ [K] $0.07 \times 10^6 \leq P \leq \text{PST}(T)$ [Pa] $370.208 < T \leq 423.15$ [K] $0.07 \times 10^6 \leq P \leq (0.446 \times (T - 273.15)[K] - 5.8577) \times 10^5$ [Pa] $25 \leq T \leq 97.058$ [°C] $0.7 \leq P \leq \text{PST}(T)$ [bar] $97.058 < T \leq 150$ [°C] $0.7 < P \leq 0.446 \times T[°C] - 5.8577$ [bar]
14	AMUTD(T)	AMUTD: Coefficient of Viscosity of Saturated Liquid [Pa·s] T*: Temperature [K], [°C]	$250 \leq T \leq 342$ [K] $-23.15 \leq T \leq 68.85$ [°C]
15	AMUTDD(T)		

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
92	BPPT(P,T)	BPPT: Volumetric Coefficient of Expansion [1/K] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
90	BSPT(P,T)	BSPT: Isentropic Compressibility [1/Pa] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
91	BTPT(P,T)	BTPT: Isothermal Compressibility [1/Pa] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
93	BVPT(P,T)	BVPT: Pressure Coefficient [1/K] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
16	CPPD(P)	CPPD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P < 4.0404 \times 10^6$ [Pa] $0.7 \leq P < 40.404$ [bar]
17	CPPDD(P)	CPPDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P < 4.0404 \times 10^6$ [Pa] $0.7 \leq P < 40.404$ [bar]
18	CPPT(P,T)	CPPT: Isobaric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
19	CPTD(T)	CPTD: Isobaric Specific Heat of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	$240 \leq T < 374$ [K] $-33.15 \leq T < 100.85$ [°C]
20	CPTDD(T)	CPTDD: Isobaric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$240 \leq T < 374$ [K] $-33.15 \leq T < 100.85$ [°C]
21	CRP('A')	CRP: Critical Constants H: 'A'='H': 0.39101×10^6 [J/kg] Specific Enthalpy P*: 'A'='P': 4.064×10^6 [Pa], 40.64 [bar] Pressure S: 'A'='S': 1.5659×10^3 [J/(kg·K)] Specific Entropy T*: 'A'='T': 374.30 [K], 101.15 [°C] Temperature V: 'A'='V': 1.9685×10^{-3} [m³/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]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
77	CVPT(P,T)	CVPT: Isochoric Specific Heat [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
7B	CVTD(T)		
78	CVTDD(T)	CVTDD: Isochoric Specific Heat of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
2A	EPSPD(P)		
2B	EPSPDD(P)		
22	EPSPT(P,T)		

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
2C	EPSTD(T)		
2D	EPSTDD(T)		
89	FC('A')	FC: Fundamental Constants M: 'A'='M': 102.032 Relative Molecular Mass R: 'A'='R': 81.4892 [J/(kg·K)] Gas Constant	one of 'M' and 'R'
9A	GAMPD(P)		
96	GAMPDD(P)	GAMPDD: Ratio of Specific Heats of Saturated Vapor [-] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P < 4.064 \times 10^6$ [Pa] $0.7 \leq P < 40.64$ [bar]
95	GAMPT(P,T)	GAMPT: Ratio of Specific Heats [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
9B	GAMTD(T)		
97	GAMTDD(T)	GAMTDD: Ratio of Specific Heats of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$240 \leq T < 374$ [K] $-33.15 \leq T < 100.85$ [°C]
23	HPD(P)	HPD: Specific Enthalpy of Saturated Liquid [J/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P < 4.064 \times 10^6$ [Pa] $0.7 \leq P < 40.64$ [bar]
24	HPDD(P)	HPDD: Specific Enthalpy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P < 4.064 \times 10^6$ [Pa] $0.7 \leq P < 40.64$ [bar]
