115-TYPE NETWORKS FOR TOLL MESSAGE AND PROGRAM CIRCUITS

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1. GENERAL

1.01 This section describes the various toll message and program circuit networks that are available in the 115-type design. Some of the older type networks have not been redesigned to the 115-type; information on these is given in Section 332-851-102.

1.02 This issue replaces Issue 1, dated December, 1942; and Addendum, Issue 2, dated December, 1948. The section has been revised to include five new 115-type networks designed for balancing toll cable circuits and three new 115-type networks for balancing or test termination for program transmission circuits.

1.03 The networks are listed on attached tables as follows:

Table A—Open-Wire Networks

Table B—Toll Cable Networks

Table C—Toll Entrance Cable Networks

Table D—Program Circuit Networks.

A figure is attached for each network giving complete information on the network, including a circuit diagram and network, impedance, and return-loss performance. In the case of certain of the open-wire networks, the strapping arrangement for different wire spacing is included.

1.04 The 115P network is satisfactory as a balancing network for 16- or 19-gauge H-86-32 side circuits. The 115BG network has been designed for use on 16- or 19-gauge H-86-32 phantom circuits. Circuit information, impedance, and return-loss data for this network are given in Fig. 26. The loading for H-86-32 facilities is obtained by paralleling two H-172-63 loading units at each loading point.

1.05 The 115AM network is designed to balance H-172-63 and H-174-106 side circuits. The 115AN is designed to balance H-172-63 phantom circuits and the 115AP is designed to balance H-174-106 phantom circuits.

1.06 The five new toll cable circuit networks are designated 115BM, BN, BP, BR, and BS. The 115BM and BN networks are intended for balancing the impedance of 10-, 13-, and 16-gauge H-44 side and H