

# X. Technical Data

## PROPERTIES OF POTASSIUM CARBONATE

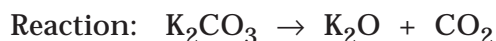
Boiling Point of $K_2CO_3$ Solutions . . . . .	Figure 16
Chemical & Physical Properties . . . . .	Table 1
Dissociation Pressure . . . . .	Table 2
Electrical Conductivity . . . . .	Table 6
Equivalent Conductance . . . . .	Table 6
Freezing Point . . . . .	Table 5, Graph 4
Heat Capacity . . . . .	Table 7
Hydrogen Ion Concentration (pH) . . . . .	Table 8
Index of Refraction . . . . .	Table 9
Solubility in Water Curve . . . . .	Graph 4
Solubility in Organic Solvents . . . . .	Table 3
Specific Gravity as Function of Temperature . . . . .	Table 5, Graph 5
— at 60°F . . . . .	Table 4
Surface Tension . . . . .	Table 10
Vapor Pressure . . . . .	Table 12
Viscosity . . . . .	Table 11

TABLE 1:

**CHEMICAL AND PHYSICAL  
PROPERTIES OF POTASSIUM CARBONATE**

<b>Chemical Name:</b>	Potassium Carbonate
<b>Chemical Formula:</b>	$K_2CO_3$
<b>Molecular Weight:</b>	138.20
<b>Acid Equivalent:</b>	1 lb. $K_2CO_3$ = 0.528 lb. HCl
<b>Alkali Equivalent:</b>	100% $K_2CO_3$ = 68.16% $K_2O$
<b>Electrical Conductivity of Molten <math>K_2CO_3</math></b>	
	1.95 ohm <sup>1</sup> cm <sup>1</sup> at 1652°F (900°C)
	2.12 ohm <sup>1</sup> cm <sup>1</sup> at 1742°F (950°C)
	2.26 ohm <sup>1</sup> cm <sup>1</sup> at 1832°F (1000°C)
<b>Dielectric Constant:</b>	4.96 at 18° and 166.6 Kcs/sec.
<b>Heat of Fusion:</b>	56.4 cal./g. or 101.5 BTU/lb.
<b>Heat of Formation:</b>	$K_2CO_3$ 1982 cal./g. at 25°C
	3568 BTU/lb. at 77°F
	$K_2CO_3 \cdot 0.5 H_2O$
	1429 cal./g. at 25°C
	2572 BTU/lb. at 77°C
	$K_2CO_3 \cdot 1.5 H_2O$
	1715 cal./g. at 25°C
	3087 BTU/lb. at 77°F
<b>Heat of Solution:</b>	$K_2CO_3$ 47.6 cal./g. (Evolved)
	85.7 BTU/lb. (Evolved)
	$K_2CO_3 \cdot 0.5 H_2O$
	28.9 cal./g. (Evolved)
	52.0 BTU/lb. (Evolved)
	$K_2CO_3 \cdot 1.5 H_2O$
	2.6 cal./g. (Absorbed)
	4.7 BTU/lb. (Absorbed)
<b>Infrared Absorption Band:</b>	6.9 $\mu$ and 11.4 $\mu$
<b>Melting Point:</b>	1636°F (891°C)
<b>pH of 47% <math>K_2CO_3</math>:</b>	12.63
<b>Specific Gravity:</b>	2.428 at 66°F (19°C)
<b>Specific Heat:</b>	0.216 BTU/lb.-°F over range 73-210°F
	0.216 cal./g.-°C over range 2-99°C
<b>Solubility in Water:</b>	
— at 68°F	112 grams per 100 grams
— at 212°F	156 grams per 100 grams
<b>Transitions:</b>	Second order at 410°C and 465°C

TABLE 2:

**DISSOCIATION PRESSURE OF  
POTASSIUM CARBONATE IN  
MILLIMETERS MERCURY**

Temperature (°C)	D.P. (mm Hg)
900 .....	0
950 .....	1.2
970 .....	1.68
1000 .....	2.1
1100 .....	7.4
1200 .....	10.3
1300 .....	15.1
1400 .....	35.6

TABLE 3:

**SOLUBILITY OF POTASSIUM CARBONATE  
IN SELECTED ORGANIC SOLVENTS**

Solvent	Category	Solubility (ppm)	
		Anhydrous K <sub>2</sub> CO <sub>3</sub>	Solution**
Kerosene	Hydrocarbons	ND*	ND*
Carbon Tetrachloride	Chlorinated Hydrocarbons	ND*	ND*
O-Dichlorobenzene	Chlorinated Hydrocarbons	0.2	0.2
Trichloroethylene	Chlorinated Hydrocarbons	0.1	< 0.1
Perchloroethylene	Chlorinated Hydrocarbons	ND*	< 0.1
Acetone	Ketones	1.3	17
Methyl Ethyl Ketone	Ketones	3.7	7.2
Ethyl Acetate	Esters	1.2	0.6
Butyl Acetate	Esters	25	5.4
Methyl Cellosolve Acetate	Esters	45	6.7
Diethanolamine	Amine	29	27
Methanol	Alcohols	16,500	16,440
Ethanol	Alcohols	904	234
Isopropanol	Alcohols	4.0	21
Ethylene Glycol	Glycols	15,300	46,100

