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TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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No. 276

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HELIUM TABLES

By Lieut. Comdr. Clinton H. Havill, U.S.N.

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Washington  
January, 1928



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

TECHNICAL NOTE NO. 276.

HELIUM TABLES.

By Lieut. Comdr. Clinton H. Havill, U.S.N.

PART I.

These tables were prepared at the request of the U.S. Naval Air Station, Lakehurst, New Jersey, and the naval representative at the U. S. Helium Production Plant at Fort Worth, Texas.

These tables are intended to provide a standard method and to facilitate the calculation of the quantity of "Standard Helium" in high pressure containers (See example at end of Table IV). The research data and the formulas used in the preparation of the tables were furnished by the Research Laboratory of Physical Chemistry, of the Massachusetts Institute of Technology.

It is to be noted that the nitrogen impurity referred to in the tables (Part I) is not atmospheric nitrogen, which usually means a mixture of nitrogen, argon, and the other inert gases of the atmosphere, but pure nitrogen, containing no argon or other inert gases, as is produced in the separation of helium from the natural gas. This nitrogen impurity is more compressible than the helium for pressures higher than atmospheric and expands more than helium for partial pressures below atmospheric.

If it is desired to find the free volume (1 atmosphere pressure and 70° F.) of a mixture of helium and nitrogen, the following formula gives a very close approximation.

$$\frac{\text{Standard Helium in mixture calculated for Tables III and IV}}{\text{Value in Table IV for (O) gauge and purity}} =$$

Number of cubic feet of mixture at 70° F., 0 (gauge).

The author is responsible for the numerical calculations and he will appreciate information as to any errors which may be found so that they may be corrected.

# HELIUM TABLES

COMPUTED BY CLINTON H. HAVILL

FROM

EQUATION FURNISHED BY DR. FREDERICK G. KEYES, PROF. J. A. BEATTIE AND DR. O. C. BRIDGEMAN

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY  
OF  
MASS. INSTITUTE OF TECHNOLOGY

EQUATION OF STATE AS FURNISHED FOR PURE, DRY HELIUM

$$P = \frac{20.515 T \left(1 - \frac{10,000}{vT^3}\right) (v + 3.5)}{v^2} - \frac{1350 \left(1 - \frac{14.96}{v}\right)}{v^2}$$

WHERE, - P = PRESSURE, ATMOSPHERES ABSOLUTE  
T = TEMPERATURE, DEGREES CENTIGRADE ABSOLUTE  
v = VOLUME PER WEIGHT IN CC/GR

CONVERSION FACTORS USED:-

1 ATMOSPHERE = 14.7 LB./SQ. IN.  
CC/GR. x .016017 = CU. FT./LB.  
T° C ABS. x 1.8 = T° F ABS.

ABSOLUTE ZERO C = -273.13°  
" " F = -459.63°

## TABLE I

VALUES IN TABLE =  $\left(\frac{Pv}{T}\right)$   
WHERE, - P = LB./SQ. FT. ABSOLUTE  
v = CU. FT./LB.  
T = TEMPERATURE DEGREES FAHRENHEIT ABSOLUTE

PRESSURE - LB./SQ. IN. ABSOLUTE	PRESSURE LB./SQ. IN. GAUGE	TEMPERATURE DEGREES F ABSOLUTE											
		479.63	489.63	499.63	509.63	519.63	529.63	539.63	549.63	559.63	569.63	579.63	589.63
		TEMPERATURE DEGREES F											
		20° F	30° F	40° F	50° F	60° F	70° F	80° F	90° F	100° F	110° F	120° F	130° F
14.7	0	386.360	386.356	386.353	386.349	386.345	386.342	386.338	386.335	386.331	386.327	386.324	386.320
114.7	100	387.725	387.721	387.718	387.714	387.710	387.707	387.703	387.700	387.696	387.692	387.689	387.685
214.7	200	389.250	389.249	389.249	389.249	389.249	389.249	389.249	389.249	389.249	389.249	389.249	389.249
314.7	300	390.775	390.771	390.769	390.767	390.765	390.763	390.761	390.759	390.757	390.755	390.753	390.751
414.7	400	392.301	392.297	392.295	392.293	392.291	392.289	392.287	392.285	392.283	392.281	392.279	392.277
514.7	500	393.826	393.822	393.820	393.818	393.816	393.814	393.812	393.810	393.808	393.806	393.804	393.802
614.7	600	395.351	395.347	395.345	395.343	395.341	395.339	395.337	395.335	395.333	395.331	395.329	395.327
714.7	700	396.876	396.872	396.870	396.868	396.866	396.864	396.862	396.860	396.858	396.856	396.854	396.852
814.7	800	398.401	398.397	398.395	398.393	398.391	398.389	398.387	398.385	398.383	398.381	398.379	398.377
914.7	900	399.926	399.922	399.920	399.918	399.916	399.914	399.912	399.910	399.908	399.906	399.904	399.902
1014.7	1000	401.452	401.448	401.446	401.444	401.442	401.440	401.438	401.436	401.434	401.432	401.430	401.428
1114.7	1100	402.977	402.973	402.971	402.969	402.967	402.965	402.963	402.961	402.959	402.957	402.955	402.953
1214.7	1200	404.502	404.498	404.496	404.494	404.492	404.490	404.488	404.486	404.484	404.482	404.480	404.478
1314.7	1300	406.027	406.023	406.021	406.019	406.017	406.015	406.013	406.011	406.009	406.007	406.005	406.003
1414.7	1400	407.552	407.548	407.546	407.544	407.542	407.540	407.538	407.536	407.534	407.532	407.530	407.528
1514.7	1500	409.077	409.073	409.071	409.069	409.067	409.065	409.063	409.061	409.059	409.057	409.055	409.053
1614.7	1600	410.603	410.599	410.597	410.595	410.593	410.591	410.589	410.587	410.585	410.583	410.581	410.579
1714.7	1700	412.128	412.124	412.122	412.120	412.118	412.116	412.114	412.112	412.110	412.108	412.106	412.104
1814.7	1800	413.653	413.649	413.647	413.645	413.643	413.641	413.639	413.637	413.635	413.633	413.631	413.629
1914.7	1900	415.178	415.174	415.172	415.170	415.168	415.166	415.164	415.162	415.160	415.158	415.156	415.154
2014.7	2000	416.703	416.699	416.697	416.695	416.693	416.691	416.689	416.687	416.685	416.683	416.681	416.679
2114.7	2100	418.228	418.224	418.222	418.220	418.218	418.216	418.214	418.212	418.210	418.208	418.206	418.204
2214.7	2200	419.754	419.750	419.748	419.746	419.744	419.742	419.740	419.738	419.736	419.734	419.732	419.730
2314.7	2300	421.279	421.275	421.273	421.271	421.269	421.267	421.265	421.263	421.261	421.259	421.257	421.255
2414.7	2400	422.804	422.800	422.798	422.796	422.794	422.792	422.790	422.788	422.786	422.784	422.782	422.780
2514.7	2500	424.329	424.325	424.323	424.321	424.319	424.317	424.315	424.313	424.311	424.309	424.307	424.305
2614.7	2600	425.854	425.850	425.848	425.846	425.844	425.842	425.840	425.838	425.836	425.834	425.832	425.830
2714.7	2700	427.379	427.375	427.373	427.371	427.369	427.367	427.365	427.363	427.361	427.359	427.357	427.355
2814.7	2800	428.905	428.901	428.899	428.897	428.895	428.893	428.891	428.889	428.887	428.885	428.883	428.881
2914.7	2900	430.430	430.426	430.424	430.422	430.420	430.418	430.416	430.414	430.412	430.410	430.408	430.406
3014.7	3000	431.955	431.951	431.949	431.947	431.945	431.943	431.941	431.939	431.937	431.935	431.933	431.931