71	HPS(P,S)	HPS: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$0.07 \times 10^6 \leq P \leq 0.072979 \times 10^6$ [Pa] $\text{SPD}(P) \leq S \leq \text{SPT}(P, 480\text{K})$ [J/(kg·K)] $0.072979 \times 10^6 < P \leq 15 \times 10^6$ [Pa] $\text{SPT}(P, 240\text{K}) \leq S \leq$ $\text{SPT}(P, 480\text{K})$ [J/(kg·K)] $0.7 \leq P \leq 0.72979$ [bar] $\text{SPD}(P) \leq S \leq$ $\text{SPT}(P, 206.85^\circ\text{C})$ [J/(kg·K)] $0.72979 < P \leq 150$ [bar] $\text{SPT}(P, -33.15^\circ\text{C}) \leq S \leq$ $\text{SPT}(P, 206.85^\circ\text{C})$ [J/(kg·K)]
25	HPT(P,T)	HPT: Specific Enthalpy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0.07 \times 10^6 \leq P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0.7 \leq P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
26	HPX(P,X)	HPX: Specific Enthalpy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.07 \times 10^6 \leq P < 4.064 \times 10^6$ [Pa] $0.7 \leq P < 40.64$ [bar] $0 \leq X \leq 1.0$ [-]
27	HTD(T)	HTD: Specific Enthalpy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
28	HTDD(T)	HTDD: Specific Enthalpy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
29	HTX(T,X)	HTX: Specific Enthalpy of Mixture [J/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $0 \leq X \leq 1.0$ [-]
84	IDENTF('A')	IDENTF: CHARACTER TYPE FUNCTION for Package Identification (Length 20) C: 'A'='C': 'CH2F-CF3' Molecular Formula S: 'A'='S': 'HFC-134A(R134A)' Name of Substance V: 'A'='V': '10.1' Version Number	one of 'C', 'S' and 'V'
66	PLDT(T)		
68	PMLT(T)		

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
85	PRPD(P)	PRPD: Prandtl Number of Saturated Liquid [-] P*: Pressure [Pa], [bar]	$0.117 \times 10^6 \leq P \leq 2.061 \times 10^6$ [Pa] $1.17 \leq P \leq 20.61$ [bar]
86	PRPDD(P)		
81	PRPT(P,T)	PRPT: Prandtl Number [-] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$298.15 \leq T \leq 360$ [K] $0.07 \times 10^6 \leq P \leq \text{PST}(T)$ [Pa] $25 \leq T \leq 86.85$ [°C] $0.7 \leq P \leq \text{PST}(T)$ [bar]
87	PRTD(T)	PRTD: Prandtl Number of Saturated Liquid [-] T*: Temperature [K], [°C]	$250 \leq T \leq 342$ [K] $-23.15 \leq T \leq 68.85$ [°C]
88	PRTDD(T)		
99	PSBT(T)		
30	PST(T)	PST*: Saturation Pressure [Pa], [bar] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
72	PSTD(T)		
73	PSTDD(T)		
31	SIGP(P)	SIGP: Surface Tension [N/m] P*: Pressure [Pa], [bar]	$0.04376 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.4376 \leq P \leq 40.64$ [bar]
32	SIGT(T)	SIGT: Surface Tension [N/m] T*: Temperature [K], [°C]	$230 \leq T \leq 374.3$ [K] $-43.15 \leq T \leq 101.15$ [°C]
33	SPD(P)	SPD: Specific Entropy of Saturated Liquid [J/(kg·K)] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
34	SPDD(P)	SPDD: Specific Entropy of Saturated Vapor [J/(kg·K)] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
35	SPT(P,T)	SPT: Specific Entropy [J/(kg·K)] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0.07 \times 10^6 \leq P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0.7 \leq P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
36	SPX(P,X)	SPX: Specific Entropy of Mixture [J/(kg·K)] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $0 \leq X \leq 1.0$ [-]
37	STD(T)	STD: Specific Entropy of Saturated Liquid [J/(kg·K)] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
38	STDD(T)	STDD: Specific Entropy of Saturated Vapor [J/(kg·K)] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
39	STX(T,X)	STX: Specific Entropy of Mixture [J/(kg·K)] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $0 \leq X \leq 1.0$ [-]
67	TLDP(P)		
69	TMLP(P)		
