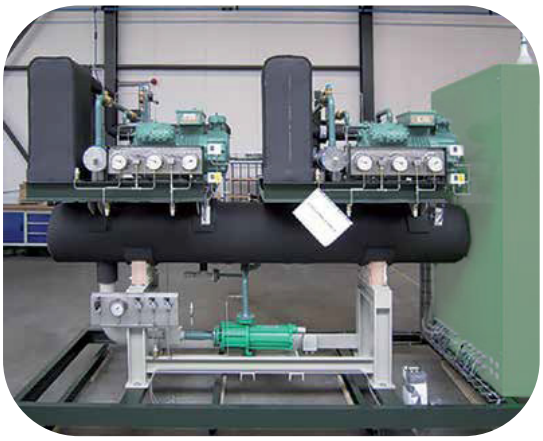
R433A
Technical information

V1 01/23

propæne
natural refrigerant

Foreword

Hydrocarbons are energy-efficient and climate-friendly refrigerants with limited impact on global warming, and no impact on the ozone layer. Hydrocarbons have been used in household refrigeration and some special applications for many years, and are now entering other applications, for instance display cabinets and large chillers. Since hydrocarbons are flammable, safety always needs to be considered when designing, building and servicing systems.

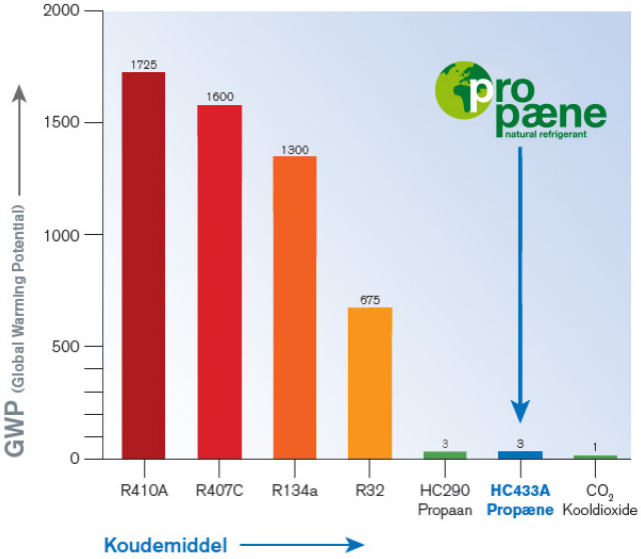


10 strong point of propæne

- Natural refrigerant (propane/propylene)
- Zero Ozone Depletion Potential
- Ultra low GWP =3
- Strong distinctive natural SMELL
- Near Azeotrope (glide ± 0,4 K)
- Very efficient at positive and in particular at negative temperatures
- Low discharge temperature
- 55 - 60 % lower charge than H(C)FC
- Suitable for mineral and most synthetic oil types
- pressure temperature almost identical to R22

Scope

Hydrocarbon refrigerants have a strong potential for retrofit and new low GWP HVAC&R applications. Propane and propylene are natural refrigerants, widely used with over 100 years of experience. This refrigerant propæne (R433A) has a full ASHRAE classification and combines the advantages of its both basic components.



Important: propæne has a strong distinctive smell. It adds up to the safety and handling issues of hydrocarbon gases.

The refrigerant is almost azeotrope. Over the whole temperature range a negligible glide of 0.35 to 0,4K occurs. Studies (paragraph 5) show that R433A equals or outperforms to R22 in capacity while COP increases 5 to 16%. Additional heat exchange increasing liquid subcooling and suction gas superheat adds up to the performance. The compressor enjoys a pleasant low discharge temperature, even at high superheat and freezing applications. Hydrocarbons reduce the charge of the system by more than 50%, resulting in considerable low refrigerant need.

The blend composes of pure propane and propylene (70/30) having very identical physical and chemical properties. The refrigerant has flammability class A3. The properties of R433A is fully listed in EN378-1 table E.2. The LFL and practical limit is very close to propane. R433A is not toxic. So, behavior of R433A does not differ to the basic components, resulting in stable and reliable performance.

The pressure temperature behavior is very close to R22, many components, selections, calculations and materials can be applied in a similar way.

Physical properties

Chemical formula	: C3H8 / C3H6
Molecular weight	: 43,5 g/mol
Boiling point	: -44,86 °C
Critical temperature	: 95°C
Critical pressure	: 4,40 MPa
Critical density	: 164,4 kg/m^3

Specification

Specification of analyses R433A a mix of propane and propylene

Test	Note	Results U. of M.
Relative density at 15°C.	0,516	Kg/lt
Vapor pressure at 20°C.	7,92 / 8,01	bar/rel
Total sulfur	< 1,00	mg/kg
Water content	5,00	mg/kg

Gas chromatography		
Propylene	29,90 %	vv
Propane	69,90 %	vv
Propylene + propæne	99,80 %	vv

Gas chromatography		
Ethane	< 5	umoli/moli
Ethylene	< 5	umoli/moli
Butanes	< 5	umoli/moli
Butenes	< 5	umoli/moli
Pentanes	< 5	umoli/moli
Pentenes	< 5	umoli/moli
Butadiene	< 5	umoli/moli

Major hazards		
UN Number	UN 3161	
CAS Number	74-98-6 / 115-07-1	

Materials compatibility

Lubricants

Hydrocarbon refrigerants possess full chemical compatibility with nearly all lubricants commonly used within refrigeration systems. Good miscibility is maintained with most lubricants under all operating conditions. Due to the particularly good solubility with mineral oils, it may be necessary to use a lubricant with lower solubility or increased viscosity to compensate for possible thinning under situations where high solubility could occur. Suppliers should be consulted for properties of oil/refrigerant combinations.
Lubricants containing silicone or silicate (often used as anti-foaming additives) are not compatible with hydrocarbon refrigerants and should not be used. If changing or selecting a lubricant for a hydrocarbon refrigerant application, always consult the compressor manufacturer as to their recommendations. Table details the various lubricants and their compatibility characteristics.

Table compatibility of various lubricants with HC refrigerants

Lubricant Type [1)]	Compatibility
Mineral (M)	Fully soluble with hydrocarbons. Excessive solubility at high temperature conditions. Compensate by selection of a high viscosity grade oil.
Alkyl benzene (AB)	Fully soluble and typical viscosity grades applicable to all applications.
Semi-synthetic (ABM)	A blend of AB and M oils achieving desirable properties for use with hydrocarbons.
Polyolester (POE)	Generally exhibit excessive solubility with hydrocarbons. May necessitate higher viscosity grade.
Polyalkylene Glycol (PAG)	Soluble and partially soluble with hydrocarbons depending upon the conditions. Normal grades are generally satisfactory.
Poly-alpha-olefins (PAO)	Soluble with hydrocarbons but typically used for low temperature applications.

[1)] It is recommended that the compressor manufacturer be consulted to determine the selection of the correct lubricant.