# NITROGEN TABLES

COMPUTED BY CLINTON H. HAVILL

FROM

EQUATION FURNISHED BY DR. FREDERICK G. KEYES, PROF. J. A. BEATTIE AND DR. O. C. BRIDGEMAN

RESEARCH LABORATORY OF PHYSICAL CHEMISTRY

MASS. INSTITUTE OF TECHNOLOGY

EQUATION OF STATE AS FURNISHED FOR PURE, DRY NITROGEN, -

$$P = \frac{2.92904 T \left(1 - \frac{1.500,000}{vT^3}\right) \left[v + 1.8011 \left(1 + \frac{24652}{v}\right)\right]}{v^2} - \frac{1713 \left(1 - \frac{93403}{v}\right)}{v^2}$$

WHERE - P = PRESSURE, ATMOSPHERES ABSOLUTE  
 T = TEMPERATURE, DEGREES CENTIGRADE ABSOLUTE  
 v = VOLUME PER WEIGHT IN CC/GR

CONVERSION FACTORS USED:-

1 ATMOSPHERE = 14.7 LB/SQ. IN.  
 CC/GR x .016017 = CU. FT./LB.  
 T° C ABS. x 1.8 = T° F ABS.

ABSOLUTE ZERO C = -273.13°  
 " " F = -459.63°

PRESSURE LB./SQ. IN. ABSOLUTE		TABLE I (a)											
PRESSURE LB./SQ. IN. GAUGE		PRELIMINARY TABLE COMPILED TO COMPUTE NITROGEN AS IMPURITY IN COMMERCIAL HELIUM, USING PARTIAL PRESSURES											
		VALUES IN TABLE = $\left(\frac{Pv}{T}\right)$											
		WHERE - P = LB./SQ. FT. ABSOLUTE v = CU. FT./LB. T = TEMPERATURE DEGREES FAHRENHEIT ABSOLUTE											
		TEMPERATURE DEGREES F ABSOLUTE											
		479.63	489.63	499.63	509.63	519.63	529.63	539.63	549.63	559.63	569.63	579.63	589.63
		TEMPERATURE DEGREES F											
		20° F	30° F	40° F	50° F	60° F	70° F	80° F	90° F	100° F	110° F	120° F	130° F
14.7	0	55.150	55.129	55.108	55.087	55.066	55.045	55.023	55.002	54.981	54.960	54.939	54.918
24.7	10	55.129	55.109	55.090	55.071	55.052	55.032	55.012	54.993	54.974	54.954	54.935	54.916
34.7	20	55.107	55.090	55.072	55.055	55.037	55.020	55.001	54.984	54.966	54.949	54.931	54.914
44.7	30	55.086	55.070	55.054	55.038	55.023	55.007	54.990	54.975	54.959	54.943	54.927	54.912
54.7	40	55.064	55.050	55.036	55.022	55.008	54.994	54.980	54.966	54.952	54.938	54.924	54.910
64.7	50	55.043	55.031	55.018	55.006	54.994	54.982	54.969	54.957	54.944	54.932	54.920	54.908
74.7	60	55.021	55.011	55.001	54.990	54.979	54.969	54.958	54.947	54.937	54.926	54.916	54.905
84.7	70	55.000	54.991	54.983	54.974	54.965	54.956	54.947	54.938	54.930	54.921	54.912	54.903
94.7	80	54.979	54.972	54.965	54.957	54.951	54.944	54.936	54.929	54.922	54.915	54.908	54.901
104.7	90	54.957	54.952	54.947	54.941	54.936	54.931	54.925	54.920	54.915	54.909	54.904	54.899
114.7	100	54.936	54.932	54.929	54.925	54.922	54.918	54.914	54.911	54.908	54.904	54.900	54.897
124.7	110	54.914	54.913	54.911	54.909	54.907	54.906	54.904	54.902	54.900	54.898	54.897	54.895
134.7	120	54.893	54.893	54.893	54.893	54.893	54.893	54.893	54.893	54.893	54.893	54.893	54.893
144.7	130	54.871	54.873	54.875	54.877	54.878	54.880	54.882	54.884	54.886	54.887	54.889	54.891
154.7	140	54.850	54.854	54.857	54.860	54.864	54.868	54.871	54.875	54.878	54.881	54.885	54.889
164.7	150	54.829	54.834	54.839	54.844	54.850	54.855	54.860	54.866	54.871	54.876	54.881	54.887
174.7	160	54.807	54.814	54.822	54.828	54.835	54.842	54.849	54.856	54.864	54.870	54.877	54.884
184.7	170	54.786	54.795	54.804	54.812	54.821	54.830	54.838	54.847	54.856	54.864	54.873	54.882
194.7	180	54.764	54.775	54.786	54.796	54.806	54.817	54.828	54.838	54.849	54.859	54.870	54.880
204.7	190	54.743	54.755	54.768	54.779	54.792	54.804	54.817	54.829	54.842	54.853	54.866	54.878
214.7	200	54.721	54.736	54.750	54.763	54.777	54.792	54.806	54.820	54.834	54.848	54.862	54.876
224.7	210	54.700	54.716	54.732	54.747	54.763	54.779	54.795	54.811	54.827	54.842	54.858	54.874

