T.E. AND LOOP RESISTANCE FOR NON-LOADED CIRCUITS

(SEE NOTES ON PAGE 4) RESISTANCE OHMS/MILE LOOP T.E. IN DB/MILE

UNLOADED CABLE P.C.Q.L.- P.C.Q. OR P.C.Q.T. - AVERAGES

Length		Loop Resistance				Db. at 800 c/s				Db. at 1600 c/s				Db. at 2000 c/s			
Miles	Yards	4lb	6½ lb	10lb	20lb	4lb	6½ lb	10lb	20lb	4lb	6½ lb	10lb	20lb	4lb	6½ lb	10lb	20lb
0.1	176	44	27	17.6	8.8	0.21	0.19	0.15	0.10	0.30	0.27	0.21	0.14	0.33	0.29	0.23	0.15
0.2	352	88	54	35.2	17.6	0.42	0.38	0.29	0.20	0.60	0.54	0.41	0.27	0.65	0.58	0.46	0.30
0.3	528	132	81	52.8	26.4	0.63	0.57	0.44	0.29	0.90	0.80	0.62	0.41	0.98	0.87	0.68	0.45
0.4	704	176	108	70.4	35.2	0.84	0.76	0.58	0.39	1.20	1.07	0.82	0.54	1.30	1.16	0.91	0.60
0.5	880	220	135	88.0	44.0	1.05	0.95	0.73	0.49	1.50	1.34	1.03	0.68	1.63	1.45	1.14	0.75
0.6	1056	264	162	105.6	52.8	1.26	1.13	0.87	0.59	1.80	1.61	1.23	0.81	1.95	1.74	1.37	0.89
0.7	1232	308	189	123.2	61.6	1.47	1.32	1.02	0.69	2.10	1.88	1.44	0.95	2.28	2.03	1.60	1.04
0.8	1408	352	216	140.8	70.4	1.68	1.51	1.16	0.78	2.40	2.14	1.64	1.08	2.60	2.32	1.82	1.19
0.9	1584	396	243	158.4	79.2	1.89	1.70	1.31	0.88	2.70	2.41	1.85	1.22	2.93	2.61	2.05	1.34
1.0	1760	440	270	176.0	88	2.10	1.89	1.45	0.98	3.00	2.68	2.05	1.35	3.25	2.90	2.28	1.49
		40lb	70lb	100lb	150lb	40lb	70lb	100lb	150lb	40lb	70lb	100lb	150lb	40lb	70lb	100lb	150lb
0.1	176	4.4	2.5	1.76	1.17	0.07	0.05	0.04	0.03	0.10	0.07	0.06	0.04	0.11	0.07	0.06	0.04
0.2	352	8.8	5.0	3.52	2.34	0.15	0.09	0.09	0.07	0.19	0.13	0.11	0.08	0.21	0.14	0.12	0.09
0.3	528	13.2	7.5	5.28	3.51	0.22	0.14	0.13	0.10	0.29	0.20	0.17	0.13	0.32	0.22	0.18	0.13
0.4	704	17.6	10.0	7.04	4.68	0.30	0.18	0.18	0.14	0.39	0.26	0.22	0.17	0.42	0.29	0.24	0.18
0.5	880	22.0	12.5	8.80	5.85	0.37	0.23	0.22	0.17	0.49	0.33	0.28	0.21	0.53	0.36	0.30	0.22
0.6	1056	26.4	15.0	10.56	7.02	0.44	0.28	0.26	0.20	0.58	0.40	0.33	0.25	0.64	0.43	0.36	0.26
0.7	1232	30.8	17.5	12.32	8.19	0.52	0.32	0.31	0.24	0.68	0.46	0.39	0.29	0.74	0.50	0.42	0.31
0.8	1408	35.2	20.0	14.08	9.36	0.59	0.37	0.35	0.27	0.78	0.53	0.44	0.34	0.85	0.58	0.48	0.35
0.9	1584	39.6	22.5	15.84	10.53	0.67	0.41	0.40	0.31	0.87	0.59	0.50	0.38	0.95	0.65	0.54	0.40
1.0	1760	44.0	25.0	17.60	11.70	0.74	0.46	0.44	0.34	0.97	0.66	0.55	0.42	1.06	0.72	0.60	0.44

