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P-T-X and P-T-h Diagrams of the Working Pair H_20/LiBr at Thermodynamic Equilibrium and Charts that Permit to Determine its Thermodynamic Properties

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Authors' contributions

This work was carried out in collaboration among all authors. Author YCN managed the literature searches, wrote the first draft of the manuscript and performed the numerical simulations. Author AK performed the statistical analysis. Author DJB managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

The thermodynamic properties at equilibrium, in this case, enthalpy, pressure, temperature, mass fraction, of working pairs are very important for researchers and in the design of absorption refrigeration systems. Although some authors have carried out their research in this direction by setting up empirical formulas, there are unfortunately no charts or easy-to-use diagrams making it possible to have these properties for the couple H_20/LiBr. The aim of this present study is to make a small contribution by making charts and diagrams available to all, making it possible to quickly and easily obtain the properties of lithium bromide at thermodynamic equilibrium.

Keywords: Thermodynamic properties; lithium bromide; absorption; diagrams.

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1. INTRODUCTION

The H_20/LiBr and NH_3/H_20 working pairs are the most used [1-4] in absorption cooling systems although there are more and more new working pairs on the market such as $H_2O/CaCl_2$, $H_2O/LiNO_3$, H_2O/KNO_3 [5]. The working pair is one of the important elements of absorption systems, which plays a very important role in their performance [2, 6, 7]. It is therefore very important to know the thermodynamic properties of the working pairs at thermodynamic equilibrium for the designing of these systems [8, 9]. Several authors have conducted their studies in the direction of establishing correlations [10, 11]. Among others, we have McNeely in 1978 who established a correlation on the enthalpy for a range of temperature and mass content respectively of 15°C - 165°C and 0.4-0.7, we also have Patterson and Perez-Blanco in 1988 , Hellmann and Grossman in 1996, Chua et al. in 2000 and Kaita in 2001 who also worked in this direction [11]. The aim of this present work is to make a contribution in determining the composition of the binary H_20/LiBr mixture at equilibrium. Indeed, it will be a question of setting up charts and diagrams making it possible to have the properties such as the pressure, the temperature and the mass fraction at equilibrium.

2. SOME CORRELATIONS ESTABLISHED BY SOME AUTHORS

2.1 McNeely Correlations

For temperature values between 5° C and 180° C, and mass fraction ranging from 45 % to 70 %, McNeely establishes the following correlation between the mass fraction, the dew point and the lithium bromide temperature[12]:

$$T = T_R \sum_{i=0}^{3} A_i X^i + \sum_{i=0}^{3} B_i X^i \quad (1)$$

The values of A_i and B_i are summarized in the table below:

For the calculation of the saturation pressure of the LiBr binary mixture, McNeely proposes the following formula:

$$\log P_{sat} = k_0 + \frac{k_1}{T_R + 273.15} + \frac{k_2}{(T_R + 273.15)^2} \quad (2)$$

With $k_0 = 7.05$; $k_1 = -1\,603.54$; $k_2 = -104\,095.5$

Table 1. Values of the coefficients Ai and Bi

i	A_i	B_i
0	-2,00755	124,937
1	0,16976	-7,7165
2	-0,00313336	0,152286
3	1,97668E-05	-0,00079509

Also, for $16°C \leq T \leq 166°C$ and $40\% \leq X \leq 70\ \%$, the specific heat capacity and enthalpy of the solution can be calculated by the following correlations:

$$h = 2.326[A + B(1.8T + 32) + C(1.8T + 32)^2] \quad (3)$$

And

$$Cp = 2.326[1.8BT + 3.6C(1.8T + 32)] \quad (4)$$

With : $A = -1\,015.07 + 79.538X - 2.358016X^2 + 0.03031583X^3 - 1.400261 \cdot 10^{-4}X^4$

$B = 4.68108 - 0.3037766X + 8.44845 \cdot 10^{-3}X^2 - 1.047721 \cdot 10^{-4}X^3 + 4.80097 \cdot 10^{-7}X^4$

$C = -4.9107 \cdot 10^{-3} + 83184 \cdot 10^{-4}X - 1.078963 \cdot 10^{-5}X^2 + 1.3152 \cdot 10^{-7}X^3 - 5.897 \cdot 10^{-10}X^4$

2.2 Uemura and Hasaba correlations

According to Uemura and Hasaba, the pressure, temperature and mass fraction of lithium bromide at thermodynamic equilibrium is related by a single equation which is the following:

$$\log P[kPa] = A + \frac{B}{T[K]} + \frac{C}{T^2[K]} \quad (5)$$

With:

$A = 3.1934 + 1.3292 \cdot 10^{-1}X - 1.4278 \cdot 10^{-3}X^2$

$B = 1.0575 \cdot 10^3 - 9.4632 \cdot 10^1X + 9.816 \cdot 10^{-1}X^2$

$C = -6.01350 \cdot 10^5 + 1.9734 \cdot 10^4X - 2.3701 \cdot 10^2X^2$

Also, according to Iyoki and Uemura, the specific heat capacity of LiBr can be calculated as follows:

$$Cp[kJ.kg^{-1}.K^{-1}] = \sum_{i=0}^{6} A_i X^i + \sum_{i=0}^{6} B_i X^i T + \sum_{i=0}^{6} C_i X^i T^2 \quad (6)$$

T being in Kelvin. The coefficients A_i, B_i and C_i are in the following table:

Table 2. Values of the coefficients Ai, Bi, Ci for the calculation of Cp

i	A_i	B_i	C_i
0	5,62514	-0,00896356	1,38744E-05
1	0,140395	-0,000819462	8,86288E-07
2	-0,00106479	-2,72788E-05	7,06171E-08
3	-0,00099788	7,56136E-06	-1,21807E-08
4	4,59723E-05	-3,12107E-07	4,74746E-10
5	-7,61618E-07	4,98885E-09	-7,39772E-12
6	4,37013E-09	-2,8148E-11	4,11735E-14

Table 3. Values of the coefficients in equation 7

i	j	a_{ij}	i	j	a_{ij}	i	j	a_{ij}
0	0	-0,1313448	0	1	0,9967944	0	2	1,97879E-05
1	0	0,1820914	1	1	0,001778069	1	2	-1,77948E-05
2	0	-0,05177356	2	1	-0,00022156	2	2	2,00243E-06
3	0	0,002827426	3	1	5,91362E-06	3	2	-7,66755E-08
4	0	-6,38054E-05	4	1	7,30856E-08	4	2	1,20153E-09
5	0	4,3405E-07	5	1	2,78847E-10	5	2	-6,64171E-12

3. CORRELATIONS AND COMPUTER PROGRAM

3.1 Correlations

In this work, we used the correlations of Da-Wen Sun [13] and we write a MATLAB program to get diagrams and charts. The composition of lithium bromide at thermodynamic equilibrium can be determined by the following correlations:

$$T_d(T,X) = \sum_{i=0}^{5}\sum_{j=0}^{2} a_{ij} X^i T^j \qquad (7)$$

$$T_d(P) = 42.6776 - \frac{3\,892.7}{\ln(P) - 9.48654} \quad si\ P < 12.33\ \text{MPa}$$

$$T_d(P) = -387.592 - \frac{12\,587.5}{\ln(P) - 15.2578} \quad si\ P \geq 12.33\ \text{MPa}$$

The enthalpy of lithium bromide is given by the following correlation:

$$h(T,X) = \sum_{i=0}^{5}\sum_{j=0}^{2} a_{ij}\, X^i T^j \qquad (8)$$

The coefficients a_{ij} are given in the tables below.

3.2 Computer Program

To solve these equations stated previously, we first established a MAPLE code to simplify the equations involving many coefficients. Then, with a MATLAB program, the properties of the mixture at equilibrium are determined by solving theses equations.

4. P-T-X, P-T-h DIAGRAMS AND CHARTS

4.1 Comparison of Our Results with Those of Other Authors

To validate our results, we will compare them with those of authors Iyoki and Uemura, Uemura and Hasaba, Jeter, Feuerecker, McNeely, Patterson, Kaita [12].

For the experimental values of temperature, mass content and pressure, we present the values calculated by other authors in Table 5. We note that ΔP in Table 5 is the rapport of the difference of pressure calculated by Iyoki and Uemura (IaU in short) and the other works divided by pressure calculated by pressure calculated by Iyoki and Uemura ($\Delta P = \frac{|P_{IaU} - P_{otherWork}|}{P_{IaU}}$). That's why the unit is the percent %.

The relative deviation for the pressure calculation in this present work is about 3.26%. Our results are quite similar to those found in the literature.

4.2 P-T-X and P-T-h Diagrams

The properties of the binary mixture used as workings pairs in absorption refrigeration systems are very important in the designing of these systems. It is therefore important to be able to know the composition of the mixture at thermodynamic equilibrium at a given temperature and pressure. The diagrams which

will follow permit to know the properties of lithium bromide for some temperature and pressure intervals. We have chosen as temperature range, 0 °C to 135 °C because for the couple LiBr/water, the minimum possible temperature is 0 °C since the water is the refrigerant. Also the operating temperature (temperature of generation) is lower (compared to other couple water/NH3 for exemple) and goes around 70 °C or less [6], so our choice of range covers a very large possibility of designing an absorption system using LiBr / water.

As for the choice of the pressure range (0.5 kPa to 20 kPa), this is explained by the fact that the desorption pressure is around 10kPa and that of absorption is around 1kPa for the couple LiBr/water [14]. Our choice of pressure range also covers a wide range of applications.

Still within the framework of the study of absorption cycles or for certain applications, it is often essential to determine the enthalpy of lithium bromide. The following diagram helps to determine this.

Fig. 1 gives the mass fraction as a function of temperature for pressures ranging from 0.5 kPa to 10 kPpa.