PRESSURE LB./SQ. IN. ABS. PRESSURE LB./SQ. IN. GAUGE		HELIUM TABLE II											
		SPECIFIC VOLUME CU. FT./LB.											
		VALUES IN THIS TABLE = VOLUME IN CU. FT. OF ONE (1) LB OF PURE, DRY HELIUM											
		TEMPERATURE DEGREES F											
		20° F	30° F	40° F	50° F	60° F	70° F	80° F	90° F	100° F	110° F	120° F	130° F
14.7	0	87.543	89.366	91.191	93.015	94.839	96.664	98.488	100.312	102.136	103.960	105.785	107.609
114.7	100	11.259	11.494	11.728	11.963	12.198	12.432	12.667	12.902	13.137	13.371	13.605	13.840
214.7	200	6.0387	6.1640	6.2895	6.4148	6.5402	6.6655	6.7908	6.9161	7.0414	7.1666	7.2919	7.4171
314.7	300	4.1359	4.2215	4.3071	4.3927	4.4782	4.5637	4.6491	4.7346	4.8200	4.9054	4.9908	5.0761
414.7	400	3.1509	3.2158	3.2808	3.3458	3.4106	3.4755	3.5404	3.6052	3.6700	3.7347	3.7995	3.8642
514.7	500	2.5486	2.6097	2.6533	2.7056	2.7579	2.8102	2.8624	2.9147	2.9668	3.0190	3.0711	3.1232
614.7	600	2.1422	2.1861	2.2300	2.2738	2.3176	2.3613	2.4050	2.4488	2.4924	2.5361	2.5797	2.6232
714.7	700	1.8496	1.8874	1.9251	1.9628	2.0005	2.0381	2.0757	2.1133	2.1508	2.1883	2.2258	2.2632
814.7	800	1.6288	1.6619	1.6951	1.7281	1.7612	1.7942	1.8272	1.8601	1.8930	1.9259	1.9588	1.9916
914.7	900	1.4563	1.4858	1.5153	1.5448	1.5742	1.6036	1.6330	1.6623	1.6916	1.7209	1.7501	1.7793
1014.7	1000	1.3178	1.3444	1.3710	1.3976	1.4241	1.4506	1.4771	1.5035	1.5299	1.5563	1.5826	1.6089
1114.7	1100	1.2041	1.2284	1.2526	1.2768	1.3010	1.3251	1.3492	1.3732	1.3972	1.4212	1.4452	1.4691
1214.7	1200	1.1092	1.1314	1.1537	1.1759	1.1980	1.2202	1.2423	1.2644	1.2864	1.3084	1.3303	1.3523
1314.7	1300	1.0287	1.0493	1.0698	1.0903	1.1108	1.1313	1.1518	1.1721	1.1924	1.2127	1.2330	1.2532
1414.7	1400	.95930	.97868	.99799	1.0169	1.0359	1.0549	1.0739	1.0928	1.1117	1.1306	1.1494	1.1682
1514.7	1500	.89959	.91744	.93529	.95310	.97089	.98864	1.0063	1.0240	1.0417	1.0593	1.0768	1.0944
1614.7	1600	.84698	.86377	.88052	.89724	.91392	.93057	.94718	.96376	.98029	.99680	1.0133	1.0297
1714.7	1700	.80055	.81637	.83215	.84789	.86360	.87928	.89492	.91052	.92609	.94162	.95712	.97258
1814.7	1800	.75723	.77149	.78590	.80039	.81483	.82936	.84381	.85831	.87285	.88732	.90175	.91623
1914.7	1900	.72223	.73641	.75056	.76466	.77873	.79277	.80677	.82073	.83466	.84855	.86241	.87623
2014.7	2000	.68891	.70239	.71584	.72924	.74262	.75595	.76926	.78252	.79575	.80895	.82210	.83522
2114.7	2100	.65873	.67158	.68440	.69717	.70991	.72262	.73529	.74793	.76052	.77309	.78561	.79810
2214.7	2200	.63128	.64356	.65579	.66800	.68016	.69230	.70439	.71645	.72847	.74046	.75241	.76432
2314.7	2300	.60620	.61796	.62967	.64135	.65299	.66460	.67617	.68770	.69920	.71066	.72209	.73347
2414.7	2400	.58321	.59448	.60571	.61691	.62806	.63919	.65028	.66133	.67235	.68333	.69427	.70518
2514.7	2500	.56205	.57286	.58365	.59440	.60512	.61580	.62645	.63706	.64763	.65817	.66866	.67913
2614.7	2600	.54248	.55290	.56328	.57362	.58393	.59420	.60444	.61464	.62480	.63493	.64502	.65507
2714.7	2700	.52437	.53441	.54441	.55437	.56430	.57420	.58405	.59387	.60366	.61341	.62311	.63279
2814.7	2800	.50754	.51723	.52688	.53649	.54607	.55561	.56512	.57459	.58401	.59341	.60277	.61209
2914.7	2900	.49187	.50123	.51055	.51984	.52909	.53830	.54748	.55662	.56572	.57479	.58382	.59281
3014.7	3000	.47724	.48630	.49531	.50429	.51323	.52214	.53101	.53984	.54864	.55740	.56612	.57481

PRESSURE LB./SQ. IN. ABS. PRESSURE LB./SQ. IN. GAUGE		NITROGEN TABLE II a											
		SPECIFIC VOLUME CU. FT./LB.											
		VALUES IN THIS TABLE = VOLUME IN CU. FT. OF ONE (1) LB OF PURE, DRY NITROGEN											
		TEMPERATURE DEGREES F											
		20° F	30° F	40° F	50° F	60° F	70° F	80° F	90° F	100° F	110° F	120° F	130° F
14.7	0	12.496	12.752	13.007	13.262	13.518	13.772	14.027	14.281	14.536	14.790	15.044	15.297
24.7	10	7.4340	7.5864	7.7386	7.8907	8.0427	8.1947	8.3463	8.4980	8.6496	8.8011	8.9525	9.1037
34.7	20	5.2896	5.3982	5.5067	5.6151	5.7234	5.8317	5.9399	6.0480	6.1561	6.2641	6.3720	6.4799
44.7	30	4.1047	4.1890	4.2734	4.3576	4.4419	4.5261	4.6101	4.6942	4.7783	4.8623	4.9462	5.0301
54.7	40	3.3529	3.4220	3.4910	3.5599	3.6289	3.6978	3.7666	3.8354	3.9042	3.9729	4.0417	4.1103
64.7	50	2.8336	2.8921	2.9505	3.0088	3.0672	3.1255	3.1838	3.2421	3.3003	3.3585	3.4167	3.4749
74.7	60	2.4533	2.5040	2.5547	2.6053	2.6559	2.7065	2.7570	2.8076	2.8581	2.9086	2.9591	3.0096
84.7	70	2.1628	2.2076	2.2523	2.2970	2.3417	2.3864	2.4311	2.4757	2.5204	2.5650	2.6096	2.6542
94.7	80	1.9937	1.9738	2.0138	2.0539	2.0939	2.1339	2.1739	2.2139	2.2539	2.2939	2.3339	2.3738
104.7	90	1.7483	1.7846	1.8209	1.8571	1.8934	1.9297	1.9659	2.0021	2.0384	2.0746	2.1108	2.1470
114.7	100	1.5953	1.6284	1.6616	1.6947	1.7279	1.7610	1.7941	1.8273	1.8604	1.8935	1.9266	1.9598
124.7	110	1.4668	1.4973	1.5278	1.5584	1.5889	1.6194	1.6499	1.6805	1.7110	1.7415	1.7720	1.8025
134.7	120	1.3574	1.3857	1.4140	1.4422	1.4706	1.4989	1.5271	1.5555	1.5838	1.6120	1.6403	1.6687
144.7	130	1.2631	1.2894	1.3158	1.3422	1.3686	1.3949	1.4213	1.4477	1.4741	1.5005	1.5269	1.5533
154.7	140	1.1811	1.2058	1.2305	1.2552	1.2799	1.3046	1.3293	1.3540	1.3788	1.4035	1.4282	1.4530
164.7	150	1.1088	1.1320	1.1553	1.1785	1.2017	1.2250	1.2482	1.2715	1.2948	1.3180	1.3413	1.3646
174.7	160	1.0449	1.0669	1.0888	1.1107	1.1327	1.1546	1.1766	1.1985	1.2205	1.2424	1.2644	1.2864
184.7	170	.98797	1.0087	1.0295	1.0503	1.0710	1.0918	1.1126	1.1334	1.1542	1.1750	1.1959	1.2167
194.7	180	.93686	.95658	.97631	.99603	1.0158	1.0355	1.0553	1.0750	1.0948	1.1146	1.1344	1.1542
204.7	190	.89075	.90953	.92831	.94709	.96590	.98471	1.0035	1.0224	1.0412	1.0600	1.0789	1.0977
214.7	200	.84893	.86685	.88478	.90271	.92067	.93863	.95660	.97458	.99256	1.0105	1.0286	1.0466
224.7	210	.81085	.82816	.84515	.86230	.87948	.89667	.91386	.93107	.94829	.96549	.98273	.99998