AERIAL LINES – NOMINAL ATTENTUATION

Length		Loop Resistance				Db. at 800 c/s				Db. at 1600 c/s				Db. at 2000 c/s			
Miles	Yards	bz 40lb	bz 70lb	bz 150lb	c.c. 40lb	bz 40lb	bz 70lb	bz 150lb	c.c. 40lb	bz 40lb	bz 70lb	bz 50lb	c.c. 40lb	bz 40lb	bz 70lb	bz 150lb	c.c. 40lb
0.1	176	9.1	5.2	2.4	5.2	0.03	0.02	0.01	0.02	0.04	0.03	0.02	0.03	0.04	0.03	0.02	0.03
0.2	352	18.2	10.4	4.8	10.4	0.07	0.05	0.03	0.05	0.08	0.06	0.03	0.05	0.09	0.06	0.03	0.06
0.3	528	27.3	15.6	7.2	15.6	0.10	0.07	0.04	0.07	0.13	0.09	0.05	0.08	0.13	0.09	0.05	0.08
0.4	704	36.4	20.8	9.6	20.8	0.13	0.10	0.06	0.09	0.17	0.12	0.06	0.11	0.18	0.12	0.06	0.11
0.5	880	45.5	26.0	12.0	26.0	0.17	0.12	0.07	0.12	0.21	0.15	0.08	0.14	0.22	0.15	0.08	0.14
0.6	1056	54.6	31.2	14.4	31.2	0.20	0.14	0.08	0.14	0.25	0.17	0.10	0.16	0.26	0.18	0.10	0.17
0.7	1232	63.7	36.4	16.8	36.4	0.23	0.17	0.10	0.16	0.29	0.20	0.11	0.19	0.31	0.21	0.11	0.20
0.8	1408	72.8	41.6	19.2	41.6	0.26	0.19	0.11	0.18	0.34	0.23	0.13	0.22	0.35	0.24	0.13	0.22
0.9	1584	81.9	46.8	21.6	46.8	0.30	0.22	0.13	0.21	0.38	0.26	0.14	0.24	0.40	0.27	0.14	0.25
1.0	1760	91.0	52.0	24.0	52.0	0.33	0.24	0.14	0.23	0.42	0.29	0.16	0.27	0.44	0.30	0.16	0.28
		c.c. 70lb	c.c. 150lb	cu 100lb	cu 150lb	c.c. 70lb	c.c. 150lb	cu 100lb	cu 150lb	c.c. 70lb	c.c. 150lb	cu 100lb	cu 150lb	c.c. 70lb	c.c. 150lb	cu 100lb	cu * 150lb
0.1	176	3.0	1.4	1.76	1.17	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
0.2	352	6.0	2.8	3.52	2.34	0.03	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02
0.3	528	9.0	4.2	5.28	3.51	0.05	0.02	0.03	0.02	0.05	0.03	0.03	0.02	0.05	0.03	0.03	0.02
0.4	704	12.0	5.6	7.04	4.68	0.06	0.03	0.04	0.03	0.07	0.04	0.04	0.03	0.07	0.04	0.04	0.03
0.5	880	15.0	7.0	8.80	5.85	0.08	0.04	0.06	0.04	0.09	0.05	0.06	0.04	0.09	0.05	0.06	0.04
0.6	1056	18.0	8.4	10.56	7.02	0.10	0.05	0.07	0.05	0.11	0.05	0.07	0.05	0.11	0.05	0.07	0.05
0.7	1232	21.0	9.8	12.32	8.19	0.11	0.06	0.08	0.06	0.13	0.06	0.08	0.06	0.13	0.06	0.08	0.06
0.8	1408	24.0	11.2	14.08	9.36	0.13	0.06	0.09	0.06	0.14	0.07	0.09	0.06	0.14	0.07	0.09	0.06
0.9	1584	27.0	12.6	15.84	10.53	0.14	0.07	0.10	0.07	0.16	0.08	0.10	0.07	0.16	0.08	0.10	0.07
1.0	1760	30.0	14.0	17.60	11.70	0.16	0.08	0.11	0.08	0.18	0.09	0.11	0.08	0.18	0.09	0.11	0.08