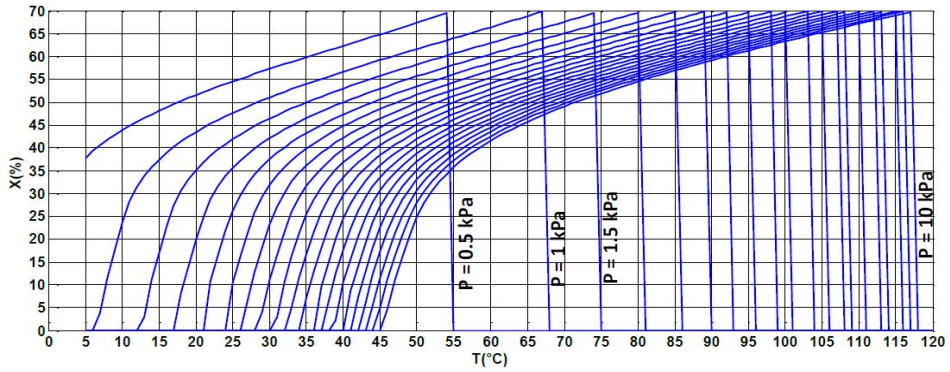

Fig. 1. P-T-X diagram for P ranging from 0.5 kPa to 10 kPa

For pressures ranging from 10 kPa to 20 kPa we have the diagram:

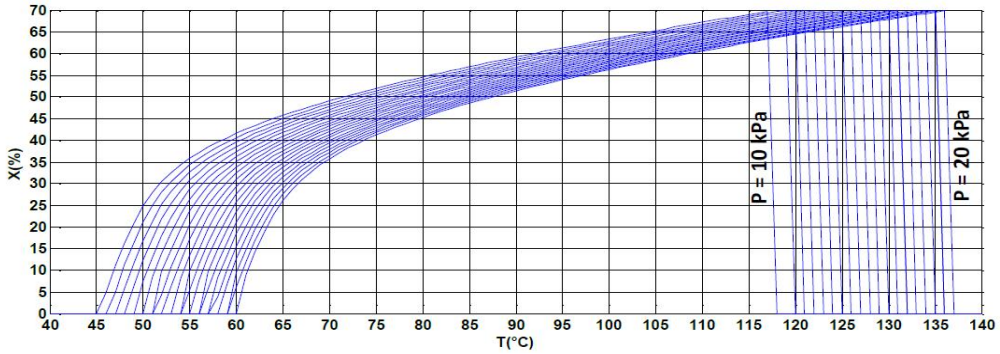

Fig. 2. P-T-X diagram for P ranging from 10 kPa to 20 kPa

Table 4. Coefficients for the calculation of the enthalpy of LiBr in equation 8

i	j	a_{ij}	i	j	a_{ij}	i	j	a_{ij}
0	0	1.134125	0	1	4.124891	0	2	0.000574369
1	0	-0.480045	1	1	-0.07643903	1	2	5.87092E-05
2	0	-0.002161438	2	1	0.002589577	2	2	-7.37532E-06
3	0	0.000233624	3	1	-9.50052E-05	3	2	3.27759E-07
4	0	-1.18868E-05	4	1	1.70803E-06	4	2	-6.0623E-09
5	0	2.29153E-07	5	1	-1.10236E-08	5	2	3.9019E-11

Table 5. Comparison of the results of this work with those of other authors

Data calculated by Iyoki and Uemura			Data calculated by authors													
			This work		Kaita		Uemura and Hasaba		Jeter		Feuerecker		McNeely		Patterson	
X (%)	T(°C)	P(kPa)	P(kPa)	ΔP(%)	P(kPa)	ΔP(%)	P(kPa)	ΔP(%)	P(kPa)	ΔP(%)	P(kPa)	ΔP(%)	P(kPa)	ΔP(%)	P(kPa)	ΔP(%)
38,9	100	**60,09**	**59,945**	0,24	59,45	1,07	59,73	0,60	60,29	0,33	59,43	1,10	70,66	17,59	59,97	0,20
	108	**77,51**	**78,88**	1,77	78,27	0,98	78,14	0,81	79,12	2,08	78,29	1,01	93,52	20,66	78,97	1,88
	116	**102,2**	**103,59**	1,39	102,8	0,63	101,9	0,26	103,6	1,42	103	0,76	123,5	20,87	103,8	1,59
	132	**167,9**	**170,88**	1,76	169,6	0,98	165,3	1,58	170	1,24	170,2	1,35	205,5	22,37	171,5	2,10
	142	**218,4**	**230,7**	5,64	228,8	4,77	220,3	0,89	228,7	4,73	230	5,33	278,7	27,61	231,7	6,07
40,7	101	**56,68**	**56,77**	0,16	56,81	0,23	56,28	0,71	56,82	0,25	56,53	0,26	63,41	11,87	56,78	0,18
	107	**69,82**	**69,66**	0,23	69,65	0,24	68,85	1,39	69,59	0,33	69,39	0,62	78,02	11,74	69,72	0,14
	117	**97,67**	**98,82**	1,18	98,65	1,00	97	0,69	98,4	0,75	98,51	0,86	111,2	13,82	98,09	0,43
	131	**157,4**	**156,65**	0,46	155,9	0,92	151,8	3,53	155,3	1,32	156,3	0,66	177,2	12,57	157,1	0,15
	143	**221**	**220,07**	0,44	218,5	1,17	210,7	4,66	217,4	1,63	219,8	0,56	249,7	12,97	220,9	0,05
49,8	121	**69,58**	**70,01**	0,62	69,29	0,42	69,22	0,52	69,34	0,34	69,01	0,82	69,85	0,39	70,07	0,70
	140	**128,9**	**131,84**	2,27	130	0,86	129,4	0,35	130	0,83	130,2	1,02	131,9	2,31	132,2	2,54
	147	**154,8**	**158,73**	2,57	156,4	1,03	155,2	0,27	156,3	1,02	156,9	1,38	158,9	2,69	159,2	2,88
	151	**177,6**	**183,04**	3,05	180,1	1,41	178,4	0,42	180,2	1,43	181	1,93	183,4	3,25	183,7	3,41
	168	**281,4**	**289,8**	3,00	284,2	1,02	287,7	2,26	284,9	1,25	287,3	2,10	291,1	3,47	291,2	3,48
50	121	**69,78**	**69,1**	0,97	68,38	2,01	68,38	2,01	68,47	1,88	68,1	2,41	68,92	1,23	67,17	3,74
	141	**129,3**	**131,39**	1,62	129,6	0,25	129,3	0,01	129,6	0,26	129,8	0,39	131,4	1,66	131,8	1,94
	147	**154,8**	**158,7**	2,51	156,3	0,97	155,3	0,28	156,4	1,00	156,9	1,31	158,9	2,61	159,2	2,85
	152	**171,7**	**181,36**	5,64	178,6	4,00	176,9	3,06	178,6	4,05	179,4	4,50	181,7	5,85	182,1	6,06
	168	**269,5**	**288,82**	7,16	283,4	5,14	278	3,15	284,1	5,39	286,3	6,23	290,1	7,63	290,3	7,70
59,9	93,9	**10,74**	**11**	2,42	10,79	0,47	11,58	7,82	11,33	5,49	10,72	0,19	10,99	2,33	10,97	2,14
	119	**30,73**	**30,47**	0,85	30,1	2,05	32,23	4,88	31,29	1,82	29,92	2,64	30,52	0,68	30,43	0,98
	139	**62,51**	**61,026**	2,37	60,76	2,80	63,89	2,21	62,61	0,16	60,22	3,66	61,23	2,05	61,05	2,34
	151	**92,29**	**88,66**	3,93	88,73	3,86	91,9	0,42	90,96	1,44	87,71	4,96	89,05	3,51	88,79	3,79
	182	**234,5**	**216,53**	7,66	220	6,20	216,1	7,83	222,4	5,17	215,3	8,18	217,8	7,10	217,4	7,30
63,4	128	**32,58**	**29,659**	8,97	29,91	8,20	32,49	0,28	31,95	1,93	29,77	8,62	29,72	8,78	29,62	9,09
	134	**39,84**	**37,135**	6,79	37,59	5,65	40,56	1,81	40,02	0,45	37,37	6,20	37,22	6,58	37,11	6,85
	138	**47,39**	**42,96**	9,35	43,61	7,98	46,79	1,27	46,3	2,30	43,31	8,61	43,06	9,14	42,94	9,39
	145	**59,68**	**54,02**	9,48	55,08	7,71	58,51	1,96	58,21	2,46	54,59	8,53	54,15	9,27	54,02	9,48
Average				**3,26**		**2,55**		**1,93**		**1,82**		**2,97**		**4,24**		**3,43**

The diagrams relating enthalpy, pressure and temperature are given in the following figures.

Fig. 3 presents the P-T-h diagram for pressures ranging from 0.5 kPa to 10 kPa.

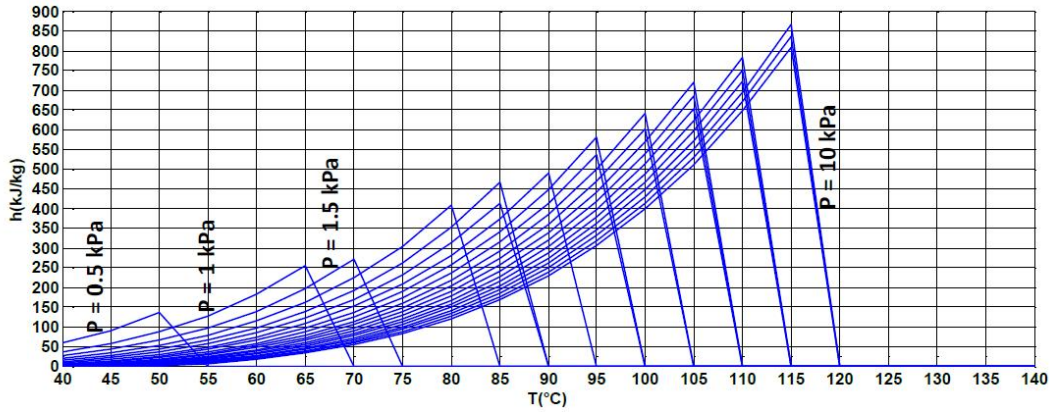

Fig. 3. P-T-h diagram for P ranging from 0.5 kPa to 10 kPa

For pressures ranging from 10 kPa to 20 kPa we have the diagram,

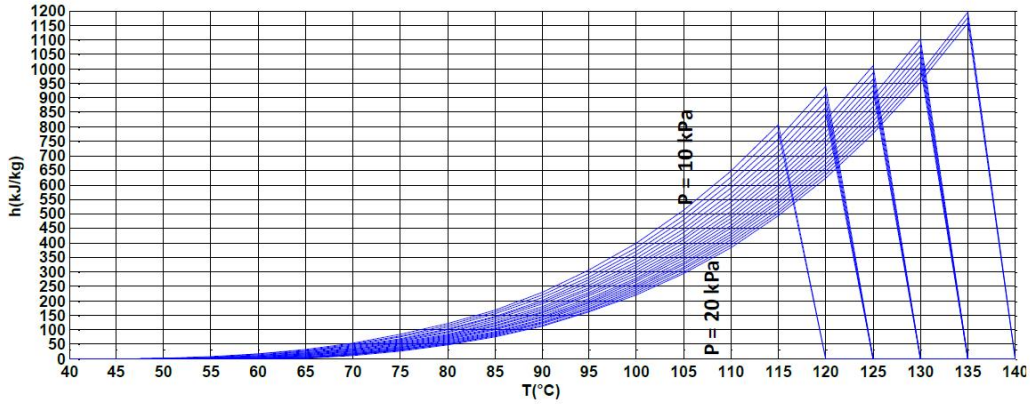

Fig. 4. P-T-h diagram for P ranging from 10 kPa to 20 kPa

4.3 Charts

The following charts have been established for different temperature and pressure intervals. This is very useful and will permit to have quick access to the thermodynamic composition of the binary lithium bromide solution.