TOTAL PRESSURE OF MIXTURE		HELIUM TABLE IV												
LBS/SQ. IN.		FACTORS TO MULTIPLY VALUES IN TABLE III FOR PURITY OTHER THAN 100 %												
ABSOLUTE GAUGE		PURITY DEFINED AS,- $\frac{\text{VOLUME OF HELIUM}}{\text{TOTAL VOLUME OF MIXTURE}}$											MEASURED AFTER SEPARATION AT A PRESSURE OF ONE ATMOSPHERE AND AT NORMAL ROOM TEMPERATURE	
		HELIUM PURITY OF MIXTURE												
		88 %	89 %	90 %	91 %	92 %	93 %	94 %	95 %	96 %	97 %	98 %	99 %	100 %
14.7	0	.87262	.88267	.89285	.90326	.91468	.92592	.93700	.94792	.95867	.96925	.97967	.98992	1.0000
1014.7	100	.87357	.88357	.89371	.90405	.91530	.92640	.93735	.94816	.95883	.96934	.97971	.98993	"
	200	.87452	.88448	.89456	.90484	.91572	.92687	.93770	.94841	.95898	.96943	.97975	.98994	"
	300	.87547	.88538	.89542	.90562	.91655	.92735	.93805	.94865	.95914	.96951	.97979	.98995	"
	400	.87642	.88628	.89627	.90641	.91767	.92783	.93840	.94889	.95929	.96960	.97983	.98996	"
	500	.87737	.88719	.89713	.90720	.91779	.92831	.93875	.94914	.95945	.96969	.97987	.98997	"
	600	.87832	.88809	.89798	.90799	.91841	.92878	.93910	.94938	.95960	.96978	.97990	.98997	"
	700	.87927	.88899	.89884	.90878	.91903	.92926	.93945	.94962	.95976	.96987	.97994	.98998	"
	800	.88022	.88989	.89969	.90956	.91966	.92974	.93980	.94986	.95991	.96995	.97998	.98999	"
	900	.88117	.89080	.90055	.91035	.92028	.93021	.94015	.95011	.96007	.97004	.98002	.99000	"
2014.7	1000	.88212	.89170	.90140	.91114	.92090	.93069	.94050	.95035	.96022	.97013	.98008	.99001	"
	1100	.88305	.89249	.90205	.91167	.92132	.93101	.94074	.95051	.96033	.97019	.98009	.99002	"
	1200	.88398	.89328	.90270	.91220	.92173	.93133	.94097	.95068	.96043	.97025	.98011	.99002	"
	1300	.88491	.89407	.90336	.91272	.92215	.93165	.94121	.95084	.96054	.97030	.98014	.99003	"
	1400	.88584	.89486	.90401	.91325	.92257	.93197	.94144	.95100	.96064	.97036	.98016	.99004	"
	1500	.88677	.89565	.90466	.91378	.92299	.93229	.94168	.95117	.96075	.97042	.98019	.99005	"
	1600	.88769	.89643	.90531	.91431	.92340	.93260	.94191	.95133	.96085	.97048	.98022	.99005	"
	1700	.88862	.89722	.90596	.91484	.92382	.93292	.94215	.95149	.96096	.97054	.98024	.99006	"
	1800	.88955	.89801	.90662	.91536	.92424	.93324	.94238	.95165	.96106	.97059	.98027	.99007	"
3014.7	1900	.89048	.89880	.90727	.91589	.92465	.93356	.94262	.95182	.96117	.97065	.98029	.99007	"
	2000	.89141	.89959	.90792	.91642	.92507	.93388	.94285	.95198	.96127	.97071	.98032	.99008	"
	2100	.89214	.90021	.90843	.91683	.92540	.93413	.94303	.95211	.96135	.97076	.98034	.99009	"
	2200	.89288	.90082	.90894	.91724	.92572	.93438	.94322	.95223	.96143	.97080	.98036	.99009	"
	2300	.89361	.90144	.90945	.91766	.92605	.93463	.94340	.95236	.96151	.97085	.98038	.99010	"
	2400	.89435	.90205	.90996	.91807	.92637	.93488	.94359	.95249	.96159	.97089	.98040	.99010	"
	2500	.89508	.90267	.91047	.91848	.92670	.93513	.94377	.95262	.96168	.97094	.98042	.99011	"
	2600	.89581	.90329	.91098	.91889	.92703	.93538	.94395	.95274	.96176	.97099	.98044	.99011	"
	2700	.89655	.90390	.91149	.91930	.92735	.93563	.94414	.95287	.96184	.97103	.98046	.99012	"
3014.7	2800	.89728	.90452	.91200	.91972	.92768	.93588	.94432	.95300	.96192	.97108	.98048	.99012	"
	2900	.89802	.90513	.91251	.92013	.92800	.93613	.94451	.95312	.96200	.97112	.98050	.99013	"
	3000	.89875	.90575	.91302	.92054	.92833	.93638	.94469	.95325	.96208	.97117	.98052	.99013	"

ABRIDGED TABLE OF PARTIAL PRESSURE OF NITROGEN IMPURITY AT 70° F.  
VALUES ARE IN  $\frac{\text{LBS}}{\text{SQ. IN.}}$  ABSOLUTE

14.7	0	1.7773	1.6282	1.4792	1.3305	1.1819	1.0335	.8853	.7373	.5894	.4418	.2943	.1470	0
1014.7	1000	118.6518	106.9779	95.6289	84.6045	73.9050	63.5302	53.4802	43.7549	34.3544	25.2787	16.5277	8.1015	0
2014.7	2000	226.3689	207.4370	185.6218	164.3980	143.8656	123.7248	104.2739	85.4175	67.1510	49.4761	32.3926	15.7527	0
3014.7	3000	230.0301	209.1025	268.7976	239.1154	210.0560	181.6194	153.8055	126.6144	100.0460	74.1004	48.7775	24.0774	0

EXAMPLE OF METHOD FOR USE OF TABLE III & IV

PROBLEM: HIGH PRESSURE CONTAINER HAS DEAD VOLUME OF 1200 CU. FT.  
 : INITIAL CONDITIONS,- 2100 LBS (GAUGE) PRESSURE, TEMPERATURE 80° F., PURITY 93 %  
 : FINAL CONDITIONS,- CONTAINER DRAINED TO ATMOSPHERIC PRESSURE, TEMPERATURE 40°, PURITY AFTER DRAINING 92.5 %  
 : REQUIRED,- NUMBER CU. FT. STANDARD HELIUM OBTAINED FROM CONTAINER.

NO. CU. FT. HELIUM (STANDARD) IN CONTAINER AT INITIAL CONDITIONS =  
 $1200 \times \frac{131.464}{2100} \times \frac{.93413}{.93} = 147,365.4$  CU. FT. STANDARD HELIUM AT INITIAL CONDITIONS  
DEAD VOL. OF CONTAINER 2100 LB (GAUGE) 80° F. TABLE III TABLE IV 2100 LB (GAUGE) 93 % PURITY

NO. CU. FT. HELIUM (STANDARD) LEFT IN CONTAINER AFTER DRAINING =  
 $1200 \times \frac{1.0600}{0} \times \frac{.92030}{.925} = 1170.6$  CU. FT. STANDARD HELIUM LEFT IN CONTAINER  
TABLE III TABLE IV 0 (GAUGE) 40° F. 0 (GAUGE) 92.5 % PURITY

HELIUM REMOVED FROM CONTAINER = 147,365.4 - 1170.6 = 146,194.8 CU. FT. STANDARD HELIUM.