bz. = Bronze cu. = Copper c.c. = Cadmium Copper

* { 200 lb. cu. 8.8 ohm/ml. 0.06 db/ml
300 lb. cu. 5.4 ohms/ml 0.04 db/ml

TRANSMISSION EQUIVALENTS OF COIL-LOADED UNDERGROUND CIRCUITS

SIDE CIRCUITS ONLY LOADED (M.E.C. 0.066 µF/ml.)

Loading Code	Weight of Conductor in lb. per mile of single wire						Approximate characteristic impedance $\sqrt{\frac{L}{C}}$ OHMS	Approximate cut-off frequency c/s
	10	20	25	40	70	100		
	Transmission equivalent in db. per mile							
250/1.136	0.54	0.25		0.145	0.10		1860	2320
176/1.136	0.58	0.28	0.23	0.155	0.102		1560	2770
176/1.3		0.30	0.24	0.16	0.104		1430	2610
176/1.6		0.32	0.26	0.17	0.11		1310	2340
136/1.136		0.31	0.25	0.165	0.107		1370	3170
136/1.3		0.32	0.26	0.170	0.11	0.082	1270	2970
136/1.6		0.35	0.29	0.185	0.115		1140	2680
136/2.272		0.41	0.33	0.21	0.13	0.096	980	2240
136/2.4		0.42	0.34	0.22	0.13		950	2180
136/2.6		0.43	0.35	0.23	0.14	0.10	920	2090
120/1.136	0.64	0.32	0.26	0.17	0.105	0.081	1260	3340
120/1.3	0.67	0.34	0.28	0.18	0.11		1200	3160
120/1.4		0.35	0.285	0.185	0.113	0.088	1150	3040
120/1.6	0.74	0.37	0.30	0.195	0.12		1080	2860
120/2.272	0.84	0.43	0.35	0.225	0.135		800	2400
120/2.6		0.46	0.37	0.24	0.14		820	2240
88/1.136	0.73	0.37	0.30	0.19	0.12	0.09	1110	3920
88.1.25		0.38					1070	3760
88/1.6		0.42	0.34	0.22	0.13		920	3270
44/1.136	0.97	0.49	0.37	0.26	0.155	0.114	780	5470
44/1.6		0.57	0.47	0.305	0.175		650	4590
30/1.136		0.58	0.48	0.31	0.18		640	6590
27/1.136		0.60	0.50	0.32	0.186		610	6950
22/1.136	1.18	0.49	0.40	0.26	0.15		780	10900
22/.568		0.65	0.54	0.36	0.205		550	7640
22/1.3				0.37			510	7120
20/1.136		0.66	0.55	0.37	0.215		520	8000
20/1.6		0.72	0.61	0.43	0.25		440	6660
16/1.136		0.70	0.59	0.41	0.24		490	8880
16/1.3				0.43			440	8260
16/1.6				0.46			400	7380
6/.568		0.75	0.64	0.45	0.27		420	20000
16/.568		0.59		0.31			660	12770

Loading Code: 250/1.136 = 250 mH. Coils at 1.136 miles spacing
250 S/156P/1.136 = 250 mH. Coils on side cct., 156 mH. Coils on Phantom, 1.136 miles.

NB – In general, working limist = 75% theoretical cut off frequency.

SIDE AND PHANTOM CIRCUITS LOADED (M.E.C. 0.062 µF/ml.)