\* ND = None Detected

\*\* Solution: 25% H<sub>2</sub>O + 75% K<sub>2</sub>CO<sub>2</sub> Dry Basis

TABLE 4:

## DENSITY OF POTASSIUM CARBONATE SOLUTIONS AT 60°F (15.6°C)

% K <sub>2</sub> CO <sub>3</sub>	% K <sub>2</sub> O	Specific Gravity 60/60°F	Degrees Baume Am. Std.	Degrees Twaddell	K <sub>2</sub> CO <sub>2</sub> Grams per Liter	K <sub>2</sub> CO <sub>2</sub> Pounds per Gallon	Total Weight of Solution in Pounds per Gallon	K <sub>2</sub> CO <sub>2</sub> Pounds per Cu. Ft.	Total Weight of Solution in Pounds per Cu. Ft.
0	0.0	0.999	—	—	0.0	0.0	8.328	0.0	62.30
1	0.68	1.001	0.15	0.2	10.0	0.084	8.353	0.62	62.49
2	1.36	1.011	1.58	2.2	20.6	0.167	8.437	1.26	63.12
3	2.04	1.021	2.99	4.2	30.6	0.256	8.520	1.91	63.74
4	2.73	1.031	4.36	6.2	41.2	0.344	8.604	2.57	64.37
5	3.41	1.041	5.72	8.2	52.0	0.434	8.687	3.25	64.99
6	4.09	1.051	7.04	10.2	63.0	0.526	8.771	3.94	65.61
7	4.77	1.060	8.21	12.0	74.2	0.619	8.846	4.63	66.18
8	5.45	1.070	9.49	14.0	85.6	0.714	8.929	5.34	66.80
9	6.13	1.080	10.74	16.0	97.2	0.811	9.013	6.07	67.42
10	6.82	1.090	11.97	18.0	109.0	0.910	9.096	6.81	68.05
11	7.50	1.100	13.18	20.0	121.0	1.010	9.180	7.55	68.67
12	8.18	1.110	14.37	22.0	133.5	1.112	9.263	8.32	69.30
13	8.86	1.120	15.54	24.0	145.6	1.215	9.346	9.09	69.62
14	9.54	1.129	16.57	25.8	158.1	1.319	9.422	9.87	70.48
15	10.22	1.138	17.59	27.8	170.8	1.425	9.497	10.66	71.05
16	10.91	1.148	18.70	29.6	183.7	1.533	9.580	11.47	71.67
17	11.59	1.158	19.79	31.6	196.9	1.643	9.664	12.29	72.29
18	12.27	1.168	20.86	33.6	210.2	1.754	9.747	13.13	72.92
19	12.95	1.178	21.92	35.6	223.8	1.868	9.830	13.97	73.54
20	13.63	1.188	22.95	37.6	237.6	1.983	9.914	14.83	74.17
21	14.31	1.199	24.07	39.8	251.8	2.101	10.006	15.72	74.85
22	15.00	1.209	25.07	41.8	266.0	2.220	10.089	16.61	75.48
23	15.68	1.219	26.06	43.8	280.4	2.340	10.173	17.50	76.10
24	16.36	1.230	27.11	46.0	295.1	2.463	10.264	18.43	76.79
25	17.04	1.240	28.06	48.0	310.0	2.587	10.348	19.35	77.41
26	17.72	1.251	29.10	50.2	325.2	2.714	10.440	20.31	78.10
27	18.40	1.262	30.11	52.4	340.7	2.843	10.531	21.27	78.79
28	19.08	1.273	31.10	54.6	356.4	2.974	10.623	22.25	79.47
29	19.77	1.284	32.08	56.8	372.3	3.107	10.715	23.25	80.16
30	20.45	1.295	33.04	59.0	388.5	3.242	10.807	24.26	80.85
31	21.13	1.306	33.98	61.2	404.9	3.379	10.899	25.27	81.53
32	21.81	1.317	34.91	63.4	421.4	3.517	10.990	26.31	82.22
33	22.49	1.328	35.82	65.6	438.2	3.657	11.082	27.36	82.91
34	23.17	1.340	36.79	68.0	455.6	3.802	11.182	28.44	83.66
35	23.86	1.351	37.68	70.2	472.8	3.946	11.274	29.52	84.34
36	24.54	1.362	38.54	72.4	490.3	4.092	11.366	30.61	85.03
37	25.22	1.374	39.47	74.8	508.3	4.242	11.466	31.74	85.78
38	25.90	1.386	40.39	77.2	526.6	4.395	11.566	32.88	86.53
39	26.58	1.398	41.29	79.6	545.2	4.550	11.666	34.04	87.28
40	27.26	1.410	42.16	82.0	563.9	4.706	11.766	35.21	88.03
41	27.95	1.422	43.04	84.4	583.0	4.865	11.867	36.40	88.78
42	28.63	1.434	43.89	86.8	602.2	5.026	11.967	37.60	89.52
43	29.31	1.446	44.73	89.2	621.8	5.189	12.067	38.82	90.27
44	29.99	1.459	45.62	91.8	641.9	5.357	12.175	40.08	91.09
45	30.67	1.471	46.43	94.2	661.9	5.524	12.275	41.32	91.83
46	31.35	1.483	47.23	96.6	682.2	5.693	12.376	42.59	92.58
47	32.04	1.496	48.08	99.2	703.0	5.867	12.484	43.90	93.40
48	32.72	1.509	48.91	101.8	724.3	6.045	12.593	45.22	94.21
49	33.40	1.522	49.74	104.4	745.7	6.223	12.701	46.56	95.02
50	34.08	1.535	50.54	107.0	767.5	6.405	12.810	47.92	95.83
51	34.76	1.549	51.40	109.8	790.0	6.592	12.926	49.32	96.70
52	35.44	1.562	52.18	112.4	812.2	6.778	13.035	50.71	97.52