## PART II.

## Lift Factors of Helium

Explanation - Tabulated Values are:

$$\frac{\text{Lift per 100 cu.ft.}}{\text{Barometric pressure in inches Hg}}$$

To determine lift of any given volume - V - under pressure - P

$$L = \frac{PV \times (\text{tabulated values})}{100}; \quad \text{for dry helium and dry air,}$$

where L = lift in lb.

V = volume in cu.ft.

P = pressure in inches of Hg.

Humidity correction:

To correct for air and gas humidity, apply the following correction to any tabulated value: This is a mean value

$$-.0034 (e - c) \quad \begin{array}{ll} \text{If the helium is dry} & c = 0 \\ \text{" " air " " } & e = 0 \end{array}$$

in which e is the partial pressure of water vapor in the atmosphere in inches of Hg, and c is the partial pressure of water vapor in the lifting gas in inches of Hg.

In these tables (Part II) the impurity is supposed to be air.

N.A.C.A. Technical Note No. 276

80% Purity

Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No° superheat	10° superheat	20° superheat	30° superheat
-20	.208050	.210133	.212126	.214033	11	.194350	.196161	.197916	.199594
-19	.207587	.209661	.211646	.213545	12	.193943	.195749	.197496	.199166
-18	.207124	.209189	.211165	.213056	13	.193537	.195336	.197075	.198739
-17	.206661	.208717	.212568	.212568	14	.193131	.194924	.196655	.198312
-16	.206198	.208245	.210204	.212080	15	.192725	.194511	.196234	.197885
-15	.205735	.207774	.209724	.211592	16	.192318	.194098	.195813	.197457
-14	.205272	.207302	.209244	.211103	17	.191912	.193686	.195393	.197030
-13	.204809	.206830	.208763	.210615	18	.191506	.193273	.194972	.196603
-12	.204346	.206358	.208283	.210127	19	.191099	.192861	.194552	.196175
-11	.203883	.205936	.207802	.209638	20	.190693	.192448	.194131	.195748
-10	.203420	.205414	.207322	.209150	21	.190304	.192051	.193728	.195339
-9	.202977	.204963	.206863	.208683	22	.189914	.191654	.193325	.194929
-8	.202535	.204512	.206404	.208217	23	.189525	.191258	.192921	.194520
-7	.202092	.204060	.205944	.207750	24	.189135	.190831	.192518	.194110
-6	.201650	.203609	.205485	.207284	25	.188746	.190464	.192115	.193701
-5	.201207	.203158	.205026	.206817	26	.188356	.190067	.191712	.193292
-4	.200764	.202707	.204567	.206350	27	.187967	.189670	.191309	.192882
-3	.200322	.202256	.204108	.205884	28	.187577	.189274	.190905	.192473
-2	.199879	.201804	.203648	.205417	29	.187188	.188877	.190502	.192063
-1	.199437	.201353	.203189	.204951	30	.186798	.188480	.190099	.191654
0	.198994	.200902	.202730	.204484	31	.186424	.188100	.189712	.191261
1	.198570	.200439	.202291	.204038	32	.186050	.187719	.189325	.190869
2	.198146	.200036	.201851	.203591	33	.185676	.187339	.188939	.190476
3	.197723	.199604	.201412	.203145	34	.185302	.186958	.188552	.190083
4	.197299	.199171	.200973	.202699	35	.184929	.186578	.188165	.189691
5	.196875	.198738	.200534	.202253	36	.184555	.186198	.187778	.189298
6	.196451	.198305	.200094	.201806	37	.184181	.185817	.187391	.188905
7	.196027	.197872	.199655	.201360	38	.183807	.185437	.187005	.188512
8	.195604	.197440	.199216	.200914	39	.183433	.185056	.186618	.188120
9	.195180	.197007	.198776	.200467	40	.183059	.184676	.186231	.187727
10	.194756	.196574	.198337	.200021					

80% Purity									
Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
41	.182700	.184311	.185861	.187350	71	.172367	.173803	.175186	.176520
42	.182340	.183945	.185488	.186973	72	.172047	.173477	.174855	.176185
43	.181981	.183580	.185117	.186596	73	.171727	.173152	.174525	.175850
44	.181621	.183214	.184745	.186219	74	.171407	.172826	.174195	.175515
45	.181262	.182849	.184374	.185843	75	.171087	.172501	.173865	.175180
46	.180903	.182453	.184003	.185466	76	.170766	.172176	.173534	.174845
47	.180543	.182118	.183631	.185089	77	.170446	.171850	.173204	.174510
48	.180184	.181752	.183260	.184712	78	.170126	.171525	.172874	.174175
49	.179824	.181387	.182888	.184335	79	.169806	.171199	.172543	.173840
50	.179465	.181021	.182517	.183958	80	.169486	.170874	.172213	.173505
51	.179120	.180670	.182160	.183596	81	.169178	.170561	.171895	.173182
52	.178774	.180318	.182803	.183234	82	.168869	.170247	.171577	.172860
53	.178429	.179967	.181446	.182871	83	.168561	.169934	.171259	.172537
54	.178083	.179615	.181089	.182509	84	.168252	.169621	.170941	.172215
55	.177738	.179254	.180733	.182147	85	.167944	.169308	.170623	.171892
56	.177393	.178913	.180376	.181785	86	.167635	.168994	.170304	.171569
57	.177047	.178561	.180019	.181423	87	.167327	.168681	.169986	.171247
58	.176702	.178210	.179662	.181060	88	.167018	.168368	.169668	.170924
59	.176356	.177858	.179305	.180698	89	.166710	.168054	.169350	.170602
60	.176011	.177507	.178948	.180336	90	.166401	.167741	.169032	.170279
61	.175679	.177169	.178605	.179988	91	.166104	.167439	.168725	.169968
62	.175346	.176831	.178262	.179640	92	.165806	.167137	.168419	.169657
63	.175014	.176493	.177918	.179292	93	.165509	.166834	.168112	.169347
64	.174681	.176155	.177575	.178944	94	.165212	.166532	.167806	.169036
65	.174349	.175818	.177232	.178596	95	.164915	.166230	.167499	.168725
66	.174017	.175480	.176889	.178247	96	.164617	.165928	.167192	.168414
67	.173684	.175142	.176546	.177899	97	.164320	.165626	.166886	.168103
68	.173352	.174804	.176202	.177551	98	.164023	.165323	.166579	.167793
69	.173019	.174466	.175859	.177203	99	.163725	.165021	.166273	.167482
70	.172687	.174128	.175516	.176855	100	.163428	.164719	.165966	.167171