Loading Code	Weight of Conductor in lb. per mile of single wire								Side Circuit		Phantom	
	20		25		40		70		Approximate characteristic impedance	Approximate characteristic frequency	Approximate characteristic impedance	Approximate characteristic frequency
	Transmission equivalent in db. per mile											
	Side	Ph.	Side	Ph.	Side	Ph	Side	Ph.				
250S/156P/1.136	0.155	0.21			0.155	0.126	0.112	0.089	1860	2320	1150	2340
176S/106P/1.136	0.29	0.235			0.165	0.135	0.113	0.092	1560	2770	950	2820
176S/106P/1.4					0.175	0.145			1400	2520	860	2560
176S/106P/1.6	0.33	0.27			0.18	0.154	0.12	0.10	1310	2340	810	2380
136S/82P/1.136	0.32	0.26			0.176	0.15	0.117	0.10	1370	3170	840	3200
136S/82P/2.272	0.42	0.35			0.22	0.19	0.14	0.123	980	2240	600	2260
136S/82P/2.6	0.44	0.37			0.23	0.20	0.145	0.13	920	2090	560	2120
120S/40P/1.136	0.33	0.36			0.17	0.195	0.105	0.125	1260	3400	590	4650
120S/40P/1.4					0.195	0.21			1150	3040	530	4200
88S/54P/1.136	0.37	0.31	0.31	0.26	0.20	0.175	0.125	0.114	1110	4020	680	3940
88S/54P/1.6	0.42	0.36	0.34	0.30	0.23	0.195	0.13	0.125	920	3350	580	3400
88S/32P/1.136	0.37	0.38	0.31	0.32	0.20	0.21	0.125	0.13	1110	3920	530	5180
88S/32P/1.6	0.42	0.44	0.34	0.37	0.23	0.24	0.13	0.145	920	3350	450	4330
44S/24P/1.136	0.50	0.43			0.27	0.23	0.16	0.145	780	5570	460	5940
44S/24P/1.4					0.29				700	5500	420	5330
44S/16P/1.136	0.50	0.49			0.27	0.27	0.16	0.165	780	5570	380	7200
22S/12P/1.136	0.66	0.54			0.37	0.30	0.21	0.18	550	7910	340	8200

T.E. AND LOOP RESISTANCE FOR MISCELLANEOUS CIRCUITS

Cable	Conductor Weight	Dielectric Weight	Resistance	Attenuation db/mile or db/ naut.				
				800 c/s	1600 c/s	2000 c/s	6000 c/s	10000 c/s
-	12½	-	140ohm/ml.	1.25				
P.C.Q.T.	25	-	70.4 ohm/ml.	0.96	1.25	1.34	1.85	2.28
P.C.Q.T. (Phantom)	10	-	88 ohm/ml.	1.56	2.55	2.90	4.90	5.90
P.C.Q.T. (Phantom)	20	-	44 ohm/ml.	0.92	1.35	1.50	2.55	3.58
Carrier (Pantom)	40	-	22 ohm/ml.	0.75	1.00	1.12	1.57	1.75
Unloaded Scr. Pr.	40	-	44 ohm/ml.	0.57	0.80	0.88	1.20	1.38
40 lb. Scr. Pr./16/1.136	40	-	44 ohm/ml.	0.36	0.37	0.37	0.41	
Submarine (pair cct.)	42¼ lb./naut.	55 lb./naut.	57 ohm/naut.	1.16				
" (Single Wire)	107 lb./naut	150 lb./naut	11.25 ohm/naut.	0.66	0.83	0.90		
" (pair cct.)	107 lb./naut	150 lb./naut	22.5 ohm/naut.	0.62	0.74	0.78		
" (Phantom)	107 lb./naut	150 lb./naut	11.5 ohm/naut.	0.66	0.80	0.86		
" (pair cct.)	160 lb./naut	105 lb./naut	14.9	0.53				
Covered Drop Wire	31 lb/ml.		67 ohm/ml.	1.3				