Table 6. Chart denoting mass fraction for differents temperature and pressure intervals (part 1)

	Mass fraction X (%)										
P(kPa) / T (°C)	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
40	62.36	56.73	53.02	50.00	47.30	44.75	42.22	39.61	36.78	33.56	29.62
41	62.86	57.25	53.58	50.63	48.02	45.57	43.17	40.72	38.14	35.30	31.98
42	63.36	57.75	54.14	51.24	48.70	46.34	44.05	41.76	39.38	36.82	33.94
43	63.85	58.26	54.68	51.84	49.37	47.09	44.90	42.72	40.51	38.17	35.61
44	64.35	58.76	55.22	52.43	50.01	47.80	45.70	43.63	41.55	39.39	37.08
45	64.85	59.25	55.74	53.00	50.64	48.49	46.46	44.49	42.52	40.51	38.40
46	65.36	59.74	56.26	53.56	51.24	49.15	47.19	45.30	43.43	41.54	39.59

	Mass fraction X (%)										
P(kPa) / T (°C)	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
47	65.86	60.22	56.77	54.11	51.84	49.80	47.90	46.08	44.29	42.51	40.68
48	66.38	60.71	57.28	54.64	52.42	50.42	48.58	46.82	45.11	43.41	41.70
49	66.89	61.19	57.78	55.17	52.98	51.03	49.24	47.53	45.89	44.27	42.65
50	67.42	61.67	58.27	55.69	53.53	51.62	49.87	48.22	46.63	45.08	43.54
51	67.95	62.14	58.76	56.21	54.08	52.20	50.49	48.89	47.35	45.86	44.38
52	68.50	62.62	59.24	56.71	54.61	52.77	51.09	49.53	48.04	46.60	45.19
53	69.05	63.09	59.72	57.21	55.13	53.32	51.68	50.15	48.71	47.31	45.95
54	69.62	63.57	60.20	57.70	55.65	53.86	52.25	50.76	49.35	48.00	46.69
55	-	64.04	60.67	58.19	56.16	54.40	52.81	51.35	49.98	48.66	47.39
56	-	64.51	61.14	58.67	56.66	54.92	53.36	51.93	50.58	49.31	48.08
57	-	64.99	61.61	59.15	57.15	55.43	53.90	52.49	51.18	49.93	48.73
58	-	65.47	62.07	59.62	57.64	55.94	54.43	53.04	51.75	50.54	49.37
59	-	65.94	62.54	60.09	58.12	56.44	54.95	53.58	52.32	51.13	49.99
60	-	66.43	63.00	60.56	58.60	56.93	55.46	54.11	52.87	51.70	50.59
61	-	66.91	63.46	61.02	59.07	57.42	55.96	54.63	53.41	52.27	51.18
62	-	67.40	63.92	61.48	59.54	57.90	56.45	55.15	53.94	52.82	51.75
63	-	67.89	64.38	61.94	60.01	58.37	56.94	55.65	54.46	53.36	52.31
64	-	68.39	64.84	62.39	60.47	58.84	57.43	56.15	54.98	53.88	52.86
65	-	68.89	65.30	62.85	60.92	59.31	57.90	56.64	55.48	54.40	53.39
66	-	69.40	65.76	63.30	61.38	59.77	58.37	57.12	55.98	54.91	53.92
67	-	69.92	66.22	63.75	61.83	60.23	58.84	57.60	56.46	55.42	54.43
68	-	-	66.69	64.20	62.28	60.68	59.30	58.07	56.95	55.91	54.94
69	-	-	67.15	64.65	62.73	61.14	59.76	58.54	57.42	56.40	55.44
70	-	-	67.62	65.10	63.17	61.58	60.21	59.00	57.89	56.88	55.93
71	-	-	68.09	65.55	63.62	62.03	60.66	59.46	58.36	57.35	56.42
72	-	-	68.56	66.00	64.06	62.47	61.11	59.91	58.82	57.82	56.90
73	-	-	69.04	66.45	64.50	62.91	61.56	60.36	59.28	58.29	57.37
74	-	-	69.52	66.90	64.94	63.35	62.00	60.80	59.73	58.75	57.84
75	-	-	-	67.35	65.38	63.79	62.44	61.25	60.18	59.20	58.30
76	-	-	-	67.80	65.82	64.23	62.87	61.69	60.62	59.65	58.75
77	-	-	-	68.26	66.26	64.66	63.31	62.12	61.06	60.10	59.21
78	-	-	-	68.71	66.70	65.10	63.74	62.56	61.50	60.54	59.65
79	-	-	-	69.17	67.14	65.53	64.17	62.99	61.94	60.98	60.10
80	-	-	-	69.63	67.58	65.96	64.60	63.42	62.37	61.41	60.54
81	-	-	-	-	68.02	66.39	65.03	63.85	62.80	61.85	60.97
82	-	-	-	-	68.47	66.83	65.46	64.27	63.22	62.28	61.41
83	-	-	-	-	68.91	67.26	65.88	64.70	63.65	62.70	61.84
84	-	-	-	-	69.35	67.69	66.31	65.12	64.07	63.13	62.26
85	-	-	-	-	69.80	68.12	66.73	65.54	64.49	63.55	62.69
86	-	-	-	-	-	68.55	67.16	65.96	64.91	63.97	63.11
87	-	-	-	-	-	68.98	67.58	66.38	65.33	64.39	63.53
88	-	-	-	-	-	69.41	68.00	66.80	65.75	64.80	63.95
89	-	-	-	-	-	69.85	68.43	67.22	66.16	65.22	64.36
90	-	-	-	-	-	-	68.85	67.64	66.58	65.63	64.77
91	-	-	-	-	-	-	69.27	68.05	66.99	66.04	65.19
92	-	-	-	-	-	-	69.69	68.47	67.40	66.45	65.59
93	-	-	-	-	-	-	-	68.88	67.81	66.86	66.00
94	-	-	-	-	-	-	-	69.29	68.22	67.27	66.41
95	-	-	-	-	-	-	-	69.70	68.63	67.67	66.81
96	-	-	-	-	-	-	-	-	69.03	68.07	67.21
97	-	-	-	-	-	-	-	-	69.44	68.48	67.61
98	-	-	-	-	-	-	-	-	69.84	68.88	68.01
99	-	-	-	-	-	-	-	-	-	69.28	68.41
100	-	-	-	-	-	-	-	-	-	69.67	68.80
101	-	-	-	-	-	-	-	-	-	-	69.20
102	-	-	-	-	-	-	-	-	-	-	69.59
103	-	-	-	-	-	-	-	-	-	-	69.98

Table 7. Chart denoting mass fraction for differents temperature and pressure intervals (part 2)

	Mass fraction X (%)								
P(kPa) / T (°C)	6	6.5	7	7.5	8	8.5	9	9.5	10
40	24.43	17.67	10.43	-	-	-	-	-	-
41	27.85	22.38	15.69	8.71	-	-	-	-	-
42	30.53	26.22	20.60	14.13	7.28	-	-	-	-
43	32.71	29.21	24.77	19.13	12.93	6.13	-	-	-
44	34.54	31.60	28.05	23.53	17.98	12.06	5.27	-	-
45	36.12	33.58	30.64	27.05	22.54	17.15	11.48	4.78	-
46	37.52	35.28	32.76	29.82	26.24	21.79	16.59	11.18	4.71
47	38.78	36.76	34.55	32.06	29.16	25.62	21.28	16.30	11.13
48	39.94	38.09	36.11	33.95	31.50	28.64	25.19	21.00	16.24
49	41.00	39.29	37.50	35.57	33.45	31.06	28.28	24.93	20.92
50	41.98	40.39	38.74	37.00	35.13	33.07	30.75	28.05	24.85
51	42.91	41.42	39.88	38.29	36.60	34.79	32.79	30.55	27.96
52	43.78	42.37	40.94	39.46	37.92	36.29	34.53	32.61	30.46
53	44.61	43.27	41.92	40.54	39.12	37.63	36.06	34.37	32.53
54	45.40	44.12	42.84	41.54	40.22	38.85	37.42	35.90	34.29
55	46.15	44.93	43.71	42.48	41.23	39.96	38.64	37.27	35.82
56	46.88	45.70	44.53	43.36	42.19	40.99	39.77	38.51	37.19
57	47.57	46.44	45.32	44.20	43.08	41.96	40.81	39.64	38.43
58	48.24	47.15	46.07	45.00	43.93	42.86	41.78	40.68	39.56
59	48.89	47.83	46.79	45.76	44.74	43.72	42.69	41.66	40.61
60	49.52	48.49	47.48	46.49	45.51	44.53	43.56	42.57	41.58
61	50.13	49.13	48.15	47.19	46.24	45.31	44.37	43.44	42.50
62	50.73	49.75	48.80	47.86	46.95	46.05	45.15	44.26	43.37
63	51.31	50.35	49.42	48.52	47.63	46.76	45.90	45.04	44.19
64	51.88	50.94	50.03	49.15	48.29	47.45	46.61	45.79	44.97
65	52.43	51.51	50.63	49.77	48.93	48.11	47.30	46.51	45.72
66	52.97	52.07	51.20	50.36	49.55	48.75	47.97	47.20	46.44
67	53.50	52.62	51.77	50.95	50.15	49.37	48.61	47.86	47.13
68	54.03	53.15	52.32	51.52	50.74	49.98	49.24	48.51	47.79
69	54.54	53.68	52.86	52.07	51.31	50.57	49.84	49.13	48.44
70	55.04	54.20	53.39	52.61	51.87	51.14	50.43	49.74	49.07
71	55.54	54.70	53.91	53.15	52.41	51.70	51.01	50.33	49.67
72	56.03	55.20	54.42	53.67	52.95	52.25	51.57	50.91	50.26
73	56.51	55.70	54.92	54.18	53.47	52.79	52.12	51.47	50.84
74	56.98	56.18	55.42	54.69	53.99	53.31	52.66	52.02	51.40
75	57.45	56.66	55.90	55.18	54.49	53.83	53.18	52.56	51.95
76	57.92	57.13	56.38	55.67	54.99	54.34	53.70	53.09	52.49
77	58.38	57.59	56.86	56.15	55.48	54.83	54.21	53.61	53.02
78	58.83	58.06	57.32	56.63	55.96	55.32	54.71	54.11	53.54
79	59.28	58.51	57.79	57.10	56.44	55.81	55.20	54.61	54.05
80	59.72	58.96	58.24	57.56	56.91	56.28	55.68	55.11	54.54
81	60.16	59.41	58.69	58.02	57.37	56.75	56.16	55.59	55.04
82	60.60	59.85	59.14	58.47	57.83	57.22	56.63	56.07	55.52
83	61.03	60.29	59.58	58.92	58.28	57.68	57.10	56.54	56.00
84	61.46	60.72	60.02	59.36	58.73	58.13	57.55	57.00	56.47
85	61.89	61.15	60.45	59.80	59.17	58.58	58.01	57.46	56.93
86	62.32	61.58	60.89	60.23	59.61	59.02	58.46	57.91	57.39
87	62.74	62.00	61.31	60.66	60.05	59.46	58.90	58.36	57.84
88	63.16	62.42	61.74	61.09	60.48	59.89	59.34	58.80	58.29
89	63.57	62.84	62.16	61.51	60.90	60.32	59.77	59.24	58.73
90	63.99	63.26	62.58	61.93	61.33	60.75	60.20	59.67	59.17
91	64.40	63.67	62.99	62.35	61.75	61.17	60.63	60.10	59.60
92	64.81	64.08	63.40	62.77	62.17	61.59	61.05	60.53	60.03
93	65.22	64.49	63.81	63.18	62.58	62.01	61.47	60.95	60.46
94	65.62	64.90	64.22	63.59	62.99	62.42	61.89	61.37	60.88

