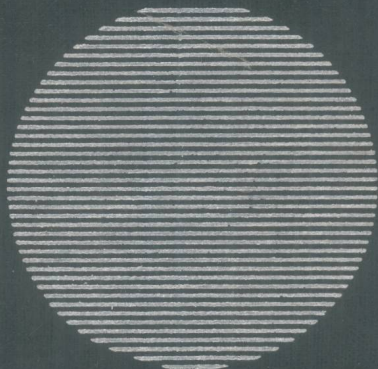




CROFT'S AMERICAN ELECTRICIANS' HANDBOOK

Revised by

Clifford C. Carr



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AMERICAN ELECTRICIANS' HANDBOOK

*A Reference Book for Practical
Electrical Workers*

CLIFFORD C. CARR, EDITOR

*Assistant Dean of the School of Engineering
Pratt Institute*

TERRELL CROFT, EDITOR, 1913 TO 1921



Eighth Edition



McGRAW-HILL BOOK COMPANY, INC.

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AMERICAN ELECTRICIANS' HANDBOOK

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PREFACE TO THE EIGHTH EDITION

In the preparation of this eighth edition of the American Electricians' Handbook the entire work has been carefully revised and expanded in accordance with the advancement of the art, the latest good practice, and the 1959 edition of the National Electrical Code. A great deal of completely new material including illustrations has been added. All illustrations have been redone and brought into accord with present-day practice.

A few of the more outstanding advancements included are new types of conductor insulation (such as THW, SA, TBS, and MI cables), safety enclosed switchgear, nickel-cadmium storage batteries, transistors, and the latest developments in fuses, motor control equipment, and luminaires. Much new material has been added on detailed instructions for the proper making of cable joints.

Every effort has been exerted to continue the original purpose of the handbook; that is, to provide a compilation of data and information on the various types of electrical equipment and materials presented without advanced mathematics and arranged so as to be as useful as possible for the intelligent selection, installation, maintenance, and operation of this equipment.

The author wishes to express his sincere appreciation to the many companies and their representatives who have given such fine cooperation in supplying illustrations, data, and valuable suggestions. Satisfactory revision of the book would have been impossible without this assistance. Special appreciation is extended to Victor F. Stampfl of the Allen-Bradley Co.; Abbott H. Lucas of the Bussmann Mfg. Co.; Peter Murphy of the General Cable Co.; J. P. Coughlin, R. D. Fitzpatrick, Donald F. Hall, and Carroll L. O'Shea of the General Electric Co.; M. S. Winslow of the Holophane Co., Inc.; and Charles J. Canniff and Edward Sullivan of the Westinghouse Electric Corp. for their most extensive cooperation.

Clifford C. Carr

Publisher's Note: Professor Clifford C. Carr had completed the revision of the manuscript for this new eighth edition before his sudden death.