TABLE 5:

**SPECIFIC GRAVITY OF POTASSIUM CARBONATE SOLUTIONS AS A FUNCTION OF TEMPERATURE**

		TEMPERATURE (°F)										
Conc.*	F.P.**	10	20	30	40	50	60	70	80	90	100	
0	32	—	—	—	0.9999	0.9997	0.9990	0.9980	0.9966	0.9950	0.9931	
5	29	—	—	1.057	1.046	1.044	1.042	1.040	1.038	1.035	1.033	
10	25	—	—	1.096	1.094	1.092	1.090	1.088	1.086	1.083	1.081	
15	21	—	1.146	1.145	1.143	1.141	1.139	1.137	1.135	1.132	1.130	
20	12	—	1.199	1.197	1.194	1.192	1.190	1.188	1.185	1.182	1.179	
25	3	1.252	1.251	1.248	1.245	1.244	1.242	1.240	1.237	1.234	1.231	
30	-3	1.308	1.306	1.303	1.301	1.298	1.296	1.293	1.290	1.287	1.284	
35	-16	1.366	1.363	1.360	1.358	1.355	1.352	1.350	1.347	1.344	1.341	
40	-34.6	1.423	1.422	1.419	1.416	1.414	1.411	1.408	1.405	1.402	1.399	
45	-1	1.486	1.484	1.481	1.479	1.476	1.473	1.470	1.467	1.463	1.460	
47	8	1.511	1.509	1.506	1.503	1.500	1.498	1.495	1.492	1.489	1.486	
50	18	—	1.547	1.545	1.542	1.540	1.537	1.534	1.531	1.528	1.525	
Conc.*		110	120	130	140	150	160	170	180	190	200	210
0		0.9910	0.9986	0.9860	0.9832	0.9803	0.9771	0.9739	0.9704	0.9669	0.9631	0.9591
5		1.031	1.028	1.025	1.022	1.019	1.016	1.013	1.010	1.006	1.002	0.998
10		1.079	1.076	1.073	1.070	1.067	1.064	1.061	1.058	1.054	1.050	1.046
15		1.127	1.124	1.121	1.118	1.115	1.112	1.109	1.105	1.101	1.097	1.093
20		1.176	1.173	1.170	1.167	1.163	1.160	1.157	1.153	1.149	1.145	1.143
25		1.228	1.225	1.222	1.219	1.215	1.212	1.209	1.205	1.201	1.197	1.195
30		1.281	1.278	1.276	1.273	1.270	1.267	1.264	1.260	1.256	1.252	1.248
35		1.338	1.335	1.332	1.329	1.325	1.322	1.319	1.316	1.312	1.308	1.304
40		1.396	1.393	1.390	1.387	1.384	1.381	1.378	1.375	1.371	1.367	1.363
45		1.457	1.454	1.451	1.448	1.445	1.442	1.439	1.435	1.431	1.427	1.423
47		1.482	1.478	1.476	1.473	1.470	1.467	1.464	1.460	1.456	1.452	1.448
50		1.522	1.518	1.515	1.511	1.507	1.504	1.501	1.497	1.493	1.487	1.483
55		—	1.583	1.580	1.577	1.573	1.570	1.567	1.563	1.559	1.555	1.550

\* Conc. = Concentration (% K<sub>2</sub>CO<sub>3</sub>) \*\* F.P. = Freezing point (°F)

TABLE 6:

**ELECTRICAL CONDUCTIVITY OF AQUEOUS K<sub>2</sub>CO<sub>3</sub> SOLUTIONS AT 15°C**

K <sub>2</sub> CO <sub>3</sub> (wt. %)	Conductance (mho/cm x 10 <sup>4</sup> )	Equivalent Conductance
5	561	74.2
10	1038	65.7
20	1806	52.4
30	2222	39.4
40	2168	26.5
50	1469	13.2

TABLE 7:

**HEAT CAPACITY OF POTASSIUM CARBONATE SOLUTIONS**

$K_2CO_3$ (wt. %)	$C_p^*$ (cal./g.-°C)
5	0.94
10	0.89
15	0.84
20	0.80
25	0.75
30	0.72
35	0.68
40	0.66
45	0.63

\* Good over range from 21-52°C

TABLE 9:

**REFRACTIVE INDEX AND MOLAR REFRACTION OF POTASSIUM CARBONATE SOLUTIONS**

$K_2CO_3$ (wt. %)	$ND^{25}$	$RD^*$
0	1.3325	8.349
5	1.3415	8.357
10	1.3514	8.362
15	1.3624	8.370
20	1.3751	8.381