64	TPH(P,H)	TPH*: Temperature [K], [°C] P*: Pressure [Pa], [bar] H: Specific Enthalpy [J/kg]	$0.07 \times 10^6 \leq P \leq 0.072979 \times 10^6$ [Pa] $\text{HPD}(P) \leq H \leq \text{HPT}(P, 480\text{K})$ [J/kg] $0.072979 \times 10^6 < P \leq 15 \times 10^6$ [Pa] $\text{HPT}(P, 240\text{K}) \leq H \leq \text{HPT}(P, 480\text{K})$ [J/kg] $0.7 \leq P \leq 0.72979$ [bar] $\text{HPD}(P) \leq H \leq \text{HPT}(P, 206.85^\circ\text{C})$ [J/kg] $0.72979 < P \leq 150$ [bar] $\text{HPT}(P, -33.15^\circ\text{C}) \leq H \leq \text{HPT}(P, 206.85^\circ\text{C})$ [J/kg]
6H	TPH2(P,H)		

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
65	TPS(P,S)	TPS*: Temperature [K], [°C] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$0.07 \times 10^6 \leq P \leq 0.072979 \times 10^6$ [Pa] $SPD(P) \leq S \leq SPT(P, 480K)$ [J/(kg·K)] $0.072979 \times 10^6 < P \leq 15 \times 10^6$ [Pa] $SPT(P, 240K) \leq S \leq$ $SPT(P, 480K)$ [J/(kg·K)] $0.7 \leq P \leq 0.72979$ [bar] $SPD(P) \leq S \leq$ $SPT(P, 206.85^\circ C)$ [J/(kg·K)] $0.72979 < P \leq 150$ [bar] $SPT(P, -33.15^\circ C) \leq S \leq$ $SPT(P, 206.85^\circ C)$ [J/(kg·K)]
68	TPS2(P,S)		
98	TPSEUP(P)	TPSEUP: Pseudo Boiling Point [K], [°C] P*: Pressure [Pa], [bar]	$4.064 \times 10^6 \leq P \leq 15 \times 10^6$ [Pa] $40.64 \leq P \leq 150$ [bar]
70	TPV(P,V)	TPV*: Temperature [K], [°C] P*: Pressure [Pa], [bar] V: Specific Volume [m³/kg]	$0.07 \times 10^6 \leq P \leq 0.072979 \times 10^6$ [Pa] $VPD(P) \leq V \leq VPT(P, 480K)$ [m³/kg] $0.072979 \times 10^6 < P \leq 15 \times 10^6$ [Pa] $VPT(P, 240K) \leq V \leq$ $VPT(P, 480K)$ [m³/kg] $0.7 \leq P \leq 0.72979$ [bar] $VPD(P) \leq V \leq$ $VPT(P, 206.85^\circ C)$ [m³/kg] $0.72979 < P \leq 150$ [bar] $VPT(P, -33.15^\circ C) \leq V \leq$ $VPT(P, 206.85^\circ C)$ [m³/kg]
41	TRPL('A')		
100	TSBP(P)		
40	TSP(P)	TSP*: Saturation Temperature [K], [°C] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
74	TSPD(P)		
75	TSPDD(P)		
42	UPD(P)	UPD: Specific Internal Energy of Saturated Liquid [J/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
43	UPDD(P)	UPDD: Specific Internal Energy of Saturated Vapor [J/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
79	UPS(P,S)	UPS: Specific Internal Energy [J/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$0.07 \times 10^6 \leq P \leq 0.072979 \times 10^6$ [Pa] $SPD(P) \leq S \leq SPT(P, 480K)$ [J/(kg·K)] $0.072979 \times 10^6 < P \leq 15 \times 10^6$ [Pa] $SPT(P, 240K) \leq S \leq$ $SPT(P, 480K)$ [J/(kg·K)] $0.7 \leq P \leq 0.72979$ [bar] $SPD(P) \leq S \leq$ $SPT(P, 206.85^\circ C)$ [J/(kg·K)] $0.72979 < P \leq 150$ [bar] $SPT(P, -33.15^\circ C) \leq S \leq$ $SPT(P, 206.85^\circ C)$ [J/(kg·K)]
44	UPT(P,T)	UPT: Specific Internal Energy [J/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0.07 \times 10^6 \leq P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0.7 \leq P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]

No.	Name of Function	Function and Argument(s)	Range of Argument(s)
45	UPX(P,X)	UPX: Specific Internal Energy of Mixture [J/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $0 \leq X \leq 1.0$ [-]
46	UTD(T)	UTD: Specific Internal Energy of Saturated Liquid [J/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
47	UTDD(T)	UTDD: Specific Internal Energy of Saturated Vapor [J/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
48	UTX(T,X)	UTX: Specific Internal Energy of Mixture [J/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $0 \leq X \leq 1.0$ [-]
49	VPD(P)	VPD: Specific Volume of Saturated Liquid [m³/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
50	VPDD(P)	VPDD: Specific Volume of Saturated Vapor [m³/kg] P*: Pressure [Pa], [bar]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar]