Elastomers

Not all common refrigeration materials used as 'O' rings, valve seats, seals and gaskets are compatible with hydro¬carbon refrigerants. Materials that are not compatible should not be used in hydrocarbon refrigeration systems. Consult your supplier for compatibility questions.

Normative

Normative references

The following documents, in whole or in part, apply normatively for the use of hydrocarbons.

All components comply with the requirements in the Pressure Equipment Directive (PED) (2014/34/EU) fluid group I (flammable/toxic media). Relevant norms & standards when working with hydrocarbon refrigerants.

Normative 95

- ATEX Directive 94/9/EC
  Specifies the requirements for equipment intended for use in potentially explosive atmospheres (both electrical and mechanical). Organizations in EU must follow the directive to protect employees from explosion risk in areas with an explosive atmosphere.

- ATEX 137 Directive 1992/92/EC
  Standard directive for electrical installations in potentially explosive atmospheres.

- Pressure Equipment Directive 2014/34/EU
  The directive provides a legislative framework for pressurized equipment and assemblies.

- EN378 1-4
  EN378 defines "best practice" for design, operation and maintenance. It is a harmonized standard, which ensures that all essential requirements in the PED are fulfilled.

- ISO 5149 1-4
  The international safety standard, defines "best practices" very similarly to EN378, but without referring to EU law.

- ISO 817
  Refrigerants – Designation and Safety classification.

- IEC 60335: International Standard
  Specifies all requirements for small hermetically sealed household appliances (supports the PED). It deals with the safety of electrical appliances for household and similar purposes

For the Netherlands

- NPR 7600
  The code of practice guideline, is focused on the use of hydrocarbons in stationary refrigeration systems and heat pumps.

- NPR 7910-1
  The code of practice provides instructions for determining the required hazardous areas classification.
  Part 1: Gas explosion hazard based on EN 60079-10:2009

Application and studies

Application

Category	Examples	Requirements
A (domestic/public)	Hospitals, prisons, theatres, schools, supermarkets, hotels, dwellings.	• <1.5kg per sealed system • <5kg in special machinery rooms or in the open air for indirect systems
B (commercial/private)	Offices, small shops, restaurants, places for general manufacturing and where people work.	• <2.5kg per sealed system • <10kg in special machinery rooms or open air for indirect systems.
C (industrial/restricted)	Cold stores, dairies, abattoirs, non-public areas of supermarkets, plant rooms.	• <10kg in human occupied spaces • <25kg if high pressure side (except air cooled condenser) is located in a special machinery room or in the open air • No limit if all refrigerant is contained in a special machinery room or in the open air.

Studies

Performance of R433A for replacing HCFC22 used in residential airconditioners and heat pumps

In this study, thermodynamic performance of R433A and HCFC22 is measured in a heat pump bench tester under airconditioning and heat pumping conditions. R433A has no ozone depletion potential and very low greenhouse warming potential of less than 5. R433A also offers a similar vapor pressure to HCFC22 for possible 'drop-in' replacement. Test results showed that the coefficient of performance of R433A is 4.9–7.6% higher than that of HCFC22 while the capacity of R433A is 1.0–5.5% lower than that of HCFC22 for both conditions. The compressor discharge temperature of R433A is 22.6–27.9 C lower than that of HCFC22 while the amount of charge for R433A is 57.0–57.7% lower than that of HCFC22 due to its low density. Overall, R433A is a good long term environmentally friendly alternative to replace HCFC22 in residential air- conditioners and heat pumps due to its excellent thermodynamic and environmental properties with minor adjustments.
All components comply with the requirements in the Pressure Equipment Directive (PED) (2014/34/EU) fluid group I (flammable/toxic media). Relevant norms & standards when working with hydrocarbon refrigerants.

Refrigerant charge

Most of the hydrocarbons have smaller density than that of the halocarbons and hence the amount of charge decreases significantly with hydrocarbons [10]. As listed in Tables 1 and 2, R433A showed a decrease in charge of 57.0–57.7% as compared to HCFC22. This will help alleviate further the direct emission of refrigerant which is responsible for the greenhouse warming.

Conclusions

In this study, thermodynamic performance of R433A and HCFC22 was measured in a breadboard type heat pump/air-conditioner under typical air-conditioning and heat pumping conditions. Various performance characteristics were measured and following conclusions were drawn:

1. The COP of R433A is 4.9–7.6% higher than that of HCFC22.
2. The capacity of R433A is 1.0–5.5% lower than that of HCFC22.
3. The compressor discharge temperature of R433A is 22.6–27.9 C lower than that of HCFC22.
4. The amount of charge for R433A is 57.0–57.7% lower than that of HCFC22 due to its low density.
5. R433A is a good long term environmentally friendly alternative refrigerant to replace HCFC22 in residential air-conditioners and heat pumps due to its excellent thermodynamic and environmental properties with minor changes.

Authors

Performance of R433A for replacing HCFC22 used in residential air-conditioners and heat pumps
Ki-Jung Park, Yun-Bo Shim, Dongsoo Jung, Inha University, Republic of Korea

Performance of R432A and R433A as alternative to R22

This study investigated the energy performance of eco-friendly R432A and R433A as alternatives to R22 in a vapour compression refrigeration system with sub-cooling heat exchanger. The effects of sub-cooling on the various refrigeration cycle performance parameters were evaluated. The results obtained showed that the saturated vapour pressure and temperature characteristic profiles for R432A and R433A are similar to those of R22 without any significant deviation between the curves. This indicates that R432A and R433A exhibited similar properties and could be used as substitute for R22. The two alternative refrigerants exhibited higher coefficient of performance (COP) and higher relative capacity index (RCI) than R22. The average COPs obtained for R432A and R433A were 12.9 and 16.7% higher than that of R22. They also exhibited lower power per ton of refrigeration (PPTR) than that of R22, but R433A emerged as the most energy efficient refrigerant among all the investigated refrigerants with average PPTR of 13.3% lower than that of R22.
Generally, incorporation of sub-cooling heat exchanger in the system, greatly improved the performance of the

system; it increases the COP, reduces the compressor energy input and the specific power consumption of the system. The two alternative refrigerants, consistently exhibited better performance than R22 in sub- cooling heat exchanger refrigeration system. R433A performed better than both R22 and R432A in that the highest RCI, COP, reduction in energy input and lowest PPTR were obtained using R433A in the system