\* Measured at Sodium D Wavelength (5893A°)

TABLE 8:

**pH OF DILUTE POTASSIUM CARBONATE SOLUTIONS**

Commercial $K_2CO_3$ (wt. %)	pH at 22°C
0.01	10.48
0.05	10.91
0.10	11.08
0.25	11.25
0.50	11.37
0.75	11.43
1.00	11.49
2.00	11.58
3.00	11.63
5.00	11.68
10.00	11.75

TABLE 10:

**SURFACE TENSION OF POTASSIUM CARBONATE SOLUTIONS AT 20°C**

$K_2CO_3$ (wt. %)	Dynes/cm
0	72.0
10	75.1
20	78.6
30	83.8
35	87.3
40	91.4
45	96.6
50	103.8

TABLE 11:

**VISCOSITY OF POTASSIUM  
CARBONATE SOLUTIONS AT 20°C**

<b>K<sub>2</sub>CO<sub>3</sub> (wt. %)</b>	<b>Viscosity (centipoise)*</b>
5 .....	3.0
10 .....	3.3
15 .....	3.7
20 .....	4.3
25 .....	4.9
30 .....	5.6
35 .....	6.3
40 .....	7.5
45 .....	9.6
47 .....	10.4
50 .....	11.5

\* Viscosities determined by  
Brookfield Method.

TABLE 12:

**VAPOR PRESSURE, WATER AT 20.5°C**

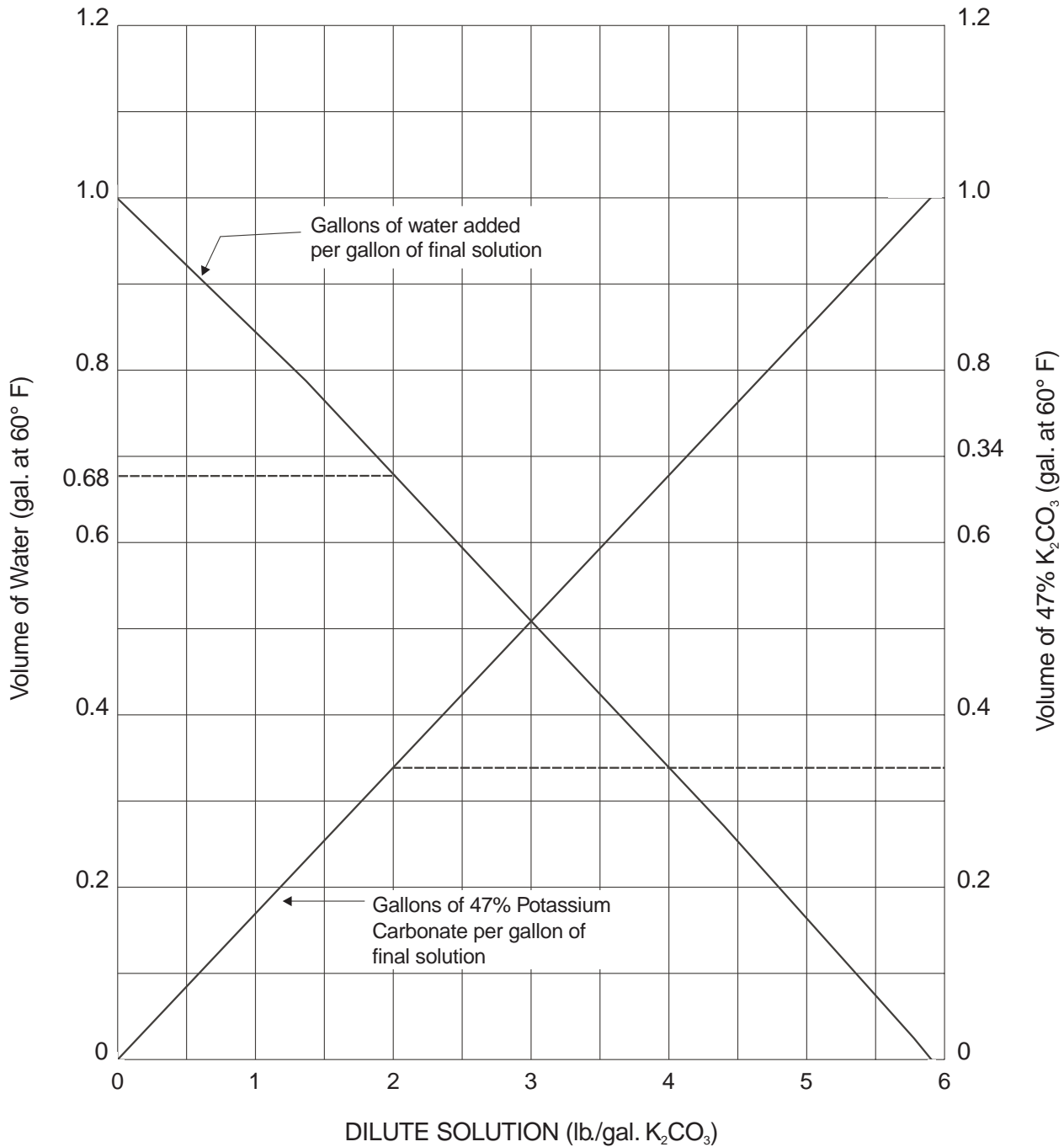
<b>K<sub>2</sub>CO<sub>3</sub> (wt. %)</b>	<b>Water Vapor Pressure*</b>
0 .....	18.1
19.6 .....	16.8
46.2 .....	11.8
54.7 .....	8.6

\* Pressure measured in millimeters  
of mercury, water at 20.5°C.