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Division 1

FUNDAMENTALS

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USEFUL TABLES

1. Natural Trigonometric Functions

Angle (θ or lag angle), deg	Sine (or reactive factor)	Cosine (or power factor)	Tangent	Cotangent	Secant	Cosecant	Angle (θ or lag angle), deg
0	0.00000	1.00000	0.00000	Infinite	1.0000	Infinite	180
1	0.01774	0.99985	0.01745	57.290	1.0001	57.299	179
2	0.03490	0.99939	0.03492	28.636	1.0006	28.654	178
3	0.05234	0.99863	0.05241	19.081	1.0014	19.107	177
4	0.06976	0.99756	0.06993	14.301	1.0024	14.335	176
5	0.08715	0.99619	0.08749	11.430	1.0038	11.474	175
6	0.10453	0.99452	0.10510	9.5144	1.0055	9.5668	174
7	0.12187	0.99255	0.12278	8.1443	1.0075	8.2055	173
8	0.13917	0.99027	0.14054	7.1154	1.0098	7.1853	172
9	0.15643	0.98769	0.15838	6.3137	1.0125	6.3924	171
10	0.17365	0.98481	0.17633	5.6713	1.0154	5.7588	170
11	0.19081	0.98163	0.19438	5.1445	1.0187	5.2408	169
12	0.20791	0.97815	0.21256	4.7046	1.0223	4.8097	168
13	0.22495	0.97437	0.23087	4.3315	1.0263	4.4454	167
14	0.24192	0.97029	0.24933	4.0108	1.0306	4.1336	166
15	0.25882	0.96592	0.26795	3.7320	1.0353	3.8637	165
16	0.27564	0.96126	0.28674	3.4874	1.0403	3.6279	164
17	0.29237	0.95630	0.30573	3.2708	1.0457	3.4203	163
18	0.30902	0.95106	0.32492	3.0777	1.0515	3.2361	162
19	0.32557	0.94552	0.34433	2.9042	1.0576	3.0715	161
20	0.34203	0.93969	0.36397	2.7475	1.0642	2.9238	160
21	0.35837	0.93358	0.38386	2.6051	1.0711	2.7904	159
22	0.37461	0.92718	0.40403	2.4751	1.0785	2.6695	158
23	0.39073	0.92050	0.42447	2.3558	1.0864	2.5593	157
24	0.40674	0.91354	0.44523	2.2460	1.0946	2.4586	156
25	0.42262	0.90631	0.46631	2.1445	1.1034	2.3662	155
26	0.43837	0.89879	0.48773	2.0503	1.1126	2.2812	154
27	0.45399	0.89101	0.50952	1.9626	1.1223	2.2027	153
28	0.46947	0.88295	0.53171	1.8807	1.1326	2.1300	152
29	0.48481	0.87462	0.55431	1.8040	1.1433	2.0627	151
30	0.50000	0.86603	0.57735	1.7320	1.1547	2.0000	150
31	0.51504	0.85717	0.60086	1.6643	1.1666	1.9416	149
32	0.52992	0.84805	0.62487	1.6003	1.1792	1.8871	148
33	0.54464	0.83867	0.64941	1.5399	1.1924	1.8361	147
34	0.55919	0.82904	0.67451	1.4826	1.2062	1.7883	146
35	0.57358	0.81915	0.70021	1.4281	1.2208	1.7434	145
36	0.58778	0.80902	0.72654	1.3764	1.2361	1.7013	144
37	0.60181	0.79863	0.75355	1.3270	1.2521	1.6616	143
38	0.61566	0.78801	0.78128	1.2799	1.2690	1.6243	142
39	0.62932	0.77715	0.80978	1.2349	1.2867	1.5890	141
40	0.64279	0.76604	0.83910	1.1917	1.3054	1.5557	140
41	0.65606	0.75741	0.86929	1.1504	1.3250	1.5242	139
42	0.66913	0.74314	0.90040	1.1106	1.3456	1.4945	138
43	0.68200	0.73135	0.93251	1.0724	1.3673	1.4663	137
44	0.69466	0.71934	0.96569	1.0355	1.3902	1.4395	136
45	0.70711	0.70711	1.0000	1.0000	1.4142	1.4142	135

Natural Trigonometric Functions (Continued)