Authors

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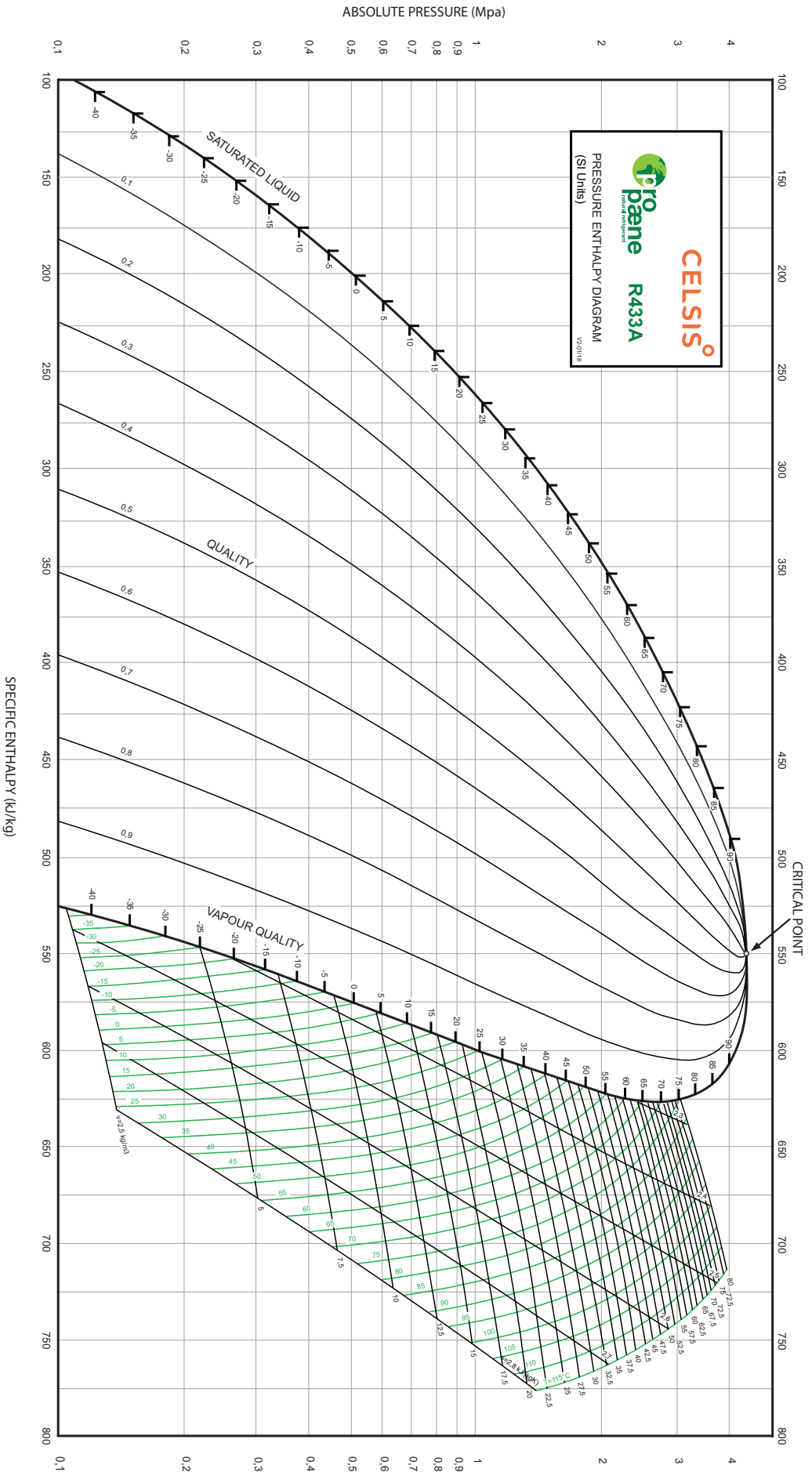
Energy performance of eco-friendly R432A and R433A as alternative to R22 in subcooling heat exchanger refrigeration system

Bolaji and Huan, University of technology, Pretoria, South Africa


ABSOLUTE PRESSURE (Mpa)
SPECIFIC ENTHALPY (kJ/kg)
CELSIS
R433A
PRESSURE ENTHALPY DIAGRAM
(SI Units)
V2-2019
SATURATED LIQUID
QUALITY
VAPOUR QUALITY
CRITICAL POINT

CELSIS

R433A saturation properties - temperature table

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
-59,25	-58,84	0,05	606,58	1,2477	63,002	507,35	0,43963	2,515
-55,66	-55,26	0,06	602,48	1,4774	70,775	511,54	0,47559	2,5003
-52,53	-52,12	0,07	598,86	1,7044	77,627	515,21	0,50679	2,4883
-49,72	-49,32	0,08	595,61	1,9291	83,781	518,47	0,53444	2,4782
-47,19	-46,78	0,09	592,63	2,152	89,389	521,43	0,55932	2,4696
-44,86	-44,46	0,1	589,89	2,3733	94,555	524,13	0,58199	2,462
-42,71	-42,31	0,11	587,34	2,5932	99,355	526,62	0,60284	2,4553
-40,7	-40,3	0,12	584,94	2,8119	103,85	528,94	0,62218	2,4493
-38,82	-38,42	0,13	582,68	3,0295	108,08	531,1	0,64022	2,4439
-37,05	-36,65	0,14	580,54	3,2462	112,08	533,14	0,65715	2,4391
-35,38	-34,98	0,15	578,51	3,462	115,88	535,07	0,67312	2,4346
-33,78	-33,39	0,16	576,56	3,6771	119,5	536,89	0,68823	2,4305
-32,27	-31,87	0,17	574,7	3,8915	122,96	538,62	0,70259	2,4267
-30,82	-30,42	0,18	572,91	4,1052	126,29	540,27	0,71628	2,4232
-29,43	-29,04	0,19	571,18	4,3184	129,49	541,85	0,72936	2,4199
-28,09	-27,7	0,2	569,52	4,5312	132,57	543,37	0,7419	2,4169
-26,81	-26,42	0,21	567,91	4,7434	135,54	544,82	0,75393	2,414
-25,57	-25,18	0,22	566,35	4,9553	138,42	546,22	0,76551	2,4113
-24,37	-23,99	0,23	564,83	5,1667	141,21	547,56	0,77667	2,4088
-23,22	-22,83	0,24	563,36	5,3779	143,91	548,86	0,78745	2,4064
-22,1	-21,71	0,25	561,93	5,5887	146,54	550,12	0,79788	2,4042
-21,01	-20,62	0,26	560,54	5,7993	149,1	551,33	0,80797	2,402
-19,95	-19,57	0,27	559,18	6,0096	151,59	552,51	0,81776	2,4
-18,92	-18,54	0,28	557,85	6,2197	154,02	553,65	0,82726	2,398
-17,92	-17,54	0,29	556,55	6,4296	156,39	554,76	0,83649	2,3962
-16,95	-16,57	0,3	555,28	6,6394	158,7	555,84	0,84548	2,3944
-16	-15,62	0,31	554,03	6,849	160,97	556,89	0,85423	2,3927
-15,07	-14,69	0,32	552,82	7,0584	163,18	557,91	0,86275	2,3911
-14,17	-13,78	0,33	551,62	7,2678	165,35	558,9	0,87107	2,3895
-13,28	-12,9	0,34	550,45	7,477	167,48	559,87	0,8792	2,3881
-12,41	-12,03	0,35	549,3	7,6862	169,56	560,82	0,88713	2,3866
-11,57	-11,19	0,36	548,17	7,8953	171,6	561,74	0,89489	2,3852
-10,74	-10,36	0,37	547,05	8,1043	173,61	562,65	0,90248	2,3839
-9,92	-9,55	0,38	545,96	8,3133	175,58	563,53	0,90991	2,3826
-9,12	-8,75	0,39	544,88	8,5223	177,52	564,39	0,91719	2,3814

