BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

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ELECTROLYSIS TESTING
TABLES AND FORMULAS

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1. GENERAL

1.01 This section includes a series of tables and formulas which will be found useful in conducting electrolysis tests in the field. The tables are abridged somewhat to facilitate reference and some of the data are approximate. However, they are sufficiently accurate to satisfy routine survey needs.

2. TABLES

2.01 The tables are listed below.

TABLE I

*Properties of Lead Sheath Exchange Cables

*Note: These values also apply to jute protected and corrosion protected toll cables.

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.	Cross Section Area of Sheath (Sq. In.)	Approx. Current Capacity (Amps)
Cir. (In.)	Diam. (In.)				
1	.318	2.19	.457	.049	10
1 1/8	.358	1.87	.535	.057	11
1 1/4	.398	1.63	.615	.066	13
1 3/8	.438	1.43	.697	.074	15
1 1/2	.477	1.28	.780	.083	17
1 5/8	.517	1.15	.867	.093	19
1 3/4	.557	1.04	.957	.102	20
1 7/8	.595	.953	1.05	.112	22
2	.635	.875	1.14	.122	24
2 1/8	.675	.808	1.24	.130	26
2 1/4	.715	.749	1.34	.140	28
2 3/8	.755	.696	1.44	.151	30
2 1/2	.795	.650	1.54	.162	32
2 5/8	.835	.609	1.64	.173	35
2 3/4	.875	.571	1.75	.184	37
2 7/8	.915	.538	1.86	.196	39
3	.955	.513	1.95	.207	41
3 1/8	.995	.485	2.06	.219	44
3 1/4	1.03	.460	2.18	.230	46
3 3/8	1.07	.436	2.29	.243	49
3 1/2	1.11	.414	2.41	.256	51
3 5/8	1.15	.394	2.54	.269	54
3 3/4	1.19	.376	2.66	.282	56
3 7/8	1.23	.359	2.79	.296	59

TABLE I (cont)
Properties of Lead Sheath Exchange Cables

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.	Cross Section Area of Sheath (Sq. In.)	Approx. Current Capacity (Amps)
Cir. (In.)	Diam. (In.)				
4	1.27	.343	2.92	.306	61
4 1/8	1.31	.328	3.05	.320	64
4 1/4	1.35	.314	3.18	.334	67
4 3/8	1.39	.302	3.32	.348	70
4 1/2	1.43	.289	3.46	.363	73
4 5/8	1.46	.279	3.59	.378	76
4 3/4	1.50	.268	3.74	.393	79
4 7/8	1.54	.257	3.89	.408	82
5	1.59	.248	4.03	.424	85
5 1/8	1.63	.239	4.18	.439	88
5 1/4	1.67	.231	4.33	.456	91
5 3/8	1.71	.225	4.44	.473	95
5 1/2	1.75	.218	4.60	.489	98
5 5/8	1.79	.210	4.76	.506	101
5 3/4	1.83	.204	4.91	.523	105
5 7/8	1.86	.197	5.08	.540	108
6	1.90	.191	5.24	.558	112
6 1/8	1.94	.185	5.41	.575	115
6 1/4	1.98	.179	5.58	.594	119
6 3/8	2.02	.174	5.75	.606	121
6 1/2	2.06	.169	5.92	.624	125
6 5/8	2.10	.164	6.10	.643	129
6 3/4	2.14	.159	6.28	.662	132
6 7/8	2.18	.155	6.46	.682	136
7	2.22	.151	6.64	.701	140
7 1/8	2.26	.147	6.83	.721	144
7 1/4	2.30	.143	7.01	.741	148

TABLE I (cont.)
Properties of Lead Sheath Exchange Cables

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.	Cross Section Area of Sheath (Sq. In.)	Approx. Current Capacity (Amps)
Cir. (In.)	Diam. (In.)				
7 3/8	2.34	.139	7.21	.761	152
7 1/2	2.38	.135	7.40	.781	156
7 5/8	2.42	.133	7.52	.801	160
7 3/4	2.46	.130	7.72	.822	164
7 7/8	2.50	.126	7.97	.843	168
8	2.54	.123	8.12	.864	173
8 1/8	2.58	.120	8.32	.886	177
8 1/4	2.63	.117	8.53	.908	182
8 3/8	2.66	.115	8.73	.931	186
8 1/2	2.70	.112	8.94	.953	191
8 5/8	2.74	.109	9.15	.975	195
8 3/4	2.78	.107	9.36	.998	200
8 7/8	2.82	.104	9.59	1.022	204