Angle (θ or lag angle), deg	Sine (or reactive factor)	Cosine (or power factor)	Tangent	Cotangent	Secant	Cosecant	Angle (θ or lag angle), deg
46	0.71934	0.69466	1.0355	0.96569	1.4395	1.3902	134
47	0.73135	0.68200	1.0724	0.93251	1.4663	1.3673	133
48	0.74314	0.66913	1.1106	0.90040	1.4945	1.3456	132
49	0.75471	0.65606	1.1504	0.86929	1.5242	1.3250	131
50	0.76604	0.64279	1.1917	0.83910	1.5557	1.3054	130
51	0.77715	0.62932	1.2349	0.80978	1.5890	1.2867	129
52	0.78801	0.61566	1.2799	0.78128	1.6243	1.2690	128
53	0.79863	0.60181	1.3270	0.75355	1.6616	1.2521	127
54	0.80902	0.58778	1.3764	0.72654	1.7013	1.2361	126
55	0.81915	0.57358	1.4281	0.70021	1.7434	1.2208	125
56	0.82904	0.55919	1.4826	0.67451	1.7883	1.2062	124
57	0.83867	0.54464	1.5399	0.64941	1.8361	1.1922	123
58	0.84805	0.52992	1.6003	0.62487	1.8871	1.1792	122
59	0.85717	0.51504	1.6643	0.60086	1.9416	1.1666	121
60	0.86603	0.50000	1.7320	0.57735	2.0000	1.1547	120
61	0.87462	0.48481	1.8040	0.55431	2.0627	1.1433	119
62	0.88295	0.46947	1.8807	0.53171	2.1300	1.1326	118
63	0.89101	0.45399	1.9626	0.50952	2.2027	1.1223	117
64	0.89879	0.43837	2.0503	0.48773	2.2812	1.1126	116
65	0.90631	0.42262	2.1445	0.46631	2.3662	1.1034	115
66	0.91354	0.40674	2.2460	0.44523	2.4586	1.0946	114
67	0.92050	0.39073	2.3558	0.42447	2.5593	1.0864	113
68	0.92718	0.37461	2.4751	0.40403	2.6695	1.0785	112
69	0.93358	0.35837	2.6051	0.38386	2.7904	1.0711	111
70	0.93969	0.34202	2.7475	0.36397	2.9238	1.0642	110
71	0.94552	0.32557	2.9042	0.34433	3.0715	1.0576	109
72	0.95106	0.30902	3.0777	0.32492	3.2361	1.0515	108
73	0.95630	0.29237	3.2708	0.30573	3.4203	1.0457	107
74	0.96126	0.27564	3.4874	0.28647	3.6279	1.0403	106
75	0.96592	0.25882	3.7320	0.26795	3.8637	1.0353	105
76	0.97029	0.24192	4.0108	0.24933	4.1336	1.0306	104
77	0.97437	0.22495	4.3315	0.23087	4.4454	1.0263	103
78	0.97815	0.20791	4.7046	0.21256	4.8097	1.0223	102
79	0.98163	0.19081	5.1445	0.19438	5.2408	1.0187	101
80	0.98481	0.17365	5.6713	0.17633	5.7588	1.0154	100
81	0.98769	0.15643	6.3137	0.15838	6.3924	1.0125	99
82	0.99027	0.13917	7.1154	0.14054	7.1853	1.0098	98
83	0.99255	0.12187	8.1443	0.12278	8.2055	1.0075	97
84	0.99452	0.10453	9.5144	0.10510	9.5668	1.0055	96
85	0.99619	0.08715	11.430	0.08749	11.474	1.0038	95
86	0.99756	0.06976	14.301	0.06993	14.335	1.0024	94
87	0.99863	0.05234	19.081	0.05241	19.107	1.0014	93
88	0.99939	0.03490	28.634	0.03492	28.654	1.0006	92
89	0.99985	0.01745	57.290	0.01745	57.299	1.0001	91
90	1.00000	0.00000	Infinite	0.00000	Infinite	1.0000	90