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
-8,34	-7,97	0,4	543,82	8,7312	179,42	565,23	0,92432	2,3802
-7,57	-7,2	0,41	542,78	8,9402	181,3	566,06	0,93132	2,3791
-6,82	-6,45	0,42	541,75	9,1492	183,14	566,87	0,93818	2,3779
-6,08	-5,71	0,43	540,74	9,3582	184,96	567,66	0,94492	2,3769
-5,35	-4,98	0,44	539,74	9,5672	186,74	568,44	0,95154	2,3758
-4,63	-4,26	0,45	538,75	9,7763	188,51	569,2	0,95804	2,3748
-3,93	-3,56	0,46	537,78	9,9854	190,24	569,94	0,96442	2,3738
-3,24	-2,87	0,47	536,82	10,195	191,95	570,68	0,97071	2,3729
-2,56	-2,19	0,48	535,87	10,404	193,64	571,4	0,97689	2,3719
-1,88	-1,51	0,49	534,93	10,613	195,31	572,1	0,98297	2,371
-1,22	-0,85	0,5	534	10,822	196,95	572,8	0,98895	2,3702
-0,57	-0,2	0,51	533,09	11,032	198,58	573,48	0,99484	2,3693
0,07	0,44	0,52	532,18	11,242	200,18	574,15	1,0006	2,3685
0,7	1,07	0,53	531,29	11,451	201,76	574,81	1,0064	2,3677
1,33	1,69	0,54	530,4	11,661	203,33	575,46	1,012	2,3669
1,94	2,31	0,55	529,52	11,871	204,87	576,09	1,0176	2,3661
2,55	2,92	0,56	528,65	12,081	206,4	576,72	1,023	2,3653
3,15	3,52	0,57	527,8	12,291	207,91	577,34	1,0284	2,3646
3,74	4,11	0,58	526,94	12,502	209,4	577,95	1,0338	2,3639
4,33	4,69	0,59	526,1	12,712	210,88	578,54	1,039	2,3632
4,91	5,27	0,6	525,27	12,923	212,34	579,13	1,0442	2,3625
5,48	5,84	0,61	524,44	13,133	213,79	579,71	1,0494	2,3618
6,04	6,4	0,62	523,62	13,344	215,22	580,28	1,0544	2,3612
6,6	6,95	0,63	522,81	13,555	216,64	580,85	1,0594	2,3605
7,15	7,5	0,64	522	13,767	218,04	581,4	1,0644	2,3599
7,69	8,05	0,65	521,2	13,978	219,43	581,95	1,0693	2,3593
8,23	8,58	0,66	520,41	14,19	220,81	582,49	1,0741	2,3587
8,76	9,12	0,67	519,63	14,402	222,18	583,02	1,0789	2,3581
9,28	9,64	0,68	518,85	14,614	223,53	583,54	1,0836	2,3575
9,8	10,16	0,69	518,08	14,826	224,87	584,06	1,0883	2,3569
10,32	10,67	0,7	517,31	15,038	226,19	584,57	1,0929	2,3563
10,83	11,18	0,71	516,55	15,251	227,51	585,07	1,0974	2,3558
11,33	11,69	0,72	515,79	15,464	228,81	585,57	1,102	2,3552
11,83	12,18	0,73	515,04	15,677	230,1	586,06	1,1064	2,3547
12,33	12,68	0,74	514,3	15,89	231,39	586,54	1,1109	2,3542
12,81	13,17	0,75	513,56	16,103	232,66	587,02	1,1152	2,3537
13,3	13,65	0,76	512,82	16,317	233,92	587,49	1,1196	2,3532

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
13,78	14,13	0,77	512,09	16,531	235,17	587,96	1,1239	2,3527
14,25	14,6	0,78	511,37	16,745	236,41	588,42	1,1281	2,3522
14,72	15,07	0,79	510,65	16,96	237,64	588,87	1,1323	2,3517
15,19	15,54	0,8	509,93	17,174	238,87	589,32	1,1365	2,3512
15,65	16	0,81	509,22	17,389	240,08	589,76	1,1407	2,3507
16,11	16,46	0,82	508,52	17,604	241,28	590,2	1,1448	2,3503
16,56	16,91	0,83	507,82	17,82	242,48	590,63	1,1488	2,3498
17,01	17,36	0,84	507,12	18,036	243,66	591,06	1,1528	2,3494
17,46	17,8	0,85	506,42	18,252	244,84	591,48	1,1568	2,3489
17,9	18,25	0,86	505,74	18,468	246,01	591,9	1,1608	2,3485
18,34	18,68	0,87	505,05	18,684	247,17	592,31	1,1647	2,348
18,77	19,12	0,88	504,37	18,901	248,33	592,71	1,1686	2,3476
19,2	19,55	0,89	503,69	19,118	249,47	593,12	1,1724	2,3472
19,63	19,97	0,9	503,02	19,335	250,61	593,51	1,1763	2,3468
20,06	20,4	0,91	502,35	19,553	251,74	593,91	1,1801	2,3463
20,48	20,82	0,92	501,68	19,771	252,87	594,29	1,1838	2,3459
20,89	21,23	0,93	501,02	19,989	253,98	594,68	1,1875	2,3455
21,31	21,65	0,94	500,36	20,208	255,09	595,06	1,1912	2,3451
21,72	22,06	0,95	499,7	20,426	256,19	595,43	1,1949	2,3447
22,13	22,47	0,96	499,04	20,646	257,29	595,81	1,1986	2,3443
22,53	22,87	0,97	498,39	20,865	258,38	596,17	1,2022	2,344
22,93	23,27	0,98	497,75	21,085	259,46	596,54	1,2058	2,3436
23,33	23,67	0,99	497,1	21,305	260,53	596,89	1,2093	2,3432
23,73	24,06	1	496,46	21,525	261,6	597,25	1,2129	2,3428
24,12	24,45	1,01	495,82	21,746	262,67	597,6	1,2164	2,3424
24,51	24,84	1,02	495,19	21,967	263,72	597,95	1,2199	2,3421
24,9	25,23	1,03	494,56	22,188	264,78	598,29	1,2233	2,3417
25,28	25,61	1,04	493,93	22,41	265,82	598,63	1,2268	2,3413
25,66	26	1,05	493,3	22,632	266,86	598,97	1,2302	2,341
26,04	26,37	1,06	492,68	22,854	267,89	599,3	1,2336	2,3406
26,42	26,75	1,07	492,05	23,077	268,92	599,63	1,2369	2,3403
26,79	27,12	1,08	491,43	23,3	269,94	599,96	1,2403	2,3399
27,16	27,49	1,09	490,82	23,523	270,96	600,28	1,2436	2,3396
27,53	27,86	1,1	490,2	23,747	271,97	600,6	1,2469	2,3392
27,9	28,23	1,11	489,59	23,971	272,98	600,91	1,2502	2,3389
28,26	28,59	1,12	488,98	24,195	273,98	601,23	1,2534	2,3385
28,62	28,95	1,13	488,38	24,42	274,98	601,53	1,2567	2,3382