TABLE II

Properties of Lead Sheath Toll Cables

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.	Cross Section Area of Sheath (Sq. In.)	Approx. Current Capacity (Amps)
Cir. (In.)	Diam. (In.)				
1	.318	1.95	.513	.060	12.0
1 1/8	.358	1.66	.602	.071	14.2
1 1/4	.398	1.44	.693	.081	16.2
1 3/8	.438	1.27	.787	.092	18.4
1 1/2	.477	1.14	.880	.109	21.8
1 5/8	.517	1.02	.979	.120	24.0
1 3/4	.557	.927	1.08	.133	26.6
1 7/8	.595	.855	1.17	.147	29.4
2	.635	.786	1.27	.159	31.8
2 1/8	.675	.726	1.38	.170	34.0
2 1/4	.715	.673	1.49	.180	36.0
2 3/8	.755	.626	1.60	.189	37.8
2 1/2	.795	.585	1.71	.200	40.0
2 5/8	.835	.548	1.82	.210	42.0
2 3/4	.875	.515	1.94	.220	44.0
2 7/8	.915	.485	2.06	.231	46.2
3	.955	.458	2.18	.243	48.6
3 1/8	.995	.433	2.31	.257	51.4
3 1/4	1.03	.411	2.43	.270	54.0
3 3/8	1.07	.390	2.56	.285	57.0
3 1/2	1.11	.371	2.69	.303	60.6
3 5/8	1.15	.354	2.83	.320	64.0
3 3/4	1.19	.338	2.96	.339	67.8
3 7/8	1.23	.323	3.10	.353	70.6
4	1.27	.309	3.24	.368	73.6
4 1/8	1.31	.296	3.38	.382	76.4

TABLE II (cont.)

Properties of Lead Sheath Toll Cables

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.	Cross Section Area of Sheath (Sq. In.)	Approx. Current Capacity (Amps)
Cir. (In.)	Diam. (In.)				
4 1/4	1.35	.286	3.49	.399	79.8
4 3/8	1.39	.275	3.64	.414	82.8
4 1/2	1.43	.264	3.79	.429	85.8
4 5/8	1.46	.254	3.94	.450	90.0
4 3/4	1.50	.245	4.09	.470	94.0
4 7/8	1.54	.236	4.25	.490	98.0
5	1.59	.227	4.40	.512	102.4
5 1/8	1.63	.219	4.56	.539	107.8
5 1/4	1.67	.212	4.73	.559	111.8
5 3/8	1.71	.205	4.89	.580	116.0
5 1/2	1.75	.198	5.06	.600	120.0
5 5/8	1.79	.191	5.23	.620	124.0
5 3/4	1.83	.185	5.40	.638	127.6
5 7/8	1.86	.180	5.57	.657	131.4
6	1.90	.174	5.75	.678	135.6
6 1/8	1.94	.169	5.92	.697	139.4
6 1/4	1.98	.164	6.10	.716	143.2
6 3/8	2.02	.159	6.29	.732	146.4
6 1/2	2.06	.155	6.47	.748	149.6
6 5/8	2.10	.151	6.61	.763	153.2
6 3/4	2.14	.147	6.79	.781	156.2
6 7/8	2.18	.143	6.98	.799	159.8
7	2.22	.139	7.17	.819	163.8
7 1/8	2.26	.136	7.37	.837	167.4
7 1/4	2.30	.132	7.56	.853	170.6
7 3/8	2.34	.129	7.76	.870	174.0
7 1/2	2.38	.126	7.97	.884	176.8

TABLE II (cont.)

Properties of Lead Sheath Toll Cables

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.	Cross Section Area of Sheath (Sq. In.)	Approx. Current Capacity (Amps.)
Cir. (In.)	Diam. (In.)				
7 5/8	2.42	.122	8.18	.902	180.4
7 3/4	2.46	.119	8.38	.925	185.0
7 7/8	2.50	.116	8.59	.942	188.4
8	2.54	.114	8.81	.962	192.4
8 1/8	2.58	.111	9.02	.983	198.6
8 1/4	2.63	.108	9.24	1.012	202.4
8 3/8	2.66	.106	9.44	1.075	215.0
8 1/2	2.70	.103	9.67	1.092	218.4
8 5/8	2.74	.101	9.89	1.109	221.8
8 3/4	2.78	.0989	10.1	1.126	225.2
8 7/8	2.82	.0966	10.4	1.139	227.8
9	2.86	.0946	10.6	1.160	232.0
9 1/8	2.90	.0925	10.8	1.173	234.6
9 1/4	2.94	.0906	11.0	1.194	238.8
9 3/8	2.98	.0887	11.3	1.207	241.4
9 1/2	3.02	.0869	11.5	1.228	245.6
9 5/8	3.05	.0851	11.8	1.231	246.2
9 3/4	3.09	.0833	12.0	1.262	252.4
9 7/8	3.12	.0817	12.3	1.274	254.8