85% Purity

Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
-20	.221053	.222847	.224563	.226205	11	.206496	.208058	.209568	.211012
-19	.220561	.222347	.224056	.225691	12	.206065	.207621	.209124	.210563
-18	.220069	.221848	.223549	.225177	13	.205633	.207183	.208680	.210113
-17	.219577	.221348	.223042	.224664	14	.205202	.206746	.208236	.209663
-16	.219085	.220849	.222535	.224150	15	.204770	.206309	.207792	.209214
-15	.218594	.220349	.222025	.223637	16	.204338	.205872	.207348	.208764
-14	.218102	.219849	.221512	.223123	17	.203907	.205435	.206904	.208314
-13	.217610	.219350	.221015	.222609	18	.203475	.204997	.206460	.207864
-12	.217118	.218850	.220508	.222095	19	.203044	.204560	.206016	.207415
-11	.216626	.218351	.220001	.221582	20	.202612	.204123	.205572	.206965
-10	.216134	.217851	.219494	.221060	21	.202198	.203703	.205146	.206534
-9	.215644	.217373	.219010	.220577	22	.201784	.203283	.204721	.206103
-8	.215193	.216896	.218525	.220086	23	.201370	.202863	.204395	.205872
-7	.214723	.216418	.218041	.219595	24	.200956	.202443	.203870	.205241
-6	.214253	.215940	.217556	.219104	25	.200542	.202023	.203444	.204810
-5	.213783	.215463	.217072	.218614	26	.200127	.201603	.203018	.204379
-4	.213312	.214985	.216587	.218123	27	.199713	.201182	.202593	.203948
-3	.212842	.214507	.216103	.217632	28	.199299	.200762	.202167	.203517
-2	.212372	.214029	.215618	.217141	29	.198885	.200342	.201742	.203086
-1	.211901	.213552	.215134	.216650	30	.198471	.199922	.201316	.202655
0	.211431	.213074	.214649	.216159	31	.198074	.199519	.200908	.202242
1	.210981	.212616	.214185	.215689	32	.197677	.199116	.200499	.201828
2	.210530	.212158	.213722	.215220	33	.197280	.198713	.200091	.201415
3	.210080	.211700	.213258	.214750	34	.196883	.198310	.199682	.201001
4	.209630	.211242	.212794	.214280	35	.196486	.197908	.199274	.200588
5	.209180	.210785	.212331	.213811	36	.196088	.197505	.198866	.200174
6	.208729	.210327	.211867	.213341	37	.195691	.197102	.198457	.199761
7	.208279	.209869	.211402	.212871	38	.195294	.196699	.198049	.199347
8	.207829	.209411	.210939	.212401	39	.194897	.196296	.197640	.198934
9	.207378	.208953	.210476	.211932	40	.194500	.195893	.197232	.198520
10	.206928	.208495	.210012	.211462					

## 85% Purity

Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
41	.194118	.195506	.196840	.198123	71	.183140	.184376	.185567	.186716
42	.193736	.195119	.196448	.197726	72	.182800	.184032	.185218	.186363
43	.193355	.194732	.196055	.197329	73	.182460	.183687	.184869	.186010
44	.192973	.194345	.195663	.196932	74	.182120	.183342	.184520	.185657
45	.192591	.193958	.195271	.196536	75	.181780	.182998	.184172	.185305
46	.192209	.193570	.194879	.196139	76	.181439	.182653	.183823	.184952
47	.191827	.193183	.194487	.195742	77	.181099	.182308	.183474	.184599
48	.191446	.192796	.194094	.195345	78	.180759	.181963	.183125	.184246
49	.191064	.192409	.193702	.194948	79	.180419	.181619	.182776	.183893
50	.190682	.192022	.193310	.194551	80	.180079	.181274	.182427	.183540
51	.190315	.191650	.192933	.194170	81	.179751	.180942	.182091	.183200
52	.189948	.191278	.192556	.193788	82	.179423	.180610	.181755	.182860
53	.189581	.190905	.192179	.193407	83	.179096	.180278	.181419	.182520
54	.189214	.190533	.191802	.193025	84	.178768	.179946	.181083	.182180
55	.188847	.190161	.191426	.192644	85	.178440	.179615	.180747	.181841
56	.188480	.189789	.191049	.192262	86	.178112	.179283	.180411	.181501
57	.188113	.189417	.190672	.191881	87	.177784	.178951	.180075	.181161
58	.187746	.189044	.190295	.191499	88	.177457	.178619	.179739	.180821
59	.187379	.188672	.189918	.191118	89	.177129	.178287	.179403	.180481
60	.187012	.188300	.189541	.190736	90	.176801	.177955	.179067	.180141
61	.186659	.187942	.189179	.190369	91	.176485	.177635	.178743	.179814
62	.186306	.187584	.188816	.190003	92	.176169	.177315	.178419	.179486
63	.185952	.187226	.188454	.189636	93	.175853	.176995	.178095	.179159
64	.185599	.186868	.188091	.189269	94	.175537	.176675	.177771	.178831
65	.185246	.186511	.187729	.188903	95	.175222	.176355	.177448	.178504
66	.184893	.186153	.187366	.188536	96	.174906	.176034	.177124	.178176
67	.184540	.185795	.187004	.188169	97	.174590	.175714	.176800	.177849
68	.184186	.185437	.186641	.187802	98	.174274	.175394	.176476	.177521
69	.183833	.185079	.186279	.187436	99	.173958	.175074	.176152	.177194
70	.183480	.184721	.185916	.187069	100	.173642	.174754	.175828	.176866

90% Purity									
Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
-20	.234056	.235561	.237000	.238378	11	.218644	.219954	.221220	.222431
-19	.233535	.235034	.236467	.237839	12	.218187	.219492	.220752	.221959
-18	.233015	.234507	.235933	.237300	13	.217730	.219031	.220385	.221486
-17	.232494	.233979	.235400	.236761	14	.217273	.218569	.219817	.221014
-16	.231973	.233452	.234866	.236222	15	.216816	.218107	.219350	.220542
-15	.231453	.232925	.234333	.235683	16	.216359	.217645	.218883	.220070
-14	.230932	.232398	.233800	.235143	17	.215902	.217183	.218415	.219598
-13	.230411	.231871	.233266	.234604	18	.215445	.216722	.217948	.219125
-12	.229890	.231343	.232733	.234065	19	.214988	.216260	.217480	.218653
-11	.229370	.230816	.232200	.233526	20	.214531	.215798	.217013	.218181
-10	.228849	.230289	.231666	.232987	21	.214092	.215355	.216565	.217729
- 9	.228351	.229785	.231156	.232472	22	.213654	.214911	.216117	.217276
- 8	.227853	.229281	.230646	.231956	23	.213215	.214468	.215669	.216824
- 7	.227355	.228776	.230136	.231441	24	.212776	.214024	.215221	.216371
- 6	.226851	.228272	.229626	.230926	25	.212338	.213581	.214773	.215919
- 5	.226359	.227768	.229117	.230411	26	.211899	.213137	.214324	.215466
- 4	.225860	.227264	.228607	.229895	27	.211460	.212694	.213876	.215014
- 3	.225362	.226760	.228097	.229380	28	.211021	.212250	.213428	.214561
- 2	.224864	.226255	.227587	.228865	29	.210583	.211807	.212980	.214109
- 1	.224366	.225751	.227077	.228349	30	.210144	.211363	.212532	.213656
0	.223868	.225247	.226567	.227834	31	.209724	.210938	.212102	.213222
1	.223391	.224764	.226079	.227341	32	.209304	.210512	.211672	.212787
2	.222915	.224281	.225591	.226848	33	.208883	.210087	.211242	.212353
3	.222438	.223798	.225103	.226355	34	.208463	.209662	.210812	.211919
4	.221961	.223315	.224615	.225862	35	.208043	.209237	.210383	.211485
5	.221485	.222832	.224127	.225369	36	.207623	.208811	.209953	.211050
6	.221008	.222348	.223639	.224875	37	.207203	.208386	.209523	.210617
7	.220531	.221865	.223151	.224382	38	.206782	.207961	.209093	.210182
8	.220054	.221382	.222663	.223889	39	.206362	.207535	.208663	.209747
9	.219578	.220899	.222175	.223396	40	.205942	.207110	.208233	.209313
10	.219101	.220416	.221687	.222903					