2. Fractions of Inch Reduced to Decimal Equivalents

Halves	4ths	8ths	16ths	32ds	64ths	Decimal equivalents	Halves	4ths	8ths	16ths	32ds	64ths	Decimal equivalents
...	...	...	...	...	$\frac{1}{16}$	0.015625	...	...	...	...	...	$\frac{3}{16}$	0.515625
...	...	...	...	$\frac{1}{32}$	$\frac{3}{16}$	0.03125	...	...	...	...	$\frac{1}{16}$	...	0.53125
...	...	...	...	...	$\frac{5}{16}$	0.046875	...	...	...	...	...	$\frac{5}{16}$	0.546875
...	...	...	$\frac{1}{16}$	...	...	0.0625	...	...	...	$\frac{1}{16}$	...	...	0.5625
...	...	...	...	$\frac{3}{16}$	$\frac{5}{16}$	0.078125	...	...	...	...	...	$\frac{3}{16}$	0.578125
...	...	...	...	$\frac{5}{16}$	...	0.09375	...	...	...	...	$\frac{1}{32}$	...	0.59375
...	...	...	...	$\frac{3}{8}$	$\frac{3}{4}$	0.109375	...	...	...	...	...	$\frac{3}{8}$	0.609375
...	...	$\frac{1}{8}$	...	...	...	0.125	...	...	$\frac{3}{8}$	...	...	...	0.625
...	...	...	...	...	$\frac{3}{4}$	0.140625	...	...	...	...	...	$\frac{1}{4}$	0.640625
...	...	...	...	$\frac{1}{8}$	...	0.15625	...	...	...	...	$\frac{1}{8}$	...	0.65625
...	...	...	...	...	$\frac{1}{4}$	0.171875	...	...	...	...	...	$\frac{1}{4}$	0.671875
...	...	...	$\frac{1}{4}$	...	...	0.1875	...	...	...	$\frac{1}{4}$	...	...	0.6875
...	...	...	...	...	$\frac{1}{2}$	0.203125	...	...	...	...	...	$\frac{1}{2}$	0.703125
...	...	...	...	$\frac{1}{2}$	...	0.21875	...	...	...	...	$\frac{1}{8}$	...	0.71875
...	...	...	...	...	$\frac{1}{2}$	0.234375	...	...	...	...	...	$\frac{1}{2}$	0.734375
...	$\frac{1}{4}$	...	...	...	...	0.25	...	$\frac{1}{4}$	...	...	...	...	0.75
...	...	...	...	...	$\frac{1}{2}$	0.265625	...	...	...	...	...	$\frac{1}{2}$	0.765625
...	...	...	...	$\frac{1}{8}$	...	0.28125	...	...	...	...	$\frac{1}{8}$	...	0.78125
...	...	...	...	$\frac{1}{4}$	$\frac{1}{2}$	0.296875	...	...	...	...	...	$\frac{1}{4}$	0.796875
...	...	...	$\frac{1}{2}$	...	...	0.3125	...	...	...	$\frac{1}{2}$	...	...	0.8125
...	...	...	...	...	$\frac{1}{2}$	0.328125	...	...	...	...	...	$\frac{1}{2}$	0.828125
...	...	...	...	$\frac{1}{8}$	$\frac{1}{2}$	0.34375	...	...	...	...	$\frac{1}{8}$	...	0.84375
...	...	...	...	$\frac{1}{4}$	$\frac{1}{2}$	0.359375	...	...	...	...	...	$\frac{1}{4}$	0.859375
...	...	$\frac{3}{8}$	...	...	...	0.375	...	...	$\frac{3}{8}$	...	...	...	0.875
...	...	...	...	...	$\frac{1}{2}$	0.390625	...	...	...	...	...	$\frac{1}{2}$	0.890625
...	...	...	...	$\frac{1}{8}$	...	0.40625	...	...	...	...	$\frac{1}{8}$	...	0.90625
...	...	...	...	$\frac{1}{4}$	$\frac{1}{2}$	0.421875	...	...	...	...	...	$\frac{1}{4}$	0.921875
...	...	...	$\frac{1}{2}$	...	...	0.4375	...	...	...	$\frac{1}{2}$	...	...	0.9375
...	...	...	...	...	$\frac{1}{2}$	0.453125	...	...	...	...	...	$\frac{1}{2}$	0.953125
...	...	...	...	$\frac{1}{8}$	...	0.46875	...	...	...	...	$\frac{1}{8}$	...	0.96875
...	...	...	...	$\frac{1}{4}$	$\frac{1}{2}$	0.484375	...	...	...	...	...	$\frac{1}{4}$	0.984375
$\frac{1}{2}$	...	...	...	...	...	0.5	...	...	...	...	...	...	...