A 140 – *contd.*

INDUCTANCE AND DIRECT CURRENT RESISTANCE OF LOADING COILS

SIDE CIRCUITS ONLY LOADED									SIDE AND PHANTOMS LOADED			
Nominal Inductance Mh	Code	Average Loop Resist. Ohms	Nominal Inductance Mh	Code	Average Loop Resist. Ohms	Nominal Inductance Mh	Code	Average Loop Resist. Ohms	Nominal Inductance Millihenries		Code	Average Loop Resist. S.+Ph.
									Side	Phantom		
250	506	5.6	88	588	3.8	22	694	1.4	250	156	582+581	15.6
or 253	582	10.5	or	688	3.7	or	794	1.3	176	106	584+583	11.0
176	508	4.0	89	788	3.1	20	A 22	1.0			A 176+106	12.2
or	584	7.4		A 88	3.0		B 22	1.8	136	82	535+536	4.6
177	684	7.3		B 88	4.3		Grade 1	1.1			586+585	9.2
	784	5.9		Grade 1	3.1		Grade 2	1.75			786+785	9.7
	400	7.0		Grade 2	3.5		Grade 3	2.0			A 136+ 82	9.8
	A 176	6.2		Grade 3	5.0		M 22	2.4	120	40	796+795	7.0
	Grade 1	5.0	68	Grade 1	2.7	16	676	1.5			A 120+ 40	7.2
	Grade2	7.2		Grade 2	3.0	or	776	0.9	88	54	588+587	6.0
	Grade 3	9.5		Grade 3	4.2	15	Grade 1	0.9			A 88+ 54	6.7
136	507	3.3	60	678	2.8		M16	2.1	88	32	788+787	5.1
	535	3.0		A 60	2.1	11 or	Grade 1	0.8			A 88+ 32	6.3
	586	6.2		B 60	3.6	10	M11	1.7	60	20	60+20	4.0
	786	4.4		C 60	4.4	8	Grade 1	0.6	44	24	590+589	3.2
	401	5.5		Grade 1	2.4		M 8	1.3			690+689	3.8
	A 136	4.8		Grade 2	2.5						790+789	3.2
	Grade 1	4.4		Grade 3	3.5						A 44+ 24	3.8
	Grade2	5.5	44	590	2.0				44	16	A 44+ 16	3.5
	Grade 3	7.4		690	2.0				22	12	A 22+ 12	2.2
120	696	4.9		790	1.7							
	796	4.9		A 44	1.7							
	A 120	4.1		B 44	2.5							
	B 120	5.8		C 44								
	C 120	8.0		Grade 1	1.9							
	Grade 1	4.2		Grade 2	2.3							
	Grade 2	4.7		Grade 3	2.7							
	Grade 3	6.7										

NOTES REFERING TO PAGE 1

1. Attenuation coefficients for cables are representative results and may be applied to any make-up of cable.
2. Attenuation coefficients for o/h lines are theoretical and neglect leakance. Practical values vary widely but will always exceed those quoted.
3. For use of the tables as a ready reckoner consider as example 1.453 miles of 6½ lb. cable.

LINE TRANSFORMERS

Suffix	Impedance Ratio Line: Office	Line Impedance Range (ohms.)	D.C. Resistance 48 Type	
			Line	Office
G	0.133 : 1	Below 120	2.9-3.4	19 Max.
F	0.286 : 1	120-200	5.8-6.7	
E	0.38 : 1	200-260	6.5-7.3	
J	0.5 : 1	260-330	8.9-10.1	
D	0.62 : 1	330-470	10.7-12	
A	1 : 1	470-760	16.5-18.5	
B	1.6 : 1	760-1100	28-32	
H	2.0 : 1	1100-1380	37-41	
C	2.6 : 1	Above 1380	43.5-49.5	

Miles	Yards	Resistance ohms	T.E. at 2000 c/s db.
1.0	1760	270.	2.90
0.4	704	108	1.16
0.05	88	13.5	.15
0.003	5.28	.8	.01
1.453	2557	392.3	4.22

Loop resistance = $\frac{\text{Length in yards}}{\text{gauge in lb/mile}}$

NOTE: - Code numbers, unless preceded by one or two letters, are preceded by a digit inidcating the manufacturer.

(756) Wt. 62446/D42437 2M. 10/52 W. B. & S. Ltd 544