Mass fraction X (%)									
P(kPa) / T (°C)	6	6.5	7	7.5	8	8.5	9	9.5	10
95	66.03	65.30	64.63	63.99	63.40	62.84	62.30	61.79	61.30
96	66.43	65.70	65.03	64.40	63.80	63.24	62.71	62.20	61.71
97	66.83	66.10	65.43	64.80	64.21	63.65	63.12	62.61	62.12
98	67.22	66.50	65.83	65.20	64.61	64.05	63.52	63.01	62.53
99	67.62	66.90	66.22	65.60	65.01	64.45	63.92	63.42	62.93
100	68.02	67.29	66.62	65.99	65.40	64.85	64.32	63.82	63.34
101	68.41	67.68	67.01	66.38	65.80	65.24	64.71	64.21	63.74
102	68.80	68.07	67.40	66.77	66.19	65.63	65.11	64.61	64.13
103	69.19	68.46	67.79	67.16	66.58	66.02	65.50	65.00	64.52
104	69.57	68.84	68.17	67.55	66.96	66.41	65.89	65.39	64.92
105	69.95	69.23	68.56	67.93	67.35	66.79	66.27	65.78	65.30
106	-	69.61	68.94	68.31	67.73	67.18	66.66	66.16	65.69
107	-	69.99	69.31	68.69	68.11	67.56	67.04	66.54	66.07
108	-	-	69.69	69.06	68.48	67.93	67.41	66.92	66.45
109	-	-	-	69.44	68.85	68.31	67.79	67.30	66.83
110	-	-	-	69.81	69.22	68.68	68.16	67.67	67.20
111	-	-	-	-	69.59	69.05	68.53	68.04	67.57
112	-	-	-	-	69.96	69.41	68.90	68.41	67.94
113	-	-	-	-	-	69.77	69.26	68.77	68.31
114	-	-	-	-	-	-	69.62	69.13	68.67
115	-	-	-	-	-	-	69.98	69.49	69.03
116	-	-	-	-	-	-	-	69.84	69.39
117	-	-	-	-	-	-	-	-	69.74

Table 8. Chart denoting mass fraction for differents temperature and pressure intervals (part 3)

Mass fraction X (%)											
P(kPa) / T(°C)	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15
46	4.71	-	-	-	-	-	-	-	-	-	-
47	11.13	5.04	-	-	-	-	-	-	-	-	-
48	16.24	11.30	5.65	-	-	-	-	-	-	-	-
49	20.92	16.38	11.67	6.46	-	-	-	-	-	-	-
50	24.85	21.03	16.72	12.23	7.40	-	-	-	-	-	-
51	27.96	24.91	21.30	17.22	12.94	8.45	-	-	-	-	-
52	30.46	28.00	25.11	21.71	17.87	13.80	9.58	4.27	-	-	-
53	32.53	30.47	28.13	25.42	22.25	18.64	14.78	10.80	6.33	-	-
54	34.29	32.52	30.57	28.36	25.83	22.88	19.52	15.87	12.10	8.09	-
55	35.82	34.27	32.60	30.75	28.67	26.31	23.59	20.47	17.05	13.47	9.76
56	37.19	35.80	34.33	32.73	30.99	29.05	26.86	24.35	21.49	18.30	14.92
57	38.43	37.17	35.84	34.44	32.93	31.29	29.48	27.45	25.15	22.53	19.59
58	39.56	38.40	37.20	35.94	34.60	33.18	31.64	29.95	28.07	25.97	23.59
59	40.61	39.53	38.42	37.27	36.07	34.81	33.47	32.02	30.45	28.72	26.80
60	41.58	40.58	39.55	38.49	37.39	36.25	35.06	33.79	32.44	30.97	29.38
61	42.50	41.55	40.59	39.60	38.59	37.55	36.47	35.34	34.14	32.87	31.52
62	43.37	42.47	41.56	40.64	39.70	38.73	37.74	36.71	35.64	34.52	33.33
63	44.19	43.33	42.47	41.60	40.72	39.82	38.90	37.96	36.98	35.97	34.91
64	44.97	44.15	43.33	42.51	41.67	40.83	39.97	39.10	38.20	37.28	36.32
65	45.72	44.93	44.15	43.36	42.57	41.78	40.97	40.15	39.32	38.47	37.59
66	46.44	45.68	44.93	44.18	43.42	42.67	41.91	41.14	40.35	39.56	38.75
67	47.13	46.40	45.67	44.95	44.23	43.51	42.79	42.06	41.32	40.57	39.82
68	47.79	47.09	46.39	45.69	45.00	44.31	43.62	42.93	42.23	41.53	40.81
69	48.44	47.75	47.08	46.41	45.74	45.08	44.41	43.75	43.09	42.42	41.75
70	49.07	48.40	47.74	47.09	46.45	45.81	45.17	44.54	43.90	43.27	42.63
71	49.67	49.02	48.39	47.76	47.13	46.52	45.90	45.29	44.68	44.07	43.46
72	50.26	49.63	49.01	48.40	47.79	47.19	46.60	46.01	45.42	44.84	44.25

	Mass fraction X (%)										
P(kPa) / T(°C)	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15
73	50.84	50.22	49.62	49.02	48.43	47.85	47.28	46.71	46.14	45.57	45.01
74	51.40	50.80	50.21	49.62	49.05	48.49	47.93	47.37	46.83	46.28	45.74
75	51.95	51.36	50.78	50.21	49.65	49.10	48.56	48.02	47.49	46.96	46.44
76	52.49	51.91	51.34	50.79	50.24	49.70	49.17	48.65	48.13	47.62	47.11
77	53.02	52.45	51.89	51.35	50.81	50.29	49.77	49.26	48.76	48.26	47.76
78	53.54	52.98	52.43	51.89	51.37	50.86	50.35	49.85	49.36	48.88	48.40
79	54.05	53.49	52.95	52.43	51.92	51.41	50.92	50.43	49.95	49.48	49.01
80	54.54	54.00	53.47	52.95	52.45	51.95	51.47	50.99	50.52	50.06	49.60
81	55.04	54.50	53.98	53.47	52.97	52.49	52.01	51.54	51.08	50.63	50.19
82	55.52	54.99	54.48	53.98	53.49	53.01	52.54	52.08	51.63	51.19	50.75
83	56.00	55.47	54.97	54.47	53.99	53.52	53.06	52.61	52.17	51.73	51.30
84	56.47	55.95	55.45	54.96	54.49	54.02	53.57	53.13	52.69	52.27	51.85
85	56.93	56.42	55.92	55.44	54.97	54.52	54.07	53.63	53.21	52.79	52.37
86	57.39	56.88	56.39	55.92	55.46	55.00	54.56	54.13	53.71	53.30	52.89
87	57.84	57.34	56.86	56.39	55.93	55.48	55.05	54.62	54.21	53.80	53.40
88	58.29	57.79	57.31	56.85	56.39	55.96	55.53	55.11	54.70	54.30	53.90
89	58.73	58.24	57.76	57.30	56.86	56.42	56.00	55.58	55.18	54.78	54.39
90	59.17	58.68	58.21	57.75	57.31	56.88	56.46	56.05	55.65	55.26	54.88
91	59.60	59.12	58.65	58.20	57.76	57.33	56.92	56.51	56.12	55.73	55.36
92	60.03	59.55	59.09	58.64	58.20	57.78	57.37	56.97	56.58	56.20	55.82
93	60.46	59.98	59.52	59.07	58.64	58.22	57.82	57.42	57.03	56.66	56.29
94	60.88	60.40	59.95	59.50	59.08	58.66	58.26	57.87	57.48	57.11	56.74
95	61.30	60.82	60.37	59.93	59.51	59.09	58.69	58.31	57.93	57.56	57.19
96	61.71	61.24	60.79	60.35	59.93	59.52	59.13	58.74	58.36	58.00	57.64
97	62.12	61.65	61.21	60.77	60.35	59.95	59.55	59.17	58.80	58.43	58.08
98	62.53	62.06	61.62	61.19	60.77	60.37	59.98	59.60	59.23	58.87	58.52
99	62.93	62.47	62.03	61.60	61.19	60.78	60.40	60.02	59.65	59.29	58.95
100	63.34	62.88	62.43	62.01	61.60	61.20	60.81	60.44	60.07	59.72	59.37
101	63.74	63.28	62.84	62.41	62.00	61.61	61.22	60.85	60.49	60.14	59.79
102	64.13	63.67	63.24	62.81	62.41	62.01	61.63	61.26	60.90	60.55	60.21
103	64.52	64.07	63.63	63.21	62.81	62.41	62.04	61.67	61.31	60.96	60.62
104	64.92	64.46	64.03	63.61	63.20	62.81	62.44	62.07	61.72	61.37	61.03
105	65.30	64.85	64.42	64.00	63.60	63.21	62.83	62.47	62.12	61.77	61.44
106	65.69	65.24	64.81	64.39	63.99	63.60	63.23	62.87	62.52	62.17	61.84
107	66.07	65.62	65.19	64.78	64.38	63.99	63.62	63.26	62.91	62.57	62.24
108	66.45	66.00	65.57	65.16	64.76	64.38	64.01	63.65	63.30	62.96	62.64
109	66.83	66.38	65.95	65.54	65.15	64.76	64.39	64.04	63.69	63.35	63.03
110	67.20	66.76	66.33	65.92	65.53	65.15	64.78	64.42	64.08	63.74	63.42
111	67.57	67.13	66.70	66.30	65.90	65.52	65.16	64.80	64.46	64.13	63.80
112	67.94	67.50	67.07	66.67	66.28	65.90	65.53	65.18	64.84	64.51	64.18
113	68.31	67.87	67.44	67.04	66.65	66.27	65.91	65.56	65.21	64.88	64.56
114	68.67	68.23	67.81	67.40	67.01	66.64	66.28	65.93	65.59	65.26	64.94
115	69.03	68.59	68.17	67.77	67.38	67.00	66.64	66.30	65.96	65.63	65.31
116	69.39	68.95	68.53	68.13	67.74	67.37	67.01	66.66	66.32	66.00	65.68
117	69.74	69.30	68.88	68.48	68.10	67.73	67.37	67.02	66.69	66.36	66.05
118	-	69.65	69.23	68.84	68.45	68.08	67.73	67.38	67.05	66.73	66.41
119	-	70.00	69.58	69.19	68.80	68.44	68.08	67.74	67.41	67.08	66.77
120	-	-	69.93	69.53	69.15	68.78	68.43	68.09	67.76	67.44	67.13
121	-	-	-	69.87	69.49	69.13	68.78	68.44	68.11	67.79	67.48
122	-	-	-	-	69.83	69.47	69.12	68.78	68.46	68.14	67.83
123	-	-	-	-	-	69.81	69.46	69.12	68.80	68.48	68.18
124	-	-	-	-	-	-	69.80	69.46	69.14	68.82	68.52
125	-	-	-	-	-	-	-	69.80	69.47	69.16	68.86
126	-	-	-	-	-	-	-	-	69.80	69.49	69.19
127	-	-	-	-	-	-	-	-	-	69.82	69.52
128	-	-	-	-	-	-	-	-	-	-	69.85