3. In figuring discounts on electrical equipment, it is often necessary to apply primary and secondary discounts. By using the values in Table 4, time and labor may be conserved. To find net price, multiply the list or gross price by the multiplier from the table which corresponds to the discounts.

Example. The discount on iron conduit may be quoted as 25 and 10 with 2 per cent for cash in 10 days. To obtain the actual cost, 25 per cent would be deducted from the list price, then 10 per cent from that result, and finally 2 per cent from the second result. Assuming that the list price of $\frac{3}{4}$ -in. conduit is \$12 per 100 ft, its actual price with the 25, 10, and 2 per cent discounts would be:

$$\begin{aligned}
 \$12 \text{ minus } 0.25 \times \$12 &= \$12 - \$3 = \$9 \\
 \$9.00 \text{ minus } 0.10 \times \$9.00 &= \$9.00 - \$0.90 = \$8.10 \\
 \$8.10 \text{ minus } 0.02 \times \$8.10 &= \$8.10 - \$0.16 = \$7.94
 \end{aligned}$$

Therefore, the net cost of the conduit would be \$7.94 per 100 ft. Now by using the multiplier (from Table 4) corresponding to a primary discount of 25 per cent and secondary discounts of 10 and 2 per cent, which is 0.661,

$$\$12.00 \times 0.661 = \$7.94$$

This is the same result as that obtained by using the longer method.

4. Table for Figuring Total Discount Multiplier by Combining Primary and Secondary Discounts

Primary discount, per cent	Secondary discounts						
	2 %	5 %	10 %	15 %	5 and 2 %	10 and 2 %	10 and 5 %
	Multiplier						
0	0.980	0.950	0.900	0.850	0.931	0.882	0.855
5	0.931	0.902	0.855	0.807	0.884	0.838	0.812
10	0.882	0.855	0.810	0.765	0.838	0.794	0.769
11	0.872	0.845	0.801	0.756	0.829	0.785	0.761
12	0.862	0.836	0.792	0.748	0.819	0.776	0.752
13	0.853	0.826	0.783	0.740	0.810	0.767	0.744
14	0.843	0.817	0.774	0.731	0.801	0.758	0.735
15	0.833	0.807	0.765	0.722	0.791	0.750	0.727
16	0.823	0.798	0.756	0.714	0.782	0.741	0.718
17	0.813	0.788	0.747	0.705	0.773	0.732	0.710
18	0.803	0.779	0.738	0.697	0.763	0.723	0.701
19	0.794	0.770	0.729	0.688	0.754	0.714	0.692
20	0.784	0.760	0.720	0.680	0.745	0.705	0.684
25	0.735	0.712	0.675	0.638	0.698	0.661	0.641
30	0.686	0.665	0.630	0.595	0.652	0.617	0.598
35	0.637	0.617	0.585	0.552	0.605	0.573	0.556
40	0.588	0.570	0.540	0.510	0.559	0.529	0.513
45	0.539	0.522	0.495	0.468	0.512	0.485	0.470
50	0.490	0.475	0.450	0.425	0.465	0.441	0.428
55	0.441	0.427	0.405	0.382	0.419	0.397	0.385
60	0.392	0.380	0.360	0.340	0.372	0.353	0.342
65	0.343	0.333	0.315	0.298	0.326	0.309	0.299
70	0.294	0.285	0.270	0.255	0.279	0.265	0.256