# TECHNICAL DATA

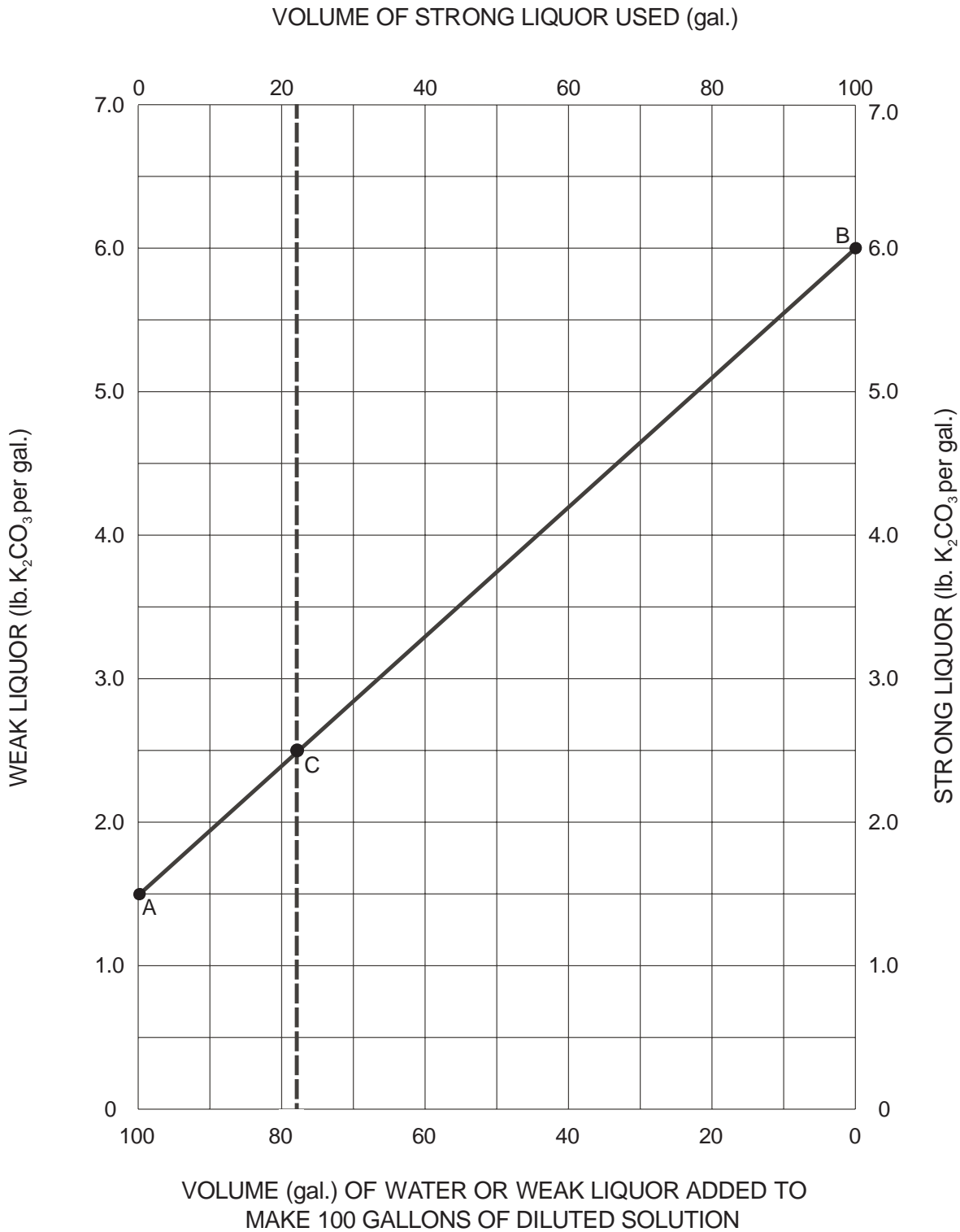
## Graph 1. Dilution of 47% Aqueous PotCarb at 60°F

Example: To make 1 gallon of solution containing 2.0 lbs. of  $K_2CO_3$  per gallon, add 0.34 gallon of 47% solution to 0.68 gallon of water