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
28,98	29,31	1,14	487,77	24,645	275,97	601,84	1,2599	2,3379
29,34	29,67	1,15	487,17	24,871	276,95	602,14	1,2631	2,3375
29,69	30,02	1,16	486,57	25,097	277,94	602,44	1,2662	2,3372
30,05	30,37	1,17	485,97	25,323	278,91	602,74	1,2694	2,3369
30,4	30,72	1,18	485,38	25,55	279,88	603,03	1,2725	2,3365
30,74	31,07	1,19	484,78	25,777	280,85	603,32	1,2757	2,3362
31,09	31,42	1,2	484,19	26,004	281,81	603,61	1,2788	2,3359
31,43	31,76	1,21	483,6	26,232	282,77	603,89	1,2818	2,3356
31,78	32,1	1,22	483,01	26,46	283,73	604,18	1,2849	2,3352
32,12	32,44	1,23	482,43	26,688	284,68	604,45	1,2879	2,3349
32,45	32,78	1,24	481,84	26,917	285,62	604,73	1,291	2,3346
32,79	33,11	1,25	481,26	27,147	286,56	605	1,294	2,3343
33,12	33,45	1,26	480,68	27,377	287,5	605,27	1,297	2,334
33,46	33,78	1,27	480,1	27,607	288,43	605,54	1,2999	2,3337
33,79	34,11	1,28	479,53	27,837	289,36	605,8	1,3029	2,3333
34,11	34,43	1,29	478,95	28,068	290,29	606,07	1,3059	2,333
34,44	34,76	1,3	478,38	28,3	291,21	606,33	1,3088	2,3327
34,77	35,08	1,31	477,81	28,531	292,12	606,58	1,3117	2,3324
35,09	35,41	1,32	477,24	28,764	293,04	606,84	1,3146	2,3321
35,41	35,73	1,33	476,67	28,996	293,95	607,09	1,3175	2,3318
35,73	36,04	1,34	476,1	29,229	294,85	607,34	1,3203	2,3315
36,05	36,36	1,35	475,54	29,463	295,75	607,58	1,3232	2,3312
36,36	36,68	1,36	474,98	29,697	296,65	607,83	1,326	2,3309
36,67	36,99	1,37	474,41	29,931	297,55	608,07	1,3288	2,3306
36,99	37,3	1,38	473,85	30,166	298,44	608,31	1,3316	2,3303
37,3	37,61	1,39	473,3	30,401	299,32	608,54	1,3344	2,33
37,61	37,92	1,4	472,74	30,637	300,21	608,78	1,3372	2,3297
37,91	38,23	1,41	472,18	30,873	301,09	609,01	1,34	2,3294
38,22	38,53	1,42	471,63	31,11	301,97	609,24	1,3427	2,3291
38,52	38,84	1,43	471,07	31,347	302,84	609,46	1,3455	2,3288
38,83	39,14	1,44	470,52	31,585	303,71	609,69	1,3482	2,3285
39,13	39,44	1,45	469,97	31,823	304,58	609,91	1,3509	2,3282
39,43	39,74	1,46	469,42	32,061	305,45	610,13	1,3536	2,3279
39,73	40,04	1,47	468,87	32,3	306,31	610,35	1,3563	2,3276
40,02	40,33	1,48	468,33	32,54	307,16	610,56	1,359	2,3273
40,32	40,63	1,49	467,78	32,78	308,02	610,78	1,3616	2,327
40,61	40,92	1,5	467,24	33,02	308,87	610,99	1,3643	2,3267

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
40,9	41,21	1,51	466,69	33,261	309,72	611,2	1,3669	2,3264
41,2	41,5	1,52	466,15	33,502	310,57	611,4	1,3695	2,3261
41,49	41,79	1,53	465,61	33,744	311,41	611,61	1,3722	2,3258
41,77	42,08	1,54	465,07	33,987	312,25	611,81	1,3748	2,3255
42,06	42,36	1,55	464,53	34,229	313,09	612,01	1,3773	2,3252
42,35	42,65	1,56	464	34,473	313,93	612,21	1,3799	2,3249
42,63	42,93	1,57	463,46	34,717	314,76	612,4	1,3825	2,3246
42,91	43,21	1,58	462,92	34,961	315,59	612,6	1,3851	2,3243
43,19	43,5	1,59	462,39	35,206	316,41	612,79	1,3876	2,324
43,47	43,78	1,6	461,85	35,451	317,24	612,98	1,3901	2,3237
43,75	44,05	1,61	461,32	35,697	318,06	613,17	1,3927	2,3234
44,03	44,33	1,62	460,79	35,944	318,88	613,35	1,3952	2,3231
44,31	44,61	1,63	460,26	36,191	319,69	613,54	1,3977	2,3229
44,58	44,88	1,64	459,73	36,439	320,51	613,72	1,4002	2,3226
44,86	45,15	1,65	459,2	36,687	321,32	613,9	1,4027	2,3223
45,13	45,43	1,66	458,67	36,935	322,13	614,08	1,4051	2,322
45,4	45,7	1,67	458,15	37,184	322,94	614,25	1,4076	2,3217
45,67	45,97	1,68	457,62	37,434	323,74	614,43	1,4101	2,3214
45,94	46,24	1,69	457,09	37,685	324,54	614,6	1,4125	2,3211
46,21	46,5	1,7	456,57	37,935	325,34	614,77	1,4149	2,3208
46,48	46,77	1,71	456,05	38,187	326,14	614,94	1,4174	2,3205
46,74	47,04	1,72	455,52	38,439	326,93	615,1	1,4198	2,3202
47,01	47,3	1,73	455	38,691	327,72	615,27	1,4222	2,3199
47,27	47,56	1,74	454,48	38,945	328,51	615,43	1,4246	2,3196
47,53	47,82	1,75	453,96	39,198	329,3	615,59	1,427	2,3193
47,79	48,08	1,76	453,44	39,453	330,09	615,75	1,4293	2,319
48,05	48,34	1,77	452,92	39,707	330,87	615,9	1,4317	2,3187
48,31	48,6	1,78	452,4	39,963	331,65	616,06	1,4341	2,3184
48,57	48,86	1,79	451,88	40,219	332,43	616,21	1,4364	2,3181
48,83	49,12	1,8	451,36	40,476	333,21	616,36	1,4388	2,3178
49,08	49,37	1,81	450,84	40,733	333,98	616,51	1,4411	2,3175
49,34	49,63	1,82	450,33	40,991	334,76	616,66	1,4434	2,3172
49,59	49,88	1,83	449,81	41,249	335,53	616,81	1,4458	2,3169
49,85	50,13	1,84	449,3	41,509	336,3	616,95	1,4481	2,3166
50,1	50,38	1,85	448,78	41,768	337,06	617,09	1,4504	2,3163
50,35	50,63	1,86	448,27	42,029	337,83	617,23	1,4527	2,316
50,6	50,88	1,87	447,75	42,29	338,59	617,37	1,455	2,3157