5. Multipliers for Computing Selling Prices Which Will Afford a Given Percentage Profit

Percentage profit desired	To obtain selling price, multiply actual cost (invoice cost + freight) by the following value		Percentage profit desired	To obtain selling price, multiply actual cost (invoice cost + freight) by the following value	
	When percentage profit is based on cost	When percentage profit is based on selling price		When percentage profit is based on cost	When percentage profit is based on selling price
5	1.05	1.053	36	1.36	1.563
6	1.06	1.064	37	1.37	1.588
7	1.07	1.075	38	1.38	1.613
8	1.08	1.087	39	1.39	1.640
9	1.09	1.100	40	1.40	1.667
10	1.10	1.111	41	1.41	1.695
11	1.11	1.124	42	1.42	1.725
12	1.12	1.136	43	1.43	1.754
13	1.13	1.149	45	1.45	1.818
14	1.14	1.163	46	1.46	1.852
15	1.15	1.176	47	1.47	1.887
16	1.16	1.190	48	1.48	1.923
17	1.17	1.204	49	1.49	1.961
18	1.18	1.220	50	1.50	2.000
19	1.19	1.235	52	1.52	2.084
20	1.20	1.250	54	1.54	2.174
21	1.21	1.267	56	1.56	2.272
22	1.22	1.283	58	1.58	2.381
23	1.23	1.299	60	1.60	2.500
24	1.24	1.316	62	1.62	2.631
25	1.25	1.334	64	1.64	2.778
26	1.26	1.352	66	1.66	2.941
27	1.27	1.370	68	1.68	3.126
28	1.28	1.390	70	1.70	3.333
29	1.29	1.409	72	1.72	3.572
30	1.30	1.429	74	1.74	3.847
31	1.31	1.450	76	1.76	4.168
32	1.32	1.471	78	1.78	4.545
33	1.33	1.493	80	1.80	5.000
34	1.34	1.516	90	1.90	10.000
35	1.35	1.539	100	2.00	Infinity

6. Table Showing Percentage Net Profit

Percentage markup above cost	Percentage overhead							
	10 %	12 %	14 %	16 %	18 %	20 %	22 %	24 %
	Percentage net profit based on selling price for a given percentage overhead based on gross sales							
10	-0.90	-2.90	-4.90	-6.90	-8.90	-10.90	-12.90	-14.90
15	3.05	1.05	-0.95	-2.95	-4.95	-6.95	-8.95	-10.95
20	6.67	4.67	2.67	0.67	-1.33	-3.33	-5.33	-7.33
25	10.00	8.00	6.00	4.00	2.00	0.00	-2.00	-4.00
30	13.08	11.08	9.08	7.08	5.08	3.08	1.08	-0.92
33½	15.00	13.00	11.00	9.00	7.00	5.00	3.00	1.00
35	15.93	13.93	11.93	9.93	7.93	5.93	3.93	1.93
40	18.57	16.57	14.57	12.57	10.57	8.57	6.57	4.57
45	21.00	19.00	17.00	15.00	13.00	11.00	9.00	7.00
50	23.33	21.33	19.33	17.33	15.33	13.33	11.33	9.33
55	25.50	23.50	21.50	19.50	17.50	15.50	13.50	11.50
60	27.50	25.50	23.50	21.50	19.50	17.50	15.50	13.50
65	29.40	27.40	25.40	23.40	21.40	19.40	17.40	15.40
70	31.18	29.18	27.18	25.18	23.18	21.18	19.18	17.18
75	32.85	30.85	28.85	26.85	24.85	22.85	20.85	18.85
80	34.45	32.45	30.45	28.45	26.45	24.45	22.45	20.45
85	35.95	33.95	31.95	29.95	27.95	25.95	23.95	21.95
90	37.37	35.37	33.37	31.37	29.37	27.37	25.37	23.37
95	38.72	36.72	34.72	32.72	30.72	28.72	26.72	24.72
100	40.00	38.00	36.00	34.00	32.00	30.00	28.00	26.00

NOTE. Minus (-) values indicate a net loss.

7. Net Profits. In figuring the net profit of doing business, Table 6 will be found to be very useful. The table may be used in three ways as explained below.

TO DETERMINE THE PERCENTAGE OF NET PROFIT ON SALES THAT ONE IS MAKING. Locate, at the top of one of the vertical columns, your percentage overhead—your “cost of doing business” in percentage of gross sales. Locate, at the extreme left of one of the horizontal columns, your percentage markup. The value at the intersection of these two columns will be the percentage profit which you are making.