N.A.C.A. Technical Note No. 276

90% Purity									
Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
41	.205538	.206701	.207820	.208896	71	.193913	.194950	.195950	.196913
42	.205133	.206293	.207407	.208479	72	.193553	.194586	.195582	.196542
43	.204729	.205884	.206994	.208062	73	.193193	.194222	.195215	.196171
44	.204325	.205475	.206581	.207645	74	.192833	.193858	.194847	.195800
45	.203921	.205067	.206168	.207229	75	.192473	.193495	.194480	.195430
46	.203516	.204658	.205755	.206812	76	.192113	.193131	.194112	.195059
47	.203112	.204249	.205342	.206395	77	.191752	.192767	.193745	.194688
48	.202708	.203840	.204929	.205978	78	.191392	.192403	.193377	.194317
49	.202303	.203432	.204516	.205561	79	.191032	.192039	.193010	.193946
50	.201899	.203023	.204103	.205144	80	.190672	.191675	.192642	.193575
51	.201510	.202630	.203706	.204743	81	.190325	.191325	.192288	.193218
52	.201122	.202237	.203309	.204342	82	.189978	.190974	.191934	.192861
53	.200733	.201844	.202912	.203942	83	.189631	.190624	.191580	.192503
54	.200345	.201451	.202515	.203541	84	.189284	.190273	.191226	.192146
55	.199956	.201058	.202119	.203141	85	.188937	.189923	.190872	.191789
56	.199567	.200655	.201722	.202740	86	.188590	.189572	.190518	.191432
57	.199179	.200272	.201325	.202339	87	.188243	.189222	.190164	.191075
58	.198790	.199879	.200928	.201938	88	.187896	.188871	.189810	.190717
59	.198402	.199486	.200531	.201538	89	.187549	.188521	.189456	.190360
60	.198013	.199093	.200134	.201137	90	.187202	.188170	.189102	.190003
61	.197639	.198715	.199752	.200752	91	.186857	.187832	.188761	.189659
62	.197265	.198337	.199370	.200366	92	.186533	.187494	.188420	.189314
63	.196891	.197959	.198989	.199981	93	.186198	.187156	.188078	.188970
64	.196517	.197581	.198607	.199596	94	.185864	.186818	.187737	.188626
65	.196143	.197204	.198226	.199211	95	.185529	.186480	.187396	.188282
66	.195769	.196826	.197844	.198826	96	.185194	.186141	.187055	.187937
67	.195395	.196448	.197462	.198440	97	.184864	.185803	.186714	.187593
68	.195021	.196070	.197080	.198055	98	.184525	.185465	.186372	.187249
69	.194647	.195692	.196699	.197669	99	.184191	.185127	.186031	.186904
70	.194273	.195314	.196317	.197284	100	.183856	.184789	.185690	.186560



95% Purity

Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
-20	.247059	.248275	.249437	.250550	11	.230791	.231850	.232871	.233849
-19	.246509	.247720	.248877	.249986	12	.230308	.231363	.232380	.233355
-18	.245960	.247165	.248317	.249421	13	.229826	.230877	.231890	.232860
-17	.245410	.246610	.247757	.248857	14	.229343	.230391	.231399	.232366
-16	.244861	.246055	.247197	.248292	15	.228861	.229905	.230908	.231871
-15	.244311	.245501	.246638	.247728	16	.228379	.229418	.230417	.231376
-14	.243761	.244946	.246074	.247163	17	.227896	.228932	.229926	.230882
-13	.243212	.244391	.245518	.246599	18	.227414	.228446	.229436	.230387
-12	.242662	.243836	.244958	.246034	19	.226931	.227959	.228945	.229893
-11	.242113	.243281	.244398	.245470	20	.226449	.227473	.228454	.229398
-10	.241563	.242726	.243838	.244905	21	.225986	.227006	.227984	.228924
-9	.241037	.242195	.243303	.244365	22	.225522	.226539	.227513	.228450
-8	.240511	.241665	.242768	.243826	23	.225059	.226073	.227043	.227975
-7	.239986	.241134	.242232	.243286	24	.224596	.225606	.226572	.227501
-6	.239460	.240603	.241697	.242746	25	.224133	.225139	.226102	.227027
-5	.238934	.240073	.241162	.242207	26	.223669	.224672	.225631	.226553
-4	.238408	.239542	.240627	.241667	27	.223206	.224205	.225161	.226079
-3	.237882	.239011	.240092	.241127	28	.222743	.223739	.224690	.225604
-2	.237357	.238480	.239556	.240587	29	.222279	.223272	.224220	.225130
-1	.236831	.237950	.239021	.240048	30	.221816	.222805	.223749	.224656
0	.236305	.237419	.238486	.239508	31	.221373	.222357	.223297	.224201
1	.235807	.236911	.237974	.238992	32	.220929	.221909	.222846	.223746
2	.235299	.236402	.237461	.238475	33	.220486	.221461	.222394	.223291
3	.234795	.235894	.236949	.237959	34	.220043	.221013	.221943	.222836
4	.234292	.235386	.236436	.237442	35	.219600	.220566	.221491	.222381
5	.233789	.234878	.235924	.236926	36	.219156	.220118	.221039	.221926
6	.233286	.234369	.235417	.236410	37	.218713	.219670	.220588	.221471
7	.232783	.233861	.234899	.235893	38	.218270	.219222	.220136	.221016
8	.232279	.233353	.234387	.235377	39	.217826	.218774	.219685	.220561
9	.231776	.232844	.233874	.234860	40	.217383	.218326	.219233	.220106
10	.231273	.232336	.233362	.234344					