Table 9. Chart denoting mass fraction for differents temperature and pressure intervals (part 4)

	Mass fraction X (%)									
P(kPa) / T (°C)	**15.5**	**16**	**16.5**	**17**	**17.5**	**18**	**18.5**	**19**	**19.5**	**20**
55	5.40	-	-	-	-	-	-	-	-	-
56	11.43	7.68	-	-	-	-	-	-	-	-
57	16.42	13.12	9.70	5.74	-	-	-	-	-	-
58	20.90	17.96	14.85	11.64	8.24	3.76	-	-	-	-
59	24.63	22.20	19.50	16.60	13.57	10.45	7.02	-	-	-
60	27.62	25.66	23.47	21.02	18.35	15.51	12.58	9.53	6.07	-
61	30.05	28.44	26.66	24.69	22.49	20.06	17.43	14.68	11.84	8.86
62	32.07	30.71	29.24	27.63	25.86	23.89	21.70	19.31	16.76	14.10
63	33.80	32.63	31.37	30.03	28.56	26.96	25.20	23.25	21.11	18.78
64	35.33	34.28	33.19	32.03	30.79	29.46	28.01	26.44	24.70	22.80
65	36.68	35.75	34.77	33.75	32.67	31.53	30.32	29.01	27.59	26.05
66	37.92	37.06	36.18	35.26	34.31	33.31	32.26	31.14	29.95	28.67
67	39.05	38.26	37.45	36.62	35.75	34.86	33.93	32.96	31.93	30.85
68	40.09	39.36	38.61	37.84	37.06	36.25	35.41	34.54	33.64	32.69
69	41.07	40.38	39.68	38.97	38.24	37.50	36.74	35.95	35.14	34.30
70	41.98	41.33	40.68	40.01	39.33	38.65	37.94	37.22	36.48	35.73
71	42.85	42.23	41.61	40.98	40.35	39.70	39.05	38.39	37.71	37.01
72	43.67	43.08	42.49	41.90	41.30	40.69	40.08	39.46	38.83	38.19
73	44.45	43.89	43.33	42.76	42.19	41.62	41.04	40.46	39.87	39.27
74	45.20	44.66	44.12	43.58	43.04	42.49	41.95	41.39	40.84	40.27
75	45.92	45.40	44.88	44.36	43.84	43.32	42.80	42.28	41.75	41.22
76	46.61	46.11	45.61	45.11	44.61	44.11	43.61	43.11	42.61	42.11
77	47.28	46.79	46.31	45.83	45.35	44.87	44.39	43.91	43.43	42.95
78	47.92	47.45	46.98	46.52	46.05	45.59	45.13	44.67	44.21	43.75
79	48.55	48.09	47.63	47.18	46.73	46.29	45.84	45.40	44.96	44.51
80	49.15	48.71	48.27	47.83	47.39	46.96	46.53	46.10	45.67	45.25
81	49.74	49.31	48.88	48.45	48.03	47.61	47.19	46.78	46.36	45.95
82	50.32	49.90	49.47	49.06	48.65	48.24	47.83	47.43	47.03	46.63
83	50.88	50.47	50.06	49.65	49.25	48.85	48.45	48.06	47.67	47.29
84	51.43	51.02	50.62	50.22	49.83	49.44	49.06	48.68	48.30	47.92
85	51.97	51.57	51.17	50.79	50.40	50.02	49.64	49.27	48.90	48.54
86	52.49	52.10	51.72	51.33	50.96	50.59	50.22	49.85	49.49	49.14
87	53.01	52.62	52.24	51.87	51.50	51.14	50.78	50.42	50.07	49.72
88	53.52	53.14	52.76	52.40	52.03	51.68	51.32	50.97	50.63	50.29
89	54.01	53.64	53.27	52.91	52.56	52.20	51.86	51.51	51.18	50.84
90	54.50	54.14	53.77	53.42	53.07	52.72	52.38	52.04	51.71	51.38
91	54.98	54.62	54.26	53.91	53.57	53.23	52.89	52.56	52.24	51.91
92	55.46	55.10	54.75	54.40	54.06	53.73	53.40	53.07	52.75	52.43
93	55.93	55.57	55.22	54.88	54.55	54.22	53.89	53.57	53.26	52.95
94	56.39	56.04	55.69	55.36	55.03	54.70	54.38	54.06	53.75	53.45
95	56.84	56.50	56.16	55.82	55.50	55.17	54.86	54.55	54.24	53.94

	Mass fraction X (%)									
P(kPa) / T (°C)	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20
96	57.29	56.95	56.61	56.28	55.96	55.64	55.33	55.02	54.72	54.42
97	57.73	57.39	57.06	56.74	56.42	56.10	55.79	55.49	55.19	54.90
98	58.17	57.84	57.51	57.18	56.87	56.56	56.25	55.95	55.66	55.37
99	58.60	58.27	57.95	57.63	57.31	57.01	56.71	56.41	56.12	55.83
100	59.03	58.70	58.38	58.06	57.75	57.45	57.15	56.86	56.57	56.29
101	59.46	59.13	58.81	58.50	58.19	57.89	57.59	57.30	57.02	56.74
102	59.88	59.55	59.23	58.92	58.62	58.32	58.03	57.74	57.46	57.18
103	60.29	59.97	59.66	59.35	59.05	58.75	58.46	58.17	57.89	57.62
104	60.70	60.38	60.07	59.77	59.47	59.17	58.88	58.60	58.33	58.05
105	61.11	60.79	60.48	60.18	59.88	59.59	59.31	59.03	58.75	58.48
106	61.52	61.20	60.89	60.59	60.30	60.01	59.72	59.45	59.17	58.91
107	61.92	61.60	61.30	61.00	60.70	60.42	60.14	59.86	59.59	59.32
108	62.31	62.00	61.70	61.40	61.11	60.82	60.54	60.27	60.00	59.74
109	62.71	62.40	62.10	61.80	61.51	61.23	60.95	60.68	60.41	60.15
110	63.10	62.79	62.49	62.20	61.91	61.63	61.35	61.08	60.82	60.56
111	63.49	63.18	62.88	62.59	62.30	62.02	61.75	61.48	61.22	60.96
112	63.87	63.56	63.27	62.98	62.69	62.41	62.14	61.88	61.61	61.36
113	64.25	63.95	63.65	63.36	63.08	62.80	62.53	62.27	62.01	61.75
114	64.63	64.33	64.03	63.74	63.46	63.19	62.92	62.66	62.40	62.15
115	65.00	64.70	64.41	64.12	63.84	63.57	63.30	63.04	62.78	62.53
116	65.37	65.07	64.78	64.50	64.22	63.95	63.68	63.42	63.17	62.92
117	65.74	65.44	65.15	64.87	64.59	64.32	64.06	63.80	63.55	63.30
118	66.11	65.81	65.52	65.24	64.96	64.69	64.43	64.17	63.92	63.68
119	66.47	66.17	65.89	65.60	65.33	65.06	64.80	64.55	64.30	64.05
120	66.83	66.53	66.25	65.97	65.69	65.43	65.17	64.91	64.67	64.42
121	67.18	66.89	66.60	66.33	66.05	65.79	65.53	65.28	65.03	64.79
122	67.53	67.24	66.96	66.68	66.41	66.15	65.89	65.64	65.39	65.15
123	67.88	67.59	67.31	67.03	66.77	66.50	66.25	66.00	65.75	65.51
124	68.22	67.94	67.66	67.38	67.12	66.85	66.60	66.35	66.11	65.87
125	68.56	68.28	68.00	67.73	67.46	67.20	66.95	66.70	66.46	66.22
126	68.90	68.61	68.34	68.07	67.80	67.55	67.29	67.05	66.81	66.57
127	69.23	68.95	68.67	68.40	68.14	67.89	67.64	67.39	67.15	66.92
128	69.56	69.28	69.00	68.74	68.48	68.22	67.97	67.73	67.49	67.26
129	69.88	69.60	69.33	69.07	68.81	68.56	68.31	68.07	67.83	67.60
130	-	69.93	69.66	69.39	69.14	68.88	68.64	68.40	68.16	67.93
131	-	-	69.97	69.71	69.46	69.21	68.96	68.73	68.49	68.26
132	-	-	-	-	69.78	69.53	69.29	69.05	68.82	68.59
133	-	-	-	-	-	69.84	69.60	69.37	69.14	68.91
134	-	-	-	-	-	-	69.92	69.68	69.46	69.23
135	-	-	-	-	-	-	-	69.99	69.77	69.55
136	-	-	-	-	-	-	-	-	-	69.86

Table 10. Chart denoting enthalpy for differents temperature and pressure intervals (part 1)