80	VPS(P,S)	VPS: Specific Volume [m³/kg] P*: Pressure [Pa], [bar] S: Specific Entropy [J/(kg·K)]	$0.07 \times 10^6 \leq P \leq 0.072979 \times 10^6$ [Pa] $\text{SPD}(P) \leq S \leq \text{SPT}(P, 480\text{K})$ [J/(kg·K)] $0.072979 \times 10^6 < P \leq 15 \times 10^6$ [Pa] $\text{SPT}(P, 240\text{K}) \leq S \leq \text{SPT}(P, 480\text{K})$ [J/(kg·K)] $0.7 \leq P \leq 0.72979$ [bar] $\text{SPD}(P) \leq S \leq \text{SPT}(P, 206.85^\circ\text{C})$ [J/(kg·K)] $0.72979 < P \leq 150$ [bar] $\text{SPT}(P, -33.15^\circ\text{C}) \leq S \leq \text{SPT}(P, 206.85^\circ\text{C})$ [J/(kg·K)]
51	VPT(P,T)	VPT: Specific Volume [m³/kg] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0.07 \times 10^6 \leq P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0.7 \leq P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
52	VPX(P,X)	VPX: Specific Volume of Mixture [m³/kg] P*: Pressure [Pa], [bar] X: Dryness Fraction [-]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $0 \leq X \leq 1.0$ [-]
53	VTD(T)	VTD: Specific Volume of Saturated Liquid [m³/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
54	VTDD(T)	VTDD: Specific Volume of Saturated Vapor [m³/kg] T*: Temperature [K], [°C]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C]
55	VTX(T,X)	VTX: Specific Volume of Mixture [m³/kg] T*: Temperature [K], [°C] X: Dryness Fraction [-]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $0 \leq X \leq 1.0$ [-]
8E	WPD(P)		
8F	WPDD(P)		
83	WPT(P,T)	WPT: Velocity of Sound [m/s] P*: Pressure [Pa], [bar] T*: Temperature [K], [°C]	$0 < P \leq 15 \times 10^6$ [Pa] $240 \leq T \leq 480$ [K] $0 < P \leq 150$ [bar] $-33.15 \leq T \leq 206.85$ [°C]
8G	WTD(T)		
8H	WTDD(T)		
56	XPH(P,H)	XPH: Dryness Fraction [-] P*: Pressure [Pa], [bar] H: Specific Enthalpy of Mixture [J/kg]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $\text{HPD}(P) \leq H \leq \text{HPDD}(P)$ [J/kg]
57	XPS(P,S)	XPS: Dryness Fraction [-] P*: Pressure [Pa], [bar] S: Specific Entropy of Mixture [J/(kg·K)]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $\text{SPD}(P) \leq S \leq \text{SPDD}(P)$ [J/(kg·K)]

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No.	Name of Function	Function and Argument(s)	Range of Argument(s)
58	XPU(P,U)	XPU: Dryness Fraction [-] P*: Pressure [Pa], [bar] U: Specific Internal Energy of Mixture [J/kg]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $UPD(P) \leq U \leq UPDD(P)$ [J/kg]
59	XPV(P,V)	XPV: Dryness Fraction [-] P*: Pressure [Pa], [bar] V: Specific Volume of Mixture [m ³ /kg]	$0.07 \times 10^6 \leq P \leq 4.064 \times 10^6$ [Pa] $0.7 \leq P \leq 40.64$ [bar] $VPD(P) \leq V \leq VPDD(P)$ [m ³ /kg]
60	XTH(T,H)	XTH: Dryness Fraction [-] T*: Temperature [K], [°C] H: Specific Enthalpy of Mixture [J/kg]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $HTD(T) \leq H \leq HTDD(T)$ [J/kg]
61	XTS(T,S)	XTS: Dryness Fraction [-] T*: Temperature [K], [°C] S: Specific Entropy of Mixture [J/(kg·K)]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $STD(T) \leq S \leq STDD(T)$ [J/(kg·K)]
62	XTU(T,U)	XTU: Dryness Fraction [-] T*: Temperature [K], [°C] U: Specific Internal Energy of Mixture [J/kg]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $UTD(T) \leq U \leq UTDD(T)$ [J/kg]
63	XTV(T,V)	XTV: Dryness Fraction [-] T*: Temperature [K], [°C] V: Specific Volume of Mixture [m ³ /kg]	$240 \leq T \leq 374.3$ [K] $-33.15 \leq T \leq 101.15$ [°C] $VTD(T) \leq V \leq VTDD(T)$ [m ³ /kg]