Example. If your cost of doing business is 18 per cent of your gross sales and you mark your goods at 35 per cent above cost, your net profit is then 7.93 per cent of gross sales, obtained by carrying down from the column headed 18 per cent and across from the 35 per cent markup.

TO DETERMINE WHAT PERCENTAGE OVERHEAD COST OF DOING BUSINESS WOULD YIELD A CERTAIN NET PROFIT FOR A GIVEN MARKUP PERCENTAGE. Locate in the extreme left-hand column the percentage that the selling price is marked above the cost price. Trace horizontally across from this value until the percentage net profit desired is located. At the top of the column in which the desired net profit is located will be found the percentage overhead cost of doing business that will allow this profit to be made.

Example. If the markup is 45 per cent and the profit desired is 15 per cent, an overhead cost of doing business of 16 per cent can be allowed, obtained by carrying across from the 45 per cent markup to the 15 per cent profit and finding that this column is headed by 16 per cent overhead.

TO DETERMINE WHAT PERCENTAGE SHOULD BE ADDED TO THE COST OF GOODS IN ORDER TO MAKE A CERTAIN PERCENTAGE NET PROFIT ON SALES. Select the vertical column which shows the percentage cost of doing business at its top. Trace down the column until the desired percentage profit is found; from this value trace

horizontally to the extreme left-hand column, in which will be found the markup percentage—the percentage to be added to the cost to afford the desired profit.

Example. It is desired to make a 12 per cent net profit when the cost of doing business is 20 per cent of the gross sales. Select the vertical column with 20 per cent at its top. Trace down the column to locate the net profit desired of 12 per cent. This will be part way between 11.00 and 13.33. Carrying across to the left from these values gives a required markup between 45 and 50, or approximately 47 per cent.

For values which do not appear in the table, approximate results can be obtained by estimation from the closest values in the table. If more accurate results are desired for these intermediate values, the following formulas may be used:

$$P = 100 - h - \frac{10,000}{100 + m} \quad (1)$$

or
$$m = \frac{100(P + h)}{100 - (P + h)} \quad (2)$$

or
$$h = 100 - P - \frac{10,000}{100 + m} \quad (3)$$

where m = percentage markup based on cost of goods; h = percentage overhead based on gross sales; P = percentage net profit based on selling price.

If you sell your goods at the retail list prices set by the manufacturers, you can use the table by converting the trade discount which you receive to an equivalent percentage markup, according to the following table:

Manufacturer's discount	Equivalent percentage markup	Manufacturer's discount	Equivalent percentage markup
10	11	35	54
15	17½	40	66⅔
20	25	45	81¼
25	33¼	50	100
30	43		

Intermediate values may be calculated from following formula:

$$m = \frac{100Q}{100 - Q} \quad (4)$$

where m = percentage markup based on cost of goods and Q = manufacturer's discount

CONVERSION FACTORS

("Standard Handbook for Electrical Engineers")

These factors were calculated with a double-length slide rule and checked with those given by Carl Hering in his "Conversion Tables."

8. Length

- 1 mil = 0.0254 mm = 0.001 in.
- 1 mm = 39.37 mils = 0.03937 in.
- 1 cm = 0.3937 in. = 0.0328 ft.
- 1 in. = 25.4 mm = 0.083 ft = 0.0278 yd = 2.54 cm.
- 1 ft = 304.8 mm = 12 in. = 0.333 yd = 0.305 m.
- 1 yd = 91.44 cm = 36 in. = 3 ft = 0.914 m.
- 1 m = 39.37 in. = 3.28 ft = 1.094 yd.
- 1 km = 3,281 ft = 1,094 yd = 0.6213 mile.
- 1 mile = 5,280 ft = 1,760 yd = 1,609 m = 1.609 km.