## 95% Purity

Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
41	.216956	.217896	.218799	.219669	71	.204686	.205523	.206331	.207109
42	.216529	.217465	.218366	.219232	72	.204306	.205140	.205945	.206620
43	.216103	.217035	.217932	.218795	73	.203926	.204757	.205559	.206331
44	.215676	.216605	.217498	.218358	74	.203546	.204374	.205173	.205942
45	.215249	.216175	.217065	.217921	75	.203166	.203991	.204787	.205554
46	.214822	.215744	.216631	.217484	76	.202785	.203607	.204400	.205165
47	.214395	.215314	.216197	.217047	77	.202405	.203224	.204014	.204776
48	.213969	.214884	.215763	.216610	78	.202025	.202841	.203628	.204387
49	.213542	.214453	.215330	.216173	79	.201645	.202458	.203242	.203998
50	.213115	.214023	.214896	.215736	80	.201265	.202075	.202856	.203609
51	.212705	.213609	.214479	.215316	81	.200899	.201706	.202484	.203235
52	.212295	.213196	.214062	.214896	82	.200532	.201337	.202112	.202860
53	.211884	.212782	.213645	.214476	83	.200166	.200968	.201740	.202486
54	.211474	.212368	.213228	.214056	84	.199800	.200599	.201368	.202111
55	.211064	.211955	.212812	.213637	85	.199434	.200230	.200997	.201737
56	.210654	.211541	.212395	.213217	86	.199067	.199860	.200625	.201362
57	.210244	.211127	.211978	.212797	87	.198701	.199491	.200253	.200988
58	.209833	.210713	.211561	.212377	88	.198335	.199122	.199881	.200613
59	.209423	.210300	.211144	.211957	89	.197968	.198753	.199509	.200239
60	.209013	.209886	.210727	.211537	90	.197602	.198384	.199137	.199864
61	.208618	.209488	.210326	.211133	91	.197249	.198028	.198778	.199503
62	.208224	.209090	.209925	.210729	92	.196896	.197672	.198420	.199142
63	.207829	.208692	.209524	.210325	93	.196542	.197316	.198061	.198781
64	.207434	.208294	.209123	.209921	94	.196189	.196960	.197703	.198420
65	.207040	.207896	.208722	.209518	95	.195836	.196604	.197344	.198060
66	.206645	.207498	.208321	.209114	96	.195483	.196248	.196985	.197699
67	.206250	.207100	.207920	.208710	97	.195130	.195892	.196627	.197338
68	.205855	.206702	.207519	.208306	98	.194776	.195536	.196268	.196977
69	.205461	.206304	.207118	.207902	99	.194423	.195180	.195910	.196616
70	.205066	.205906	.206717	.207498	100	.194070	.194824	.195551	.196255

100% Purity									
Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
-20	.260062	.260989	.261874	.262722	11	.242937	.243746	.244523	.245268
-19	.259484	.260406	.261288	.262132	12	.242430	.243235	.244009	.244751
-18	.258905	.259824	.260701	.261542	13	.241922	.242724	.243494	.244234
-17	.258327	.259241	.260115	.260952	14	.241414	.242213	.242980	.243717
-16	.257748	.258659	.259528	.260362	15	.240907	.241703	.242466	.243200
-15	.257170	.258076	.258942	.259773	16	.240399	.241192	.241952	.242682
-14	.256591	.257493	.258356	.259183	17	.239891	.240681	.241438	.242165
-13	.256013	.256911	.257770	.258593	18	.239383	.240170	.240923	.241648
-12	.255434	.256328	.257183	.258003	19	.238876	.239659	.240409	.241131
-11	.254856	.255746	.256596	.257413	20	.238368	.239148	.239895	.240614
-10	.254277	.255163	.256010	.256823	21	.237880	.238658	.239402	.240118
-9	.253724	.254606	.255449	.256259	22	.237392	.238168	.238909	.239623
-8	.253170	.254049	.254889	.255695	23	.236904	.237677	.238416	.239127
-7	.252617	.253491	.254328	.255131	24	.236416	.237187	.237923	.238631
-6	.252063	.252934	.253768	.254567	25	.235929	.236697	.237430	.238136
-5	.251510	.252377	.253207	.254003	26	.235441	.236207	.236937	.237640
-4	.250956	.251820	.252646	.253439	27	.234953	.235717	.236444	.237144
-3	.250403	.251263	.252086	.252875	28	.234465	.235226	.235951	.236648
-2	.249849	.250706	.251525	.252311	29	.233977	.234736	.235458	.236153
-1	.249296	.250148	.250965	.251747	30	.233489	.234246	.234965	.235657
0	.248742	.249591	.250404	.251183	31	.233023	.233776	.234492	.235181
1	.248212	.249058	.249867	.250643	32	.232556	.233305	.234019	.234705
2	.247683	.248524	.249331	.250103	33	.232090	.232835	.233546	.234230
3	.247153	.247991	.248794	.249564	34	.231623	.232365	.233073	.233754
4	.246623	.247457	.248257	.249024	35	.231157	.231894	.232600	.233278
5	.246094	.246924	.247721	.248484	36	.230609	.231342	.232126	.232802
6	.245564	.246390	.247184	.247944	37	.230224	.230954	.231653	.232326
7	.245034	.245857	.246647	.247404	38	.229757	.230484	.231180	.231851
8	.244504	.245324	.246110	.246865	39	.229291	.230013	.230707	.231375
9	.243975	.244790	.245574	.246325	40	.228824	.229543	.230234	.230899
10	.243445	.244257	.245037	.245785					

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100% Purity									
Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat	Air temp. °F.	No superheat	10° superheat	20° superheat	30° superheat
41	.228375	.229091	.229780	.230442	71	.215459	.216097	.216712	.217305
42	.227926	.228639	.229325	.229985	72	.215059	.215694	.216307	.216898
43	.227476	.228187	.228871	.229528	73	.214659	.215292	.215903	.216492
44	.227027	.227735	.228416	.229071	74	.214259	.214890	.215498	.216085
45	.226578	.227284	.227962	.228614	75	.213859	.214487	.215094	.215678
46	.226129	.226832	.227507	.228157	76	.213458	.214085	.214689	.215271
47	.225680	.226380	.227053	.227700	77	.213058	.213682	.214284	.214864
48	.225230	.225928	.226598	.227243	78	.212658	.213280	.213879	.214458
49	.224781	.225476	.226144	.226786	79	.212258	.212877	.213475	.214051
50	.224232	.225024	.225689	.226329	80	.211858	.212475	.213070	.213644
51	.223900	.224590	.225252	.225890	81	.211472	.212087	.212680	.213252
52	.223468	.224155	.224815	.225451	82	.211087	.211700	.212290	.212860
53	.223037	.223721	.224378	.225011	83	.210701	.211312	.211901	.212469
54	.222605	.223286	.223941	.224572	84	.210316	.210924	.211511	.212077
55	.222173	.222852	.223505	.224133	85	.209930	.210537	.211121	.211685
56	.221741	.222417	.223068	.223694	86	.209544	.210149	.210731	.211293
57	.221309	.221983	.222631	.223255	87	.209159	.209761	.210341	.210901
58	.220878	.221548	.222194	.222815	88	.208773	.209373	.209952	.210510
59	.220446	.221114	.221757	.222376	89	.208388	.208986	.209562	.210118
60	.220014	.220679	.221320	.221937	90	.208002	.208598	.209172	.209726
61	.219599	.220261	.220900	.221515	91	.207630	.208224	.208796	.209348
62	.219183	.219843	.220479	.221092	92	.207258	.207850	.208420	.208971
63	.218768	.219425	.220059	.220670	93	.206887	.207476	.208044	.208593
64	.218352	.219007	.219639	.220247	94	.206515	.207102	.207668	.208215
65	.217937	.218589	.219219	.219825	95	.206143	.206729	.207293	.207838
66	.217521	.218171	.218798	.219402	96	.205771	.206355	.206917	.207460
67	.217106	.217753	.218378	.218980	97	.205399	.205981	.206541	.207082
68	.216690	.217335	.217958	.218557	98	.205028	.205607	.206165	.206704
69	.216275	.216917	.217537	.218135	99	.204656	.205233	.205789	.206327
70	.215859	.216499	.217117	.217712	100	.204284	.204859	.205413	.205949