	Enthalpy h (kJ/kg)										
P(kPa) / T (°C)	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**
40	58.894	36.683	26.148	19.507	14.788	11.206	8.376	6.083	4.201	2.656	1.424
41	64.375	40.321	28.970	21.822	16.743	12.884	9.830	7.347	5.297	3.594	2.195
42	70.262	44.226	32.007	24.323	18.863	14.713	11.422	8.741	6.517	4.655	3.100
43	76.583	48.412	35.271	27.020	21.157	16.699	13.160	10.271	7.867	5.843	4.133
44	83.366	52.895	38.774	29.921	23.635	18.852	15.052	11.945	9.352	7.161	5.297
45	90.645	57.690	42.527	33.039	26.304	21.180	17.106	13.769	10.981	8.616	6.593
46	98.456	62.815	46.544	36.383	29.176	23.692	19.329	15.753	12.758	10.213	8.028
47	106.837	68.287	50.838	39.966	32.260	26.397	21.731	17.902	14.693	11.959	9.605
48	115.834	74.126	55.423	43.799	35.567	29.305	24.319	20.227	16.792	13.862	11.332
49	125.495	80.353	60.315	47.895	39.108	32.425	27.104	22.734	19.063	15.927	13.216
50	135.879	86.987	65.529	52.266	42.893	35.768	30.095	25.434	21.515	18.165	15.263
51	147.049	94.053	71.080	56.925	46.936	39.345	33.302	28.335	24.157	20.581	17.481
52	159.082	101.574	76.986	61.888	51.247	43.166	36.734	31.446	26.996	23.185	19.878
53	172.066	109.576	83.266	67.168	55.840	47.244	40.403	34.778	30.043	25.986	22.462
54	186.108	118.086	89.937	72.781	60.728	51.589	44.318	38.341	33.308	28.993	25.242
55	-	127.135	97.019	78.742	65.925	56.215	48.493	42.145	36.799	32.214	28.227
56	-	136.755	104.534	85.069	71.446	61.134	52.938	46.201	40.527	35.660	31.425
57	-	146.978	112.503	91.778	77.304	66.360	57.666	50.521	44.503	39.341	34.847
58	-	157.843	120.950	98.889	83.516	71.906	62.689	55.116	48.739	43.267	38.502
59	-	169.390	129.899	106.420	90.098	77.788	68.020	59.999	53.244	47.448	42.401
60	-	181.662	139.377	114.391	97.067	84.019	73.674	65.182	58.032	51.897	46.554
61	-	194.708	149.410	122.823	104.441	90.616	79.664	70.678	63.114	56.624	50.971
62	-	208.581	160.028	131.739	112.239	97.595	86.005	76.501	68.504	61.642	55.666
63	-	223.338	171.263	141.162	120.478	104.972	92.713	82.665	74.213	66.963	60.648
64	-	239.046	183.147	151.116	129.181	112.767	99.803	89.185	80.257	72.600	65.930
65	-	255.777	195.715	161.626	138.367	120.996	107.292	96.075	86.648	78.565	71.526
66	-	273.613	209.007	172.720	148.060	129.679	115.196	103.352	93.402	84.874	77.447
67	-	292.649	223.062	184.427	158.281	138.836	123.535	111.032	100.534	91.539	83.708
68	-	-	237.923	196.776	169.056	148.488	132.327	119.132	108.060	98.576	90.322
69	-	-	253.639	209.799	180.410	158.657	141.590	127.669	115.995	106.000	97.304
70	-	-	270.258	223.530	192.368	169.365	151.345	136.662	124.357	113.827	104.668

Enthalpy h (kJ/kg)											
P(kPa) / T (°C)	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
71	-	-	287.838	238.005	204.960	180.636	161.613	146.129	133.164	122.074	112.430
72	-	-	306.436	253.260	218.214	192.494	172.415	156.091	142.433	130.756	120.607
73	-	-	326.119	269.337	232.161	204.966	183.775	166.568	152.183	139.892	129.213
74	-	-	346.958	286.276	246.833	218.078	195.716	177.581	162.434	149.500	138.268
75	-	-	-	304.124	262.264	231.857	208.261	189.152	173.206	159.599	147.788
76	-	-	-	322.928	278.488	246.334	221.438	201.304	184.520	170.208	157.791
77	-	-	-	342.740	295.545	261.539	235.271	214.061	196.397	181.348	168.297
78	-	-	-	363.614	313.471	277.503	249.789	227.447	208.861	193.038	179.325
79	-	-	-	385.608	332.309	294.259	265.020	241.487	221.934	205.301	190.895
80	-	-	-	408.784	352.102	311.843	280.993	256.209	235.641	218.159	203.029
81	-	-	-	-	372.895	330.290	297.740	271.639	250.005	231.635	215.746
82	-	-	-	-	394.735	349.638	315.292	287.805	265.054	245.753	229.071
83	-	-	-	-	417.673	369.925	333.682	304.737	280.812	260.537	243.025
84	-	-	-	-	441.760	391.193	352.945	322.465	297.309	276.011	257.631
85	-	-	-	-	467.053	413.482	373.115	341.020	314.570	292.203	272.916
86	-	-	-	-	-	436.838	394.230	360.434	332.627	309.139	288.902
87	-	-	-	-	-	461.304	416.325	380.739	351.508	326.846	305.615
88	-	-	-	-	-	486.928	439.442	401.970	371.243	345.351	323.083
89	-	-	-	-	-	513.758	463.617	424.160	391.865	364.685	341.331
90	-	-	-	-	-	-	488.893	447.346	413.404	384.875	360.386
91	-	-	-	-	-	-	515.310	471.563	435.892	405.953	380.278
92	-	-	-	-	-	-	542.910	496.847	459.364	427.947	401.033
93	-	-	-	-	-	-	-	523.236	483.852	450.889	422.680
94	-	-	-	-	-	-	-	550.765	509.389	474.810	445.250
95	-	-	-	-	-	-	-	579.473	536.009	499.740	468.770
96	-	-	-	-	-	-	-	-	563.745	525.711	493.270
97	-	-	-	-	-	-	-	-	592.631	552.754	518.780
98	-	-	-	-	-	-	-	-	622.699	580.900	545.328
99	-	-	-	-	-	-	-	-	-	610.178	572.944
100	-	-	-	-	-	-	-	-	-	640.617	601.655
101	-	-	-	-	-	-	-	-	-	-	631.488
102	-	-	-	-	-	-	-	-	-	-	662.471
103	-	-	-	-	-	-	-	-	-	-	694.627

Table 11. Chart denoting enthalpy for differents temperature and pressure intervals (part 2)

	Enthalpy h (kJ/kg)								
P(pKa) / T (°C)	6	6.5	7	7.5	8	8.5	9	9.5	10
40	0.543	0.108	0.008	-	-	-	-	-	-
41	1.099	0.368	0.062	0.003	-	-	-	-	-
42	1.825	0.852	0.255	0.039	0.001	-	-	-	-
43	2.700	1.534	0.672	0.185	0.026	0.001	-	-	-
44	3.711	2.381	1.311	0.545	0.142	0.019	0.000	-	-
45	4.858	3.376	2.133	1.145	0.460	0.117	0.016	0.000	-
46	6.141	4.511	3.115	1.947	1.028	0.406	0.104	0.014	0.000
47	7.564	5.787	4.246	2.922	1.816	0.952	0.376	0.099	0.015
48	9.131	7.207	5.521	4.052	2.788	1.733	0.911	0.367	0.101
49	10.850	8.773	6.944	5.334	3.925	2.709	1.693	0.903	0.375
50	12.726	10.492	8.516	6.766	5.218	3.858	2.681	1.695	0.924
51	14.766	12.370	10.244	8.351	6.666	5.169	3.848	2.701	1.736
52	16.977	14.413	12.132	10.094	8.271	6.639	5.183	3.893	2.767
53	19.368	16.628	14.187	12.000	10.036	8.270	6.681	5.257	3.990
54	21.946	19.024	16.416	14.076	11.968	10.064	8.343	6.789	5.390
55	24.720	21.608	18.827	16.327	14.070	12.027	10.172	8.489	6.962
56	27.698	24.388	21.427	18.762	16.351	14.164	12.173	10.359	8.705
57	30.890	27.374	24.225	21.387	18.818	16.482	14.352	12.404	10.622
58	34.305	30.573	27.229	24.212	21.478	18.988	16.714	14.630	12.718
59	37.953	33.996	30.448	27.245	24.339	21.690	19.266	17.042	14.997
60	41.844	37.652	33.891	30.495	27.410	24.596	22.018	19.649	17.466
61	45.988	41.551	37.568	33.970	30.700	27.713	24.975	22.456	20.132
62	50.396	45.703	41.489	37.680	34.217	31.052	28.147	25.473	23.002
63	55.079	50.119	45.665	41.636	37.971	34.620	31.543	28.707	26.085
64	60.049	54.810	50.104	45.847	41.972	38.428	35.171	32.168	29.389
65	65.318	59.788	54.820	50.324	46.231	42.485	39.042	35.864	32.922
66	70.899	65.065	59.822	55.078	50.757	46.802	43.164	39.806	36.695
67	76.803	70.652	65.124	60.120	55.562	51.388	47.549	44.002	40.715
68	83.045	76.562	70.736	65.461	60.657	56.256	52.206	48.464	44.994
69	89.638	82.809	76.672	71.115	66.053	61.415	57.146	53.201	49.541
70	96.596	89.405	82.944	77.093	71.762	66.878	62.381	58.224	54.367
71	103.933	96.366	89.566	83.409	77.798	72.657	67.923	63.546	59.483