TABLE III

Properties of Gopher Protected Cables
(Including Tapes)

Dimensions over Lead Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.
Cir. (In.)	Diam. (In.)		
5 1/2	1.75	.215	4.65
5 5/8	1.79	.207	4.82
5 3/4	1.83	.202	4.96
5 7/8	1.86	.195	5.13
6	1.90	.189	5.29
6 1/8	1.94	.183	5.46
6 1/4	1.98	.177	5.64
6 3/8	2.02	.172	5.82
6 1/2	2.06	.167	5.99
6 5/8	2.10	.162	6.17
6 3/4	2.14	.157	6.36
6 7/8	2.18	.153	6.52
7	2.22	.150	6.69
7 1/8	2.26	.146	6.87
7 1/4	2.30	.142	7.06
7 3/8	2.34	.138	7.26
7 1/2	2.38	.134	7.47
7 5/8	2.42	.132	7.58
7 3/4	2.46	.129	7.75
7 7/8	2.50	.125	8.00
8	2.54	.122	8.19
8 1/8	2.58	.119	8.39

TABLE IV

Properties of Alpeth Sheath Cables

Dimensions over Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.
Cir. (In.)	Diam. (In.)		
3 1/2	1.11	.544	1.84
3 5/8	1.15	.544	1.84
3 3/4	1.19	.544	1.84
3 7/8	1.23	.511	1.96
4	1.27	.511	1.96
4 1/8	1.31	.511	1.96
4 1/4	1.35	.458	2.19
4 3/8	1.39	.458	2.19
4 1/2	1.43	.458	2.19
4 5/8	1.46	.458	2.19
4 3/4	1.50	.417	2.40
4 7/8	1.54	.417	2.40
5	1.59	.417	2.40
5 1/8	1.63	.417	2.40
5 1/4	1.67	.417	2.40
5 3/8	1.71	.379	2.64
5 1/2	1.75	.379	2.64
5 5/8	1.79	.379	2.64
5 3/4	1.83	.348	2.87
5 7/8	1.86	.348	2.87
6	1.90	.348	2.87
6 1/8	1.94	.348	2.87
6 1/4	1.98	.348	2.87
6 3/8	2.02	.312	3.21
6 1/2	2.06	.312	3.21

TABLE IV (cont.)
Properties of Alpeth Sheath Cables

Dimensions over Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.
Cir. (In.)	Diam. (In.)		
6 5/8	2.10	.312	3.21
6 3/4	2.14	.312	3.21
6 7/8	2.18	.312	3.21
7	2.22	.312	3.21
7 1/8	2.26	.312	3.21
7 1/4	2.30	.288	3.47
7 3/8	2.34	.288	3.47
7 1/2	2.38	.288	3.47
7 5/8	2.42	.288	3.47
7 3/4	2.46	.270	3.83
7 7/8	2.50	.270	3.83
8	2.54	.270	3.83
8 1/8	2.58	.246	4.07
8 1/4	2.63	.246	4.07
8 3/8	2.66	.246	4.07
8 1/2	2.70	.246	4.07
8 5/8	2.74	.246	4.07
8 3/4	2.78	.246	4.07

TABLE V

Properties of Stalpeth Sheath Cables

Dimensions over Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.
Cir. (In.)	Diam. (In.)		
3 1/2	1.11	.657	1.52
3 5/8	1.15	.657	1.52
3 3/4	1.19	.657	1.52
3 7/8	1.23	.625	1.60
4	1.27	.579	1.73
4 1/8	1.31	.579	1.73
4 1/4	1.35	.579	1.73
4 3/8	1.39	.539	1.85
4 1/2	1.43	.539	1.85
4 5/8	1.46	.502	1.99
4 3/4	1.50	.502	1.99
4 7/8	1.54	.473	2.11
5	1.59	.473	2.11
5 1/8	1.63	.445	2.25
5 1/4	1.67	.445	2.25
5 3/8	1.71	.417	2.40
5 1/2	1.75	.417	2.40
5 5/8	1.79	.398	2.51
5 3/4	1.83	.398	2.51
5 7/8	1.86	.398	2.51
6	1.90	.398	2.51
6 1/8	1.94	.398	2.51
6 1/4	1.98	.359	2.78
6 3/8	2.02	.359	2.78
6 1/2	2.06	.359	2.78