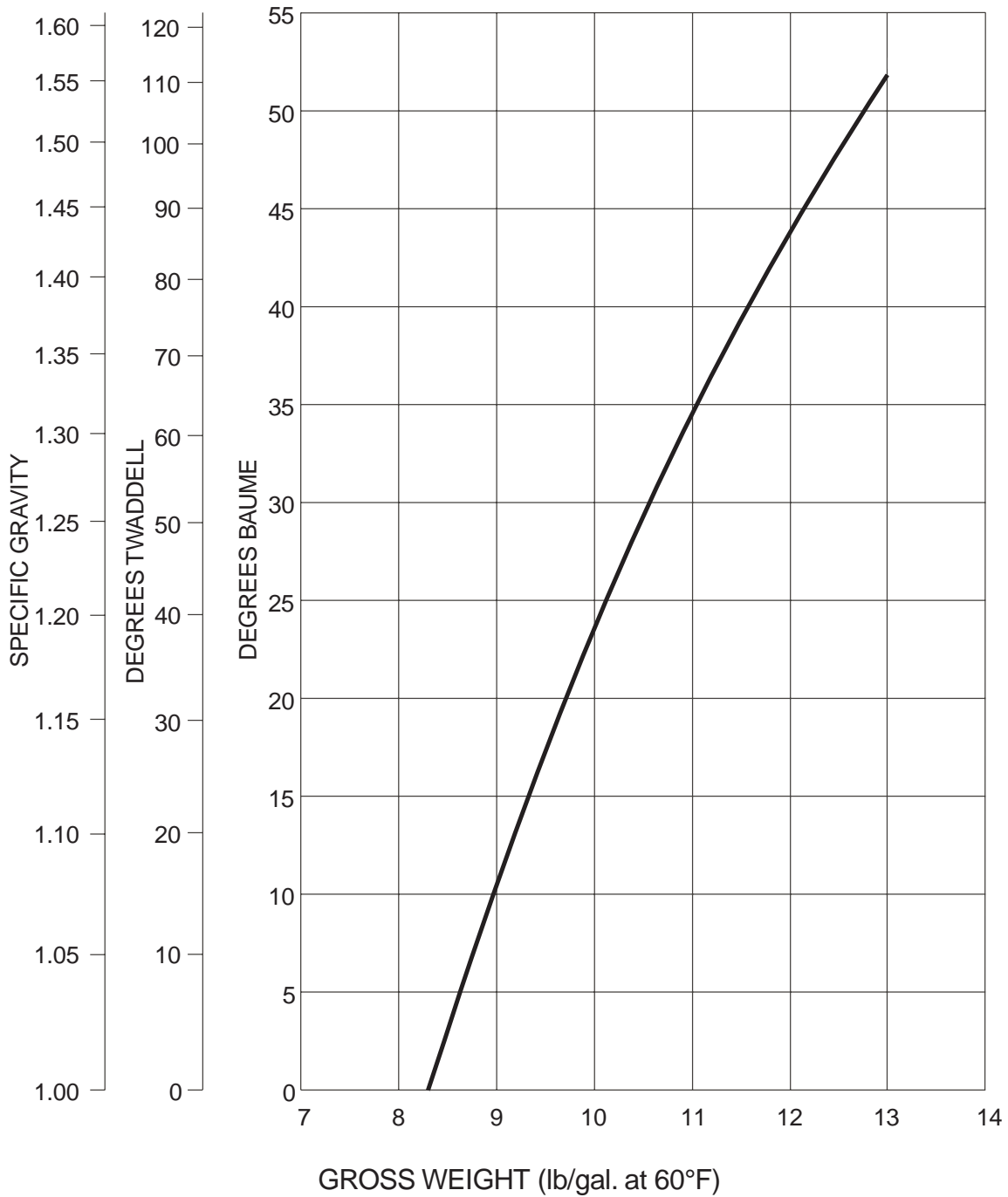
# TECHNICAL DATA

Graph 2. Determining Dilution Volumes



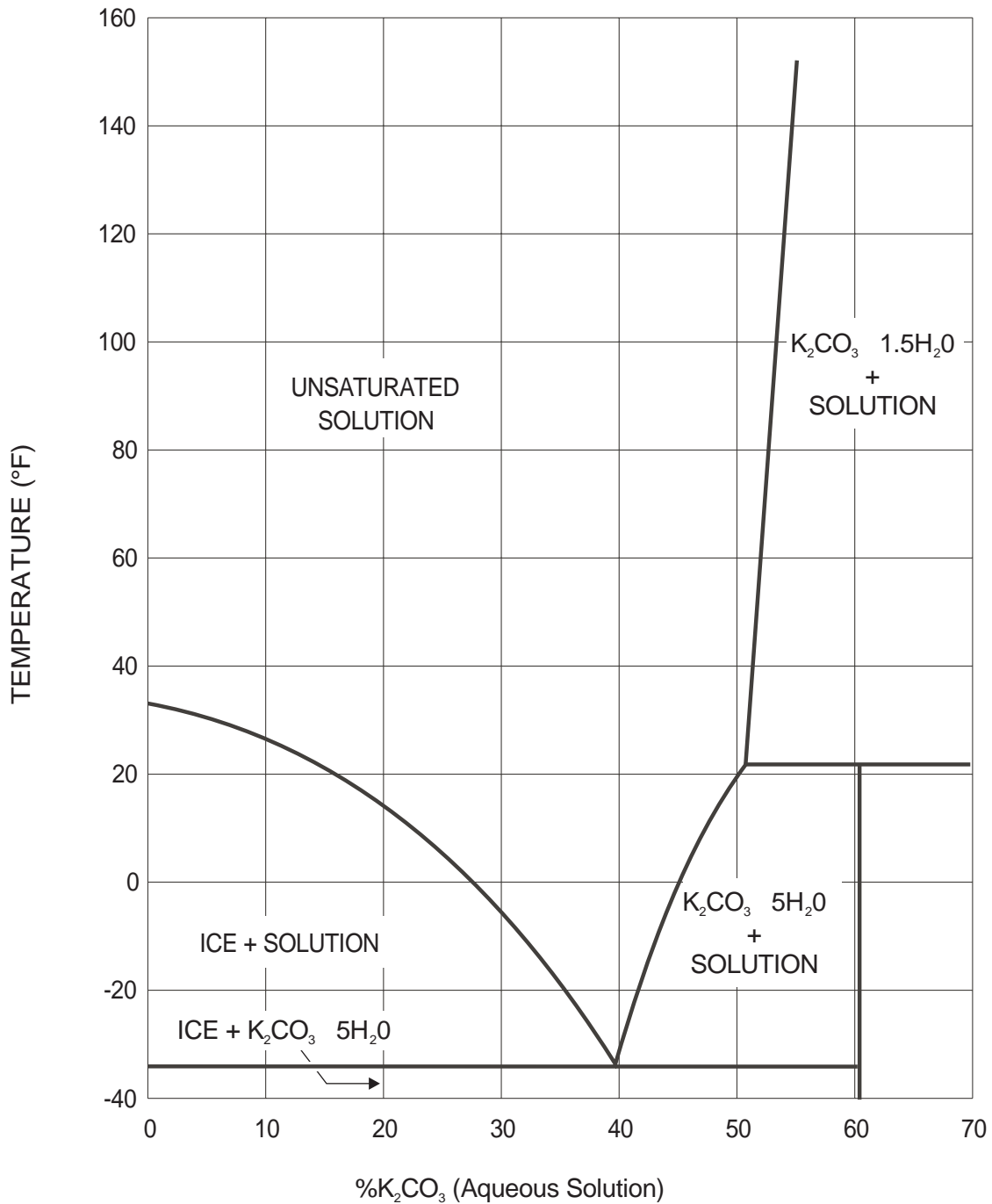
# TECHNICAL DATA

## Graph 3. Gross Weight of