Enthalpy h (kJ/kg)									
P(pKa) / T (°C)	6	6.5	7	7.5	8	8.5	9	9.5	10
72	111.666	103.705	96.551	90.075	84.173	78.764	73.783	69.177	64.900
73	119.809	111.437	103.915	97.105	90.899	85.212	79.974	75.129	70.631
74	128.380	119.578	111.672	104.514	97.991	92.014	86.508	81.415	76.686
75	137.393	128.144	119.836	112.316	105.464	99.184	93.399	88.048	83.078
76	146.868	137.150	128.424	120.526	113.330	106.735	100.661	95.041	89.821
77	156.822	146.615	137.452	129.161	121.606	114.683	108.307	102.407	96.927
78	167.272	156.556	146.937	138.235	130.307	123.043	116.352	110.161	104.411
79	178.239	166.990	156.897	147.766	139.449	131.829	124.810	118.317	112.285
80	189.742	177.937	167.348	157.770	149.048	141.058	133.698	126.890	120.566
81	201.801	189.416	178.309	168.267	159.122	150.745	143.032	135.896	129.267
82	214.437	201.446	189.800	179.272	169.688	160.909	152.826	145.349	138.404
83	227.672	214.049	201.840	190.806	180.763	171.567	163.099	155.267	147.993
84	241.527	227.244	214.448	202.887	192.367	182.735	173.868	165.667	158.050
85	256.027	241.055	227.647	215.536	204.519	194.433	185.150	176.565	168.592
86	271.193	255.502	241.455	228.773	217.237	206.679	196.963	187.979	179.636
87	287.050	270.609	255.897	242.618	230.543	219.494	209.327	199.928	191.200
88	303.623	286.399	270.993	257.092	244.456	232.896	222.261	212.430	203.302
89	320.937	302.896	286.767	272.219	258.998	246.906	235.784	225.504	215.961
90	339.017	320.125	303.242	288.020	274.191	261.545	249.916	239.169	229.195
91	357.891	338.110	320.442	304.518	290.056	276.834	264.679	253.447	243.024
92	377.584	356.877	338.391	321.737	306.615	292.796	280.092	268.357	257.468
93	398.123	376.452	357.115	339.699	323.893	309.451	296.179	283.921	272.548
94	419.537	396.861	376.637	358.431	341.912	326.823	312.960	300.158	288.283
95	441.853	418.130	396.983	377.955	360.696	344.935	330.459	317.092	304.696
96	465.099	440.286	418.180	398.297	380.268	363.810	348.696	334.745	321.808
97	489.302	463.357	440.253	419.481	400.654	383.472	367.697	353.138	339.640
98	514.491	487.367	463.227	441.533	421.877	403.943	387.482	372.294	358.214
99	540.694	512.346	487.130	464.478	443.962	425.249	408.077	392.235	377.553
100	567.936	538.318	511.985	488.341	466.933	447.413	429.504	412.986	397.680
101	596.246	565.310	537.820	513.146	490.815	470.458	451.786	434.568	418.616
102	625.649	593.347	564.658	538.919	515.632	494.409	474.948	457.005	440.385
103	656.170	622.454	592.524	565.684	541.407	519.289	499.011	480.320	463.008
104	687.832	652.654	621.442	593.463	568.164	545.120	524.000	504.534	486.509
105	720.657	683.970	651.435	622.280	595.925	571.927	549.935	529.671	510.909

Enthalpy h (kJ/kg)									
P(pKa) / T (°C)	6	6.5	7	7.5	8	8.5	9	9.5	10
106	-	716.424	682.523	652.156	624.713	599.730	576.840	555.753	536.231
107	-	750.033	714.727	683.111	654.548	628.551	604.736	582.800	562.494
108	-	-	748.065	715.166	685.450	658.409	633.643	610.832	589.721
109	-	-	-	748.336	717.437	689.324	663.579	639.871	617.931
110	-	-	-	782.638	750.526	721.313	694.564	669.934	647.143
111	-	-	-	-	784.731	754.392	726.615	701.039	677.374
112	-	-	-	-	820.066	788.575	759.745	733.202	708.642
113	-	-	-	-	-	823.873	793.968	766.436	740.962
114	-	-	-	-	-	-	829.297	800.756	774.348
115	-	-	-	-	-	-	865.739	836.170	808.811
116	-	-	-	-	-	-	-	872.689	844.361
117	-	-	-	-	-	-	-	-	881.006

Table 12. Chart denoting enthalpy for differents temperature and pressure intervals (part 3)

Enthalpy h (kJ/kg)											
P(kPa) / T (°C)	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15
46	0.0001	-	-	-	-	-	-	-	-	-	-
47	0.015	0.0001	-	-	-	-	-	-	-	-	-
48	0.101	0.017	0.001	-	-	-	-	-	-	-	-
49	0.375	0.111	0.020	0.001	-	-	-	-	-	-	-
50	0.924	0.401	0.127	0.027	0.002	-	-	-	-	-	-
51	1.736	0.974	0.445	0.154	0.037	0.004	-	-	-	-	-
52	2.767	1.814	1.053	0.509	0.192	0.053	0.009	0.0001	-	-	-
53	3.990	2.880	1.932	1.163	0.597	0.247	0.077	0.016	0.001	-	-
54	5.390	4.140	3.038	2.089	1.307	0.713	0.322	0.115	0.029	0.004	-
55	6.962	5.582	4.343	3.244	2.288	1.488	0.862	0.425	0.170	0.052	0.010
56	8.705	7.199	5.832	4.599	3.498	2.532	1.710	1.047	0.560	0.251	0.090
57	10.622	8.992	7.501	6.142	4.909	3.802	2.822	1.976	1.275	0.736	0.366
58	12.718	10.961	9.348	7.867	6.511	5.276	4.159	3.162	2.289	1.550	0.958
59	14.997	13.113	11.375	9.774	8.298	6.942	5.701	4.572	3.555	2.655	1.877
60	17.466	15.451	13.588	11.865	10.271	8.797	7.437	6.187	5.043	4.005	3.076
61	20.132	17.983	15.992	14.145	12.431	10.840	9.365	7.998	6.736	5.575	4.515

	Enthalpy h (kJ/kg)										
P(kPa) / T (°C)	**10**	**10.5**	**11**	**11.5**	**12**	**12.5**	**13**	**13.5**	**14**	**14.5**	**15**
62	23.002	20.715	18.592	16.619	14.784	13.075	11.484	10.003	8.627	7.351	6.172
63	26.085	23.654	21.396	19.294	17.334	15.506	13.798	12.204	10.716	9.328	8.035
64	29.389	26.810	24.412	22.176	20.089	18.138	16.312	14.603	13.002	11.504	10.102
65	32.922	30.190	27.647	25.273	23.055	20.978	19.032	17.206	15.492	13.882	12.371
66	36.695	33.803	31.110	28.594	26.240	24.034	21.964	20.018	18.189	16.467	14.846
67	40.715	37.659	34.809	32.146	29.653	27.313	25.115	23.047	21.099	19.263	17.531
68	44.994	41.766	38.755	35.940	33.301	30.824	28.494	26.299	24.230	22.277	20.431
69	49.541	46.135	42.957	39.983	37.194	34.574	32.108	29.783	27.589	25.515	23.554
70	54.367	50.776	47.424	44.285	41.341	38.574	35.967	33.508	31.184	28.987	26.906
71	59.483	55.700	52.167	48.858	45.753	42.832	40.079	37.481	35.025	32.700	30.496
72	64.900	60.917	57.196	53.711	50.438	47.358	44.455	41.712	39.119	36.662	34.331
73	70.631	66.440	62.523	58.854	55.408	52.163	49.103	46.212	43.476	40.882	38.421
74	76.686	72.279	68.160	64.299	60.673	57.258	54.035	50.989	48.106	45.371	42.775
75	83.078	78.447	74.117	70.058	66.244	62.652	59.261	56.055	53.019	50.138	47.402
76	89.821	84.956	80.407	76.143	72.134	68.358	64.793	61.420	58.226	55.194	52.313
77	96.927	91.819	87.043	82.564	78.354	74.387	70.640	67.096	63.737	60.548	57.517
78	104.411	99.050	94.038	89.336	84.916	80.750	76.816	73.093	69.564	66.213	63.026
79	112.285	106.662	101.404	96.472	91.834	87.462	83.332	79.424	75.718	72.198	68.851
80	120.566	114.670	109.156	103.983	99.119	94.534	90.201	86.101	82.212	78.517	75.003
81	129.267	123.087	117.307	111.886	106.786	101.979	97.436	93.136	89.057	85.181	81.494
82	138.404	131.929	125.873	120.192	114.849	109.811	105.050	100.543	96.267	92.203	88.336
83	147.993	141.212	134.869	128.919	123.322	118.044	113.057	108.334	103.854	99.596	95.543
84	158.050	150.950	144.309	138.079	132.219	126.693	121.471	116.525	111.832	107.372	103.126
85	168.592	161.161	154.210	147.689	141.556	135.772	130.305	125.128	120.215	115.546	111.100
86	179.636	171.860	164.588	157.765	151.348	145.296	139.576	134.159	129.018	124.131	119.478
87	191.200	183.066	175.459	168.324	161.611	155.282	149.299	143.632	138.255	133.142	128.274
88	203.302	194.796	186.842	179.381	172.362	165.744	159.489	153.563	147.940	142.594	137.503
89	215.961	207.068	198.753	190.954	183.618	176.700	170.162	163.968	158.090	152.502	147.180
90	229.195	219.901	211.211	203.061	195.396	188.167	181.335	174.863	168.721	162.881	157.320
91	243.024	233.313	224.235	215.720	207.712	200.161	193.025	186.265	179.849	173.748	167.938
92	257.468	247.325	237.842	228.950	220.587	212.701	205.249	198.189	191.490	185.119	179.052
93	272.548	261.955	252.053	242.769	234.038	225.805	218.025	210.655	203.661	197.011	190.677
94	288.283	277.224	266.888	257.196	248.083	239.491	231.371	223.680	216.381	209.441	202.831
95	304.696	293.153	282.366	272.252	262.743	253.778	245.306	237.282	229.667	222.427	215.531

	Enthalpy h (kJ/kg)										
P(kPa) / T (°C)	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15
96	321.808	309.763	298.508	287.957	278.037	268.686	259.849	251.480	243.537	235.986	228.793
97	339.640	327.074	315.334	304.330	293.985	284.233	275.019	266.292	258.011	250.137	242.638
98	358.214	345.109	332.867	321.393	310.607	300.441	290.835	281.738	273.106	264.898	257.082
99	377.553	363.890	351.127	339.167	327.924	317.329	307.318	297.838	288.842	280.289	272.144
100	397.680	383.438	370.136	357.672	345.957	334.917	324.487	314.610	305.239	296.329	287.844
101	418.616	403.775	389.916	376.931	364.727	353.227	342.363	332.077	322.316	313.038	304.201
102	440.385	424.924	410.488	396.964	384.255	372.280	360.967	350.257	340.095	330.434	321.234
103	463.008	446.907	431.875	417.794	404.562	392.096	380.320	369.171	358.594	348.538	338.963
104	486.509	469.746	454.098	439.441	425.670	412.696	400.442	388.840	377.834	367.371	357.408
105	510.909	493.463	477.180	461.928	447.601	434.103	421.354	409.285	397.836	386.953	376.589
106	536.231	518.080	501.140	485.276	470.374	456.335	443.077	430.526	418.620	407.303	396.526
107	562.494	543.618	526.002	509.506	494.012	479.416	465.632	452.584	440.207	428.442	417.240
108	589.721	570.097	551.785	534.639	518.534	503.365	489.039	475.480	462.617	450.391	438.750
109	617.931	597.538	578.510	560.695	543.962	528.202	513.319	499.233	485.870	473.170	461.076
110	647.143	625.960	606.197	587.693	570.315	553.947	538.492	523.863	509.986	496.798	484.239
111	677.374	655.381	634.863	615.653	597.612	580.621	564.576	549.390	534.985	521.294	508.258
112	708.642	685.819	664.527	644.593	625.872	608.240	591.591	575.833	560.886	546.679	533.151
113	740.962	717.290	695.205	674.529	655.111	636.823	619.555	603.210	587.706	572.970	558.939
114	774.348	749.807	726.912	705.477	685.347	666.388	648.485	631.539	615.465	600.186	585.638
115	808.811	783.385	759.663	737.453	716.595	696.948	678.396	660.836	644.178	628.344	613.266
116	844.361	818.033	793.469	770.469	748.867	728.520	709.305	691.117	673.862	657.460	641.840
117	881.006	853.762	828.341	804.537	782.178	761.116	741.225	722.395	704.531	687.549	671.376
118	-	890.578	864.286	839.665	816.537	794.748	774.168	754.685	736.200	718.626	701.889
119	-	928.486	901.313	875.863	851.952	829.425	808.145	787.998	768.880	750.704	733.391
120	-	-	939.423	913.134	888.432	865.155	843.166	822.343	802.583	783.793	765.895
121	-	-	-	951.483	925.980	901.945	879.236	857.729	837.316	817.905	799.412
122	-	-	-	-	964.599	939.798	916.361	894.162	873.089	853.047	833.950
123	-	-	-	-	-	978.717	954.545	931.646	909.906	889.226	869.518
124	-	-	-	-	-	-	993.788	970.184	947.770	926.446	906.120
125	-	-	-	-	-	-	-	1009.775	986.684	964.709	943.761
126	-	-	-	-	-	-	-	-	1026.645	1004.017	982.442
127	-	-	-	-	-	-	-	-	-	1044.367	1022.162
128	-	-	-	-	-	-	-	-	-	-	1062.919