TABLE V (cont.)
Properties of Stalpeth Sheath Cables

Dimensions over Sheath		Res. Ohms per 1000 Ft. at 59°F	Amps. per mv. Drop per Ft.
Cir. (In.)	Diam. (In.)		
6 5/8	2.10	.359	2.78
6 3/4	2.14	.331	3.02
6 7/8	2.18	.331	3.02
7	2.22	.331	3.02
7 1/8	2.26	.331	3.02
7 1/4	2.30	.303	3.33
7 3/8	2.34	.303	3.33
7 1/2	2.38	.303	3.33
7 5/8	2.42	.303	3.33
7 3/4	2.46	.284	3.52
7 7/8	2.50	.284	3.52
8	2.54	.271	3.52
8 1/8	2.58	.271	3.69
8 1/4	2.63	.265	3.77
8 3/8	2.66	.265	3.77
8 1/2	2.70	.250	4.07
8 5/8	2.74	.250	4.07
8 3/4	2.78	.250	4.07

TABLE VI

Properties of Solid Copper Wires

Note: Standard bonding ribbon (3/8" wide, .051" thick) is equivalent to #6 copper wire.

* To adjust for other temperatures:
Add 1% for each 4.5° over 59°F
Subtr. " " " " under 59°F

Size of Wire A.W.G. or B. & S. Gauge	Area in mcm	Diam. of Wire in Inches	Res. in Ohms per 1000 Ft. at 59°F*	Res. in Ft. per Ohm at 59°F	Safe Carrying Capacity in Amps.
0000	221.6	.46	.04805	20,810	300
000	167.8	.41	.06059	16,500	260
00	133.1	.36	.07640	13,090	225
0	105.5	.32	.09634	10,380	195
1	83.7	.29	.1215	8,232	165
2	66.4	.26	.1532	6,528	140
4	41.7	.20	.2436	4,105	105
6	26.3	.16	.3873	2,582	80
8	16.5	.13	.6158	1,624	55
10	10.4	.10	.9792	1,021	40
12	6.5	.08	1.557	642.2	25
14	4.1	.06	2.476	403.9	20
16	2.6	.05	3.937	254.0	–
18	1.6	.04	6.260	159.8	–
19	1.3	.04	7.893	126.7	–
20	1.0	.03	9.953	100.5	–
22	.6	.03	15.83	63.2	–

TABLE VII

Properties of Stranded Copper Conductors

Note: For stranded conductors smaller than A.W.G. #8 use solid wire table.

* To adjust for other temperatures:
Add 1% for each 4.5° over 59°F
Subtr. " " " " under 59°F

Size in A.W.G. or Area in mcm	Diam. of Conductor in Inches	Res. in Ohms per 1000 Ft at 59°F*	Res. in Ft. per Ohm at 59°F	Safe Carrying Capacity in Amps.
2,000	1.63	.00518	193,050	1155
1,500	1.41	.00691	144,718	980
1,000	1.15	.0104	96,154	780
750	1.00	.0138	72,464	655
500	.81	.0208	48,077	515
250	.58	.0414	24,155	340
0000	.53	.0489	20,450	300
000	.47	.0617	16,208	260
00	.42	.0779	12,837	225
0	.37	.0981	10,194	195
1	.33	.124	8,065	165
2	.29	.156	6,410	140
4	.23	.249	4,016	105
6	.18	.394	2,538	80
8	.15	.628	1,592	55

3. USEFUL FORMULAS

3.01 The formulas are listed below.

USEFUL FORMULAS

$$\frac{1}{\text{Ohms per ft.}} = \frac{\text{ft. per ohm}}{1}$$

$$\text{Amps. per M.V. ft.} = \frac{.001 \text{ volts}}{\text{Ohms per ft.}} = \text{Ft. per Amp. per M.V.}$$

$$\text{Amps. per M.V. in.} = \frac{.001 \text{ volts}}{\text{Ohms per in.}} = 12 \times \text{Amp. per M.V. ft.}$$

$$\text{Amps. per M.V. in.} = \text{inches per M.V. amp.}$$

$$\text{Amps. per M.V. in.} \times \frac{\text{M.V.}}{\text{Amps.}} = \text{inches drop}$$

$$\text{Amps. per M.V. in.} \times \frac{\text{M.V.(full scale)}}{\text{Amps.(full scale)}} = \text{inches drop}$$

$$\text{Area in Cir. Mils} = (\text{Diameter in mils})^2$$

$$\text{Area in Cir. Mils} = 1.273 \times 10^6 \text{ area in square inches}$$

$$\text{Area in Sq. In.} = 7.8534 \times 10^7 \text{ area in circular mils}$$