Aqueous Solutions at 60°F



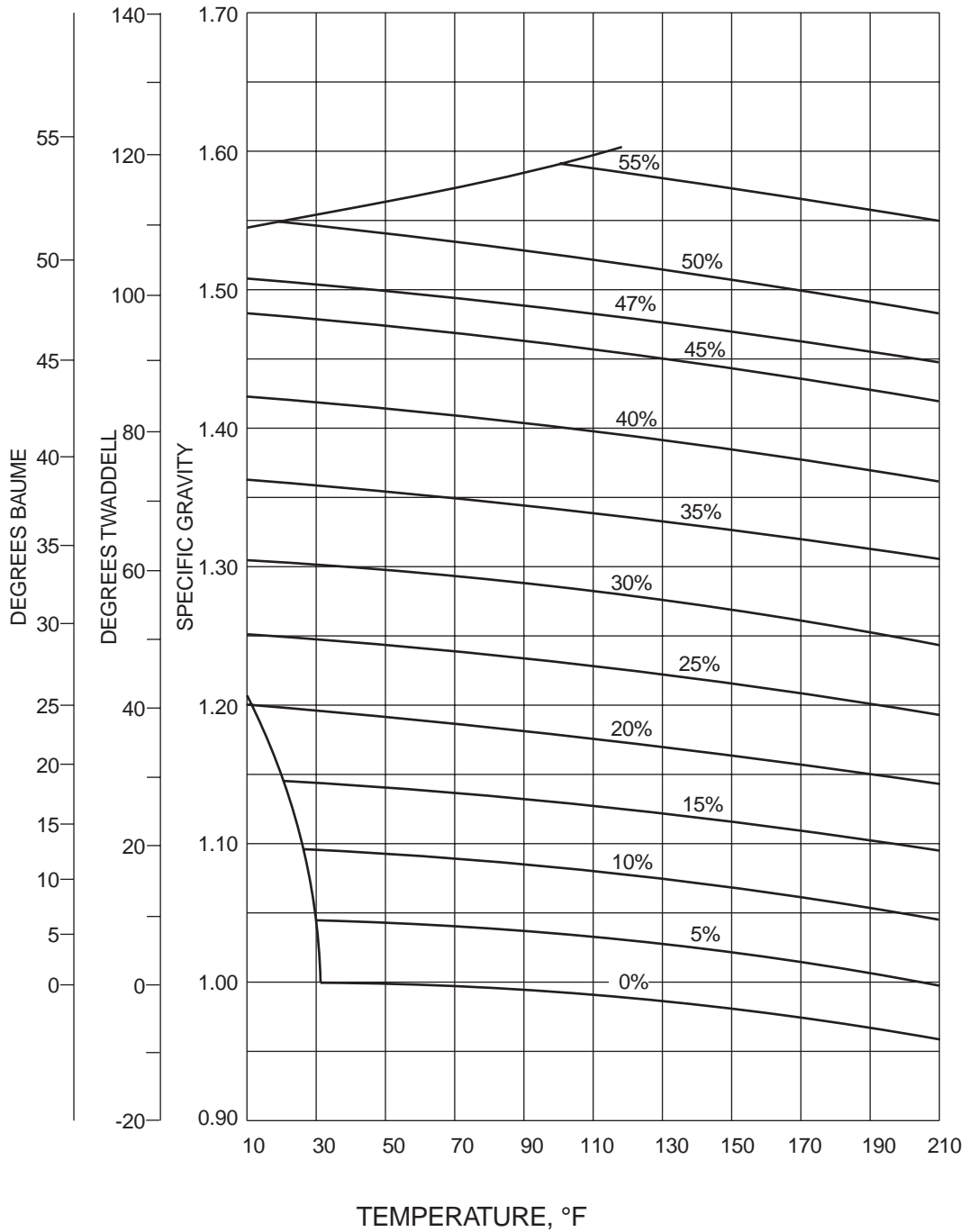
## TECHNICAL DATA

Graph 4. Solubility and Temperature Correlations



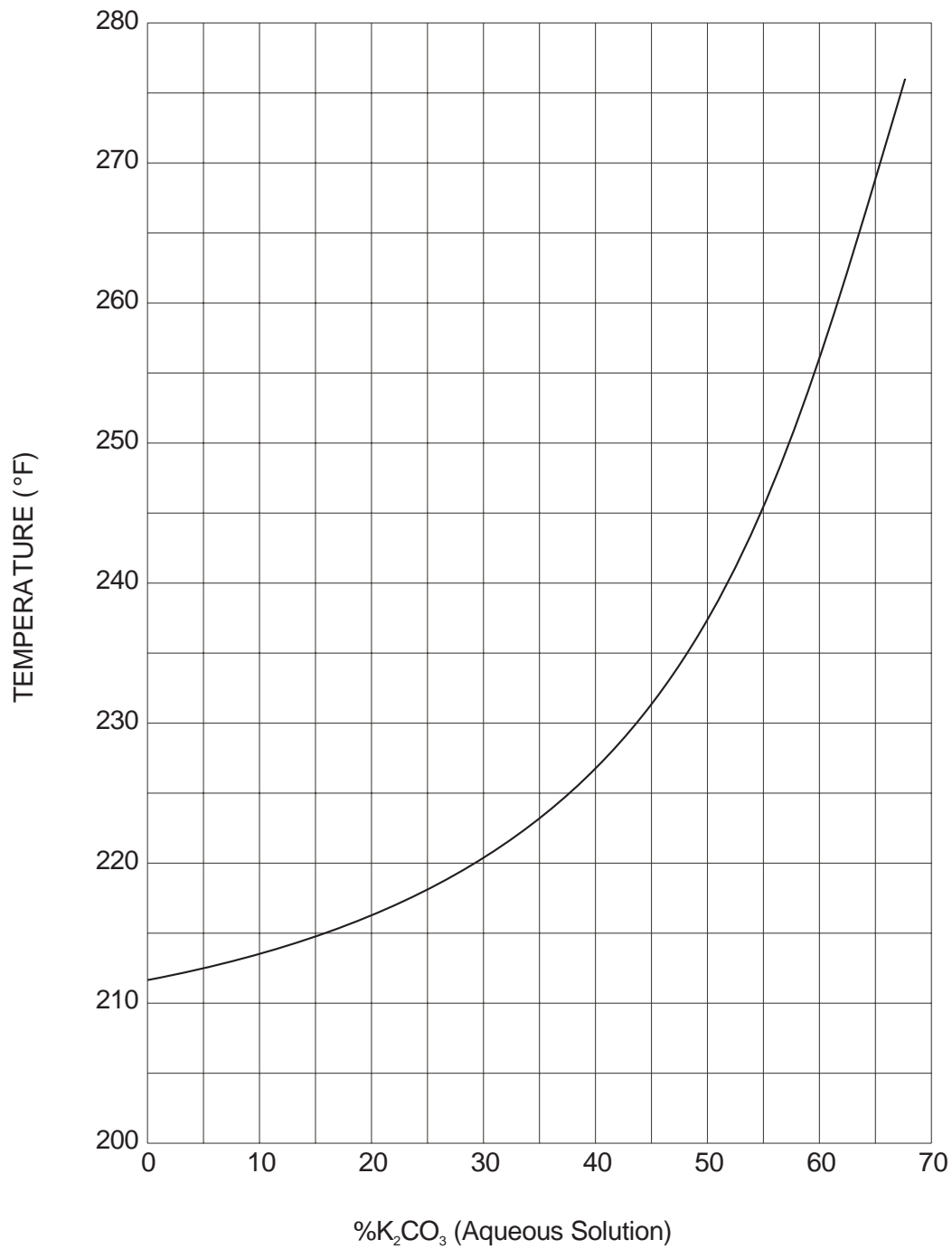
# TECHNICAL DATA

Graph 5. Solution Density at Various Temperatures



## TECHNICAL DATA

Graph 6. Boiling Points at 760 mm Hg



## References

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