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
50,85	51,13	1,88	447,24	42,551	339,35	617,51	1,4573	2,3154
51,1	51,38	1,89	446,73	42,814	340,11	617,65	1,4595	2,3151
51,34	51,63	1,9	446,22	43,077	340,87	617,78	1,4618	2,3148
51,59	51,87	1,91	445,7	43,34	341,63	617,91	1,4641	2,3145
51,83	52,12	1,92	445,19	43,604	342,38	618,04	1,4663	2,3142
52,08	52,36	1,93	444,68	43,869	343,13	618,17	1,4686	2,3139
52,32	52,6	1,94	444,17	44,135	343,88	618,3	1,4708	2,3136
52,56	52,84	1,95	443,66	44,401	344,63	618,42	1,473	2,3132
52,81	53,08	1,96	443,15	44,668	345,38	618,55	1,4752	2,3129
53,05	53,32	1,97	442,64	44,936	346,12	618,67	1,4775	2,3126
53,29	53,56	1,98	442,13	45,204	346,87	618,79	1,4797	2,3123
53,52	53,8	1,99	441,63	45,473	347,61	618,91	1,4819	2,312
53,76	54,04	2	441,12	45,743	348,35	619,02	1,4841	2,3117
54	54,27	2,01	440,61	46,013	349,09	619,14	1,4862	2,3114
54,23	54,51	2,02	440,1	46,284	349,82	619,25	1,4884	2,3111
54,47	54,74	2,03	439,59	46,556	350,56	619,36	1,4906	2,3107
54,7	54,98	2,04	439,09	46,828	351,29	619,47	1,4928	2,3104
54,94	55,21	2,05	438,58	47,102	352,02	619,58	1,4949	2,3101
55,17	55,44	2,06	438,07	47,376	352,75	619,69	1,4971	2,3098
55,4	55,67	2,07	437,57	47,65	353,48	619,79	1,4992	2,3095
55,63	55,9	2,08	437,06	47,926	354,21	619,9	1,5014	2,3091
55,86	56,13	2,09	436,55	48,202	354,94	620	1,5035	2,3088
56,09	56,36	2,1	436,05	48,479	355,66	620,1	1,5057	2,3085
56,32	56,59	2,11	435,54	48,757	356,38	620,2	1,5078	2,3082
56,55	56,82	2,12	435,04	49,035	357,1	620,29	1,5099	2,3078
56,78	57,04	2,13	434,53	49,314	357,82	620,39	1,512	2,3075
57	57,27	2,14	434,03	49,594	358,54	620,48	1,5141	2,3072
57,23	57,5	2,15	433,52	49,875	359,26	620,58	1,5162	2,3069
57,45	57,72	2,16	433,02	50,157	359,98	620,67	1,5183	2,3065
57,68	57,94	2,17	432,51	50,439	360,69	620,75	1,5202	2,3062
57,9	58,16	2,18	432,01	50,722	361,4	620,84	1,5225	2,3059
58,12	58,39	2,19	431,5	51,006	362,12	620,93	1,5246	2,3055
58,34	58,61	2,2	431	51,291	362,83	621,01	1,5267	2,3052
58,56	58,83	2,21	430,49	51,577	363,54	621,09	1,5285	2,3049
58,78	59,05	2,22	429,99	51,863	364,24	621,18	1,5308	2,3045
59	59,27	2,23	429,48	52,15	364,95	621,25	1,5326	2,3042
59,22	59,48	2,24	428,98	52,438	365,66	621,33	1,5347	2,3039

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
59,44	59,7	2,25	428,48	52,727	366,36	621,41	1,5369	2,3035
59,66	59,92	2,26	427,97	53,017	367,06	621,48	1,5388	2,3032
59,87	60,13	2,27	427,47	53,308	367,77	621,56	1,541	2,3028
60,09	60,35	2,28	426,96	53,599	368,47	621,63	1,5431	2,3025
60,31	60,56	2,29	426,46	53,892	369,17	621,7	1,5451	2,3021
60,52	60,78	2,3	425,95	54,185	369,86	621,77	1,5471	2,3018
60,73	60,99	2,31	425,45	54,479	370,56	621,83	1,5489	2,3014
60,95	61,2	2,32	424,94	54,774	371,26	621,9	1,5511	2,3011
61,16	61,41	2,33	424,44	55,07	371,95	621,96	1,5529	2,3007
61,37	61,63	2,34	423,93	55,367	372,65	622,02	1,555	2,3004
61,58	61,84	2,35	423,42	55,665	373,34	622,09	1,5572	2,3
61,79	62,05	2,36	422,92	55,964	374,03	622,14	1,559	2,2997
62	62,25	2,37	422,41	56,263	374,72	622,2	1,5609	2,2993
62,21	62,46	2,38	421,91	56,564	375,41	622,26	1,5631	2,2989
62,42	62,67	2,39	421,4	56,865	376,1	622,31	1,5649	2,2986
62,63	62,88	2,4	420,89	57,168	376,79	622,36	1,5669	2,2982
62,83	63,08	2,41	420,39	57,471	377,48	622,42	1,5691	2,2978
63,04	63,29	2,42	419,88	57,776	378,16	622,47	1,571	2,2974
63,25	63,49	2,43	419,37	58,081	378,85	622,51	1,5728	2,2971
63,45	63,7	2,44	418,87	58,388	379,53	622,56	1,575	2,2967
63,66	63,9	2,45	418,36	58,695	380,21	622,6	1,5765	2,2964
63,86	64,11	2,46	417,85	59,004	380,89	622,65	1,5789	2,296
64,06	64,31	2,47	417,34	59,313	381,58	622,69	1,5806	2,2956
64,27	64,51	2,48	416,83	59,624	382,26	622,73	1,5826	2,2952
64,47	64,71	2,49	416,32	59,935	382,94	622,77	1,5847	2,2948
64,67	64,91	2,5	415,81	60,248	383,61	622,8	1,5863	2,2945
64,87	65,11	2,51	415,3	60,561	384,29	622,84	1,5884	2,2941
65,07	65,31	2,52	414,79	60,876	384,97	622,87	1,5901	2,2937
65,27	65,51	2,53	414,28	61,192	385,64	622,91	1,5924	2,2933
65,47	65,71	2,54	413,77	61,508	386,32	622,94	1,5944	2,2929
65,67	65,91	2,55	413,26	61,826	386,99	622,97	1,5963	2,2925
65,86	66,11	2,56	412,75	62,145	387,67	622,99	1,5976	2,2922
66,06	66,3	2,57	412,23	62,466	388,34	623,02	1,5999	2,2917
66,26	66,5	2,58	411,72	62,787	389,01	623,04	1,6014	2,2914
66,45	66,69	2,59	411,21	63,109	389,68	623,07	1,6039	2,2909
66,65	66,89	2,6	410,69	63,433	390,35	623,09	1,6056	2,2905
66,85	67,08	2,61	410,18	63,757	391,02	623,11	1,6075	2,2901