Table 13. Chart denoting enthalpy for differents temperature and pressure intervals (part 4)

	Enthalpy h (kJ/kg)									
P(pKa) / T (°C)	**15.5**	**16**	**16.5**	**17**	**17.5**	**18**	**18.5**	**19**	**19.5**	**20**
55	0.001	-	-	-	-	-	-	-	-	-
56	0.024	0.003	-	-	-	-	-	-	-	-
57	0.151	0.049	0.011	0.001	-	-	-	-	-	-
58	0.524	0.245	0.095	0.028	0.005	0.0001	-	-	-	-
59	1.232	0.733	0.383	0.171	0.063	0.017	0.002	-	-	-
60	2.259	1.564	1.000	0.577	0.292	0.126	0.044	0.011	0.001	-
61	3.556	2.701	1.957	1.332	0.835	0.471	0.234	0.099	0.034	0.008
62	5.088	4.099	3.207	2.416	1.733	1.166	0.722	0.403	0.198	0.084
63	6.836	5.727	4.708	3.779	2.944	2.207	1.574	1.053	0.649	0.362
64	8.792	7.571	6.436	5.387	4.423	3.545	2.757	2.064	1.471	0.984
65	10.953	9.624	8.380	7.219	6.139	5.140	4.222	3.386	2.637	1.977
66	13.320	11.884	10.535	9.267	8.079	6.969	5.935	4.977	4.097	3.295
67	15.896	14.354	12.899	11.527	10.235	9.019	7.878	6.810	5.815	4.891
68	18.687	17.037	15.477	14.001	12.606	11.288	10.044	8.872	7.770	6.737
69	21.697	19.938	18.271	16.691	15.193	13.774	12.429	11.157	9.953	8.818
70	24.934	23.063	21.288	19.602	18.001	16.479	15.035	13.663	12.361	11.126
71	28.405	26.420	24.534	22.740	21.033	19.409	17.864	16.392	14.992	13.660
72	32.119	30.016	28.015	26.111	24.297	22.569	20.921	19.349	17.851	16.422
73	36.083	33.858	31.741	29.723	27.800	25.964	24.212	22.539	20.941	19.414
74	40.306	37.957	35.719	33.585	31.548	29.603	27.744	25.967	24.268	22.642
75	44.799	42.321	39.958	37.704	35.551	33.493	31.525	29.642	27.839	26.112
76	49.571	46.959	44.468	42.089	39.816	37.643	35.562	33.570	31.661	29.830
77	54.631	51.881	49.257	46.751	44.354	42.061	39.865	37.760	35.742	33.806
78	59.992	57.098	54.337	51.698	49.174	46.757	44.442	42.222	40.091	38.046
79	65.662	62.621	59.717	56.941	54.285	51.741	49.303	46.963	44.717	42.560
80	71.654	68.460	65.409	62.491	59.699	57.023	54.457	51.995	49.630	47.356
81	77.980	74.627	71.423	68.359	65.425	62.614	59.916	57.327	54.838	52.446
82	84.651	81.133	77.771	74.556	71.476	68.523	65.690	62.969	60.353	57.838
83	91.679	87.991	84.466	81.093	77.862	74.764	71.790	68.933	66.186	63.543
84	99.078	95.213	91.519	87.983	84.595	81.346	78.227	75.229	72.347	69.572
85	106.861	102.813	98.943	95.239	91.689	88.283	85.013	81.871	78.847	75.937
86	115.040	110.803	106.751	102.872	99.154	95.587	92.161	88.868	85.700	82.648

Enthalpy h (kJ/kg)										
P(pKa) / T (°C)	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20
87	123.631	119.197	114.957	110.897	107.005	103.271	99.684	96.235	92.916	89.719
88	132.647	128.009	123.574	119.327	115.255	111.347	107.593	103.983	100.508	97.161
89	142.103	137.254	132.617	128.175	123.917	119.829	115.902	112.125	108.490	104.987
90	152.015	146.947	142.099	137.457	133.005	128.732	124.626	120.676	116.874	113.211
91	162.396	157.102	152.037	147.186	142.535	138.069	133.778	129.649	125.675	121.845
92	173.264	167.735	162.446	157.379	152.520	147.855	143.372	139.059	134.906	130.903
93	184.635	178.863	173.340	168.050	162.977	158.106	153.424	148.919	144.582	140.401
94	196.525	190.501	184.737	179.216	173.920	168.835	163.948	159.246	154.717	150.351
95	208.952	202.666	196.653	190.892	185.366	180.061	174.961	170.053	165.327	160.771
96	221.932	215.376	209.104	203.095	197.332	191.798	186.477	181.358	176.427	171.673
97	235.483	228.648	222.108	215.843	209.834	204.063	198.515	193.176	188.033	183.075
98	249.624	242.500	235.683	229.152	222.888	216.872	211.089	205.523	200.162	194.993
99	264.373	256.949	249.846	243.041	236.513	230.244	224.217	218.417	212.830	207.442
100	279.749	272.015	264.616	257.527	250.727	244.196	237.917	231.875	226.053	220.440
101	295.771	287.717	280.011	272.628	265.547	258.745	252.206	245.913	239.850	234.004
102	312.457	304.072	296.050	288.364	280.991	273.910	267.102	260.550	254.237	248.150
103	329.828	321.102	312.752	304.753	297.079	289.709	282.624	275.804	269.233	262.897
104	347.904	338.824	330.136	321.813	313.829	306.161	298.789	291.693	284.856	278.263
105	366.703	357.259	348.222	339.565	331.261	323.285	315.616	308.235	301.124	294.265
106	386.247	376.426	367.030	358.028	349.393	341.100	333.125	325.450	318.055	310.923
107	406.554	396.346	386.579	377.221	368.245	359.624	351.335	343.356	335.668	328.254
108	427.646	417.038	406.888	397.165	387.837	378.878	370.264	361.972	353.983	346.278
109	449.541	438.521	427.978	417.877	408.187	398.881	389.932	381.318	373.018	365.014
110	472.261	460.817	449.868	439.379	429.316	419.651	410.358	401.413	392.793	384.480
111	495.823	483.944	472.578	461.689	451.243	441.209	431.562	422.275	413.326	404.695
112	520.248	507.921	496.127	484.827	473.986	463.574	453.562	443.923	434.636	425.678
113	545.554	532.767	520.533	508.811	497.566	486.764	476.377	466.378	456.743	447.449
114	571.760	558.502	545.816	533.661	521.999	510.798	500.027	489.657	479.664	470.025
115	598.883	585.141	571.992	559.393	547.306	535.695	524.529	513.779	503.419	493.426
116	626.940	612.703	599.081	586.027	573.503	561.471	549.901	538.761	528.025	517.669
117	655.947	641.205	627.097	613.578	600.607	588.146	576.161	564.622	553.501	542.773
118	685.920	670.661	656.058	642.063	628.635	615.734	603.325	591.378	579.863	568.753
119	716.872	701.085	685.977	671.497	657.602	644.252	631.411	619.046	607.127	595.628
120	748.816	732.492	716.869	701.894	687.523	673.715	660.432	647.640	635.310	623.413

Enthalpy h (kJ/kg)										
P(pKa) / T (°C)	**15.5**	**16**	**16.5**	**17**	**17.5**	**18**	**18.5**	**19**	**19.5**	**20**
121	781.763	764.894	748.746	733.267	718.412	704.136	690.403	677.177	664.426	652.123
122	815.723	798.300	781.619	765.629	750.280	735.529	721.337	707.668	694.490	681.772
123	850.705	832.719	815.499	798.988	783.138	767.905	753.247	739.127	725.514	712.375
124	886.715	868.160	850.393	833.355	816.997	801.274	786.142	771.566	757.510	743.942
125	923.758	904.628	886.307	868.736	851.865	835.645	820.034	804.993	790.488	776.486
126	961.837	942.127	923.247	905.138	887.746	871.024	854.928	839.418	824.458	810.015
127	1000.951	980.658	961.215	942.563	924.648	907.419	890.832	874.847	859.427	844.538
128	1041.100	1020.220	1000.212	981.014	962.571	944.831	927.750	911.286	895.401	880.062
129	1082.279	1060.813	1040.237	1020.491	1001.516	983.263	965.684	948.737	932.385	916.590
130	-	1102.430	1081.286	1060.990	1041.484	1022.715	1004.636	987.204	970.380	954.128
131	-	-	1123.354	1102.508	1082.469	1063.184	1044.603	1026.685	1009.388	992.676
132	-	-	-	-	1124.468	1104.666	1085.584	1067.178	1049.407	1032.233
133	-	-	-	-	-	1147.155	1127.572	1108.679	1090.433	1072.798
134	-	-	-	-	-	-	1170.560	1151.181	1132.462	1114.366
135	-	-	-	-	-	-	-	1194.676	1175.486	1156.930
136	-	-	-	-	-	-	-	-	-	1200.483

5. CONCLUSION

The thermodynamic properties of lithium bromide are important in the designing of absorption refrigeration systems. Several authors have proposed correlations and there are empirical formulas making it possible to find these properties at thermodynamic equilibrium, but no charts or diagrams where the characteristics of LiBr can be read directly as a function of thermal conditions. This work makes a contribution in this direction and is very useful for industries manufacturing and researchers. The diagrams and charts proposed in this paper offer fairly satisfactory results because they agree with those of many authors who have already worked in this field.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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