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
67,04	67,28	2,62	409,66	64,083	391,69	623,13	1,6096	2,2897
67,23	67,47	2,63	409,15	64,41	392,36	623,14	1,6108	2,2894
67,43	67,66	2,64	408,63	64,739	393,03	623,16	1,6134	2,2889
67,62	67,85	2,65	408,11	65,068	393,7	623,17	1,6147	2,2886
67,81	68,05	2,66	407,59	65,399	394,36	623,18	1,6164	2,2882
68	68,24	2,67	407,08	65,731	395,03	623,19	1,6181	2,2878
68,19	68,43	2,68	406,56	66,064	395,69	623,2	1,6202	2,2874
68,39	68,62	2,69	406,04	66,398	396,36	623,2	1,6202	2,2874
68,58	68,81	2,7	405,52	66,734	397,02	623,21	1,623	2,2867
68,77	69	2,71	405	67,07	397,69	623,21	1,623	2,2867
68,95	69,18	2,72	404,47	67,409	398,35	623,21	1,623	2,2867
69,14	69,37	2,73	403,95	67,748	399,01	623,21	1,623	2,2867
69,33	69,56	2,74	403,43	68,089	399,68	623,21	1,623	2,2867
69,52	69,75	2,75	402,9	68,431	400,34	623,21	1,623	2,2867
69,7	69,93	2,76	402,38	68,774	401	623,2	1,6202	2,2874
69,89	70,12	2,77	401,85	69,119	401,66	623,2	1,6202	2,2874
70,08	70,3	2,78	401,33	69,465	402,32	623,19	1,6181	2,2878
70,26	70,49	2,79	400,8	69,813	402,98	623,18	1,6164	2,2882
70,45	70,67	2,8	400,27	70,162	403,64	623,17	1,6147	2,2886
70,63	70,86	2,81	399,74	70,512	404,3	623,15	1,6121	2,2892
70,82	71,04	2,82	399,21	70,864	404,95	623,14	1,6108	2,2894
71	71,22	2,83	398,68	71,217	405,61	623,12	1,6087	2,2899
71,18	71,4	2,84	398,15	71,572	406,27	623,1	1,6066	2,2903
71,36	71,59	2,85	397,61	71,928	406,93	623,08	1,6047	2,2907
71,55	71,77	2,86	397,08	72,285	407,58	623,06	1,603	2,2911
71,73	71,95	2,87	396,55	72,645	408,24	623,04	1,6014	2,2914
71,91	72,13	2,88	396,01	73,005	408,89	623,01	1,5992	2,2919
72,09	72,31	2,89	395,47	73,367	409,55	622,98	1,597	2,2923
72,27	72,49	2,9	394,93	73,731	410,21	622,95	1,5949	2,2928
72,45	72,67	2,91	394,39	74,096	410,86	622,92	1,593	2,2932
72,63	72,84	2,92	393,85	74,463	411,52	622,89	1,5913	2,2935
72,81	73,02	2,93	393,31	74,832	412,17	622,86	1,5895	2,2939
72,98	73,2	2,94	392,77	75,202	412,82	622,82	1,5872	2,2943
73,16	73,38	2,95	392,23	75,574	413,48	622,78	1,5851	2,2947
73,34	73,55	2,96	391,68	75,947	414,13	622,74	1,5832	2,2951
73,52	73,73	2,97	391,13	76,322	414,79	622,7	1,5812	2,2955
73,69	73,9	2,98	390,59	76,699	415,44	622,66	1,5793	2,2959

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
73,87	74,08	2,99	390,04	77,077	416,09	622,61	1,5771	2,2963
74,04	74,25	3	389,49	77,458	416,75	622,56	1,575	2,2967
74,22	74,43	3,01	388,93	77,84	417,4	622,51	1,5728	2,2971
74,39	74,6	3,02	388,38	78,223	418,05	622,46	1,5706	2,2975
74,57	74,77	3,03	387,83	78,609	418,71	622,41	1,5687	2,2979
74,74	74,95	3,04	387,27	78,996	419,36	622,35	1,5665	2,2983
74,91	75,12	3,05	386,71	79,386	420,01	622,3	1,5645	2,2987
75,09	75,29	3,06	386,15	79,777	420,66	622,24	1,5623	2,2991
75,26	75,46	3,07	385,59	80,17	421,32	622,18	1,5603	2,2994
75,43	75,63	3,08	385,03	80,565	421,97	622,11	1,558	2,2998
75,6	75,81	3,09	384,47	80,962	422,62	622,05	1,556	2,3002
75,77	75,98	3,1	383,9	81,361	423,28	621,98	1,5536	2,3006
75,94	76,15	3,11	383,34	81,761	423,93	621,91	1,5513	2,301
76,11	76,31	3,12	382,77	82,164	424,58	621,84	1,5493	2,3014
76,28	76,48	3,13	382,2	82,569	425,23	621,77	1,5471	2,3018
76,45	76,65	3,14	381,63	82,976	425,89	621,69	1,5449	2,3021
76,62	76,82	3,15	381,05	83,385	426,54	621,62	1,5429	2,3025
76,79	76,99	3,16	380,48	83,797	427,19	621,54	1,5404	2,3029
76,96	77,15	3,17	379,9	84,21	427,85	621,46	1,5384	2,3033
77,12	77,32	3,18	379,32	84,626	428,5	621,37	1,5359	2,3037
77,29	77,49	3,19	378,74	85,043	429,15	621,29	1,5337	2,304
77,46	77,65	3,2	378,16	85,464	429,81	621,2	1,5314	2,3044
77,63	77,82	3,21	377,58	85,886	430,46	621,11	1,5291	2,3048
77,79	77,98	3,22	376,99	86,311	431,12	621,02	1,5269	2,3052
77,96	78,15	3,23	376,4	86,738	431,77	620,92	1,5244	2,3056
78,12	78,31	3,24	375,81	87,167	432,43	620,82	1,5219	2,306
78,29	78,48	3,25	375,22	87,598	433,08	620,72	1,5196	2,3063
78,45	78,64	3,26	374,62	88,033	433,74	620,62	1,5173	2,3067
78,62	78,8	3,27	374,02	88,469	434,4	620,52	1,515	2,3071
78,78	78,97	3,28	373,43	88,909	435,05	620,41	1,5124	2,3075
78,94	79,13	3,29	372,82	89,35	435,71	620,3	1,5101	2,3078
79,1	79,29	3,3	372,22	89,795	436,37	620,19	1,5076	2,3082
79,27	79,45	3,31	371,61	90,242	437,02	620,08	1,5052	2,3086
79,43	79,61	3,32	371	90,692	437,68	619,96	1,5027	2,3089
79,59	79,78	3,33	370,39	91,144	438,34	619,85	1,5005	2,3093
79,75	79,94	3,34	369,78	91,599	439	619,72	1,4977	2,3097
79,91	80,1	3,35	369,16	92,057	439,66	619,6	1,4954	2,31

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
80,07	80,26	3,36	368,54	92,518	440,32	619,48	1,493	2,3104
80,23	80,41	3,37	367,92	92,982	440,98	619,35	1,4904	2,3108
80,39	80,57	3,38	367,3	93,449	441,65	619,22	1,4878	2,3111
80,55	80,73	3,39	366,67	93,919	442,31	619,08	1,4852	2,3115
80,71	80,89	3,4	366,04	94,391	442,97	618,94	1,4825	2,3119
80,87	81,05	3,41	365,41	94,867	443,64	618,81	1,4801	2,3122
81,03	81,21	3,42	364,77	95,346	444,3	618,66	1,4772	2,3127
81,19	81,36	3,43	364,14	95,828	444,97	618,52	1,4748	2,313
81,34	81,52	3,44	363,49	96,314	445,63	618,37	1,4721	2,3134
81,5	81,67	3,45	362,85	96,803	446,3	618,22	1,4694	2,3137
81,66	81,83	3,46	362,2	97,295	446,97	618,07	1,4668	2,3141
81,81	81,99	3,47	361,55	97,791	447,64	617,91	1,4641	2,3145
81,97	82,14	3,48	360,89	98,29	448,31	617,75	1,4613	2,3148
82,13	82,3	3,49	360,24	98,793	448,98	617,59	1,4586	2,3152
82,28	82,45	3,5	359,58	99,299	449,65	617,42	1,7696	2,2415
82,44	82,6	3,51	358,91	99,809	450,33	617,25	1,4529	2,316
82,59	82,76	3,52	358,24	100,32	451	617,08	1,4502	2,3163
82,74	82,91	3,53	357,57	100,84	451,68	616,9	1,775	2,2392
82,9	83,06	3,54	356,89	101,36	452,35	616,73	1,4446	2,3171
83,05	83,22	3,55	356,21	101,89	453,03	616,54	1,4416	2,3175
83,2	83,37	3,56	355,53	102,42	453,71	616,36	1,4388	2,3178
83,36	83,52	3,57	354,84	102,95	454,39	616,17	1,4357	2,3182
83,51	83,67	3,58	354,15	103,49	455,08	615,98	1,4329	2,3186
83,66	83,82	3,59	353,45	104,03	455,76	615,78	1,4298	2,3189
83,81	83,98	3,6	352,75	104,58	456,45	615,58	1,7879	2,2336
83,97	84,13	3,61	352,05	105,13	457,13	615,38	1,4239	2,3197
84,12	84,28	3,62	351,34	105,69	457,82	615,17	1,4207	2,3201
84,27	84,43	3,63	350,62	106,25	458,51	614,96	1,7934	2,231
84,42	84,57	3,64	349,9	106,81	459,21	614,75	1,4147	2,3208
84,57	84,72	3,65	349,18	107,38	459,9	614,53	1,4115	2,3212
84,72	84,87	3,66	348,45	107,96	460,6	614,3	1,4083	2,3216
84,87	85,02	3,67	347,71	108,54	461,3	614,08	1,4051	2,322
85,02	85,17	3,68	346,97	109,13	462	613,85	1,4019	2,3224
85,16	85,32	3,69	346,23	109,72	462,7	613,61	1,3987	2,3227
85,31	85,46	3,7	345,48	110,32	463,4	613,37	1,3954	2,3231
85,46	85,61	3,71	344,72	110,92	464,11	613,13	1,3922	2,3235
85,61	85,76	3,72	343,96	111,53	464,82	612,88	1,8103	2,2229

These data collected by application REFPROP 7

Liquid phase	Vapor phase	Absolute	Liquid phase	Vapor phase	Liquid phase	Vapor phase	Liquid phase	Vapor phase
Temperature		Pressure	Entropy					
(°C)		(MPa)	(kg/m³)		(kJ/kg)		(kJ/kg-K)	
85,76	85,9	3,73	343,19	112,14	465,53	612,62	1,3853	2,3243
85,9	86,05	3,74	342,41	112,76	466,24	612,36	1,8141	2,221
86,05	86,2	3,75	341,63	113,39	466,96	612,1	1,816	2,22
86,2	86,34	3,76	340,85	114,02	467,68	611,83	1,375	2,3255
86,34	86,49	3,77	340,05	114,66	468,4	611,56	1,8199	2,218
86,49	86,63	3,78	339,25	115,31	469,13	611,28	1,368	2,3263
86,63	86,78	3,79	338,44	115,97	469,86	610,99	1,3643	2,3267
86,78	86,92	3,8	337,62	116,63	470,59	610,7	1,8257	2,2149
86,92	87,06	3,81	336,8	117,3	471,32	610,41	1,3571	2,3275
87,07	87,21	3,82	335,97	117,97	472,06	610,11	1,3533	2,3279
87,21	87,35	3,83	335,12	118,66	472,8	609,8	1,3496	2,3283
87,36	87,49	3,84	334,28	119,35	473,55	609,48	1,8336	2,2106
87,5	87,63	3,85	333,42	120,05	474,3	609,16	1,8356	2,2095
87,64	87,78	3,86	332,55	120,76	475,05	608,84	1,8376	2,2083
87,78	87,92	3,87	331,67	121,48	475,81	608,5	1,3339	2,33
87,93	88,06	3,88	330,79	122,21	476,57	608,16	1,33	2,3305
88,07	88,2	3,89	329,89	122,94	477,34	607,81	1,8437	2,2048
88,21	88,34	3,9	328,99	123,69	478,11	607,46	1,3218	2,3313
88,35	88,48	3,91	328,07	124,45	478,88	607,1	1,8478	2,2024
88,49	88,62	3,92	327,14	125,22	479,66	606,73	1,3134	2,3322
88,63	88,76	3,93	326,2	126	480,45	606,35	1,3091	2,3327
88,78	88,9	3,94	325,25	126,79	481,24	605,96	1,3047	2,3332
88,92	89,04	3,95	324,28	127,59	482,04	605,56	1,8562	2,1973
89,06	89,18	3,96	323,3	128,41	482,84	605,16	1,2958	2,3341
89,2	89,32	3,97	322,31	129,23	483,65	604,74	1,8605	2,1946
89,33	89,45	3,98	321,3	130,08	484,47	604,32	1,8626	2,1932
89,47	89,59	3,99	320,28	130,93	485,3	603,88	1,8648	2,1918
89,61	89,73	4	319,24	131,8	486,13	603,44	1,2769	2,3361

These data collected by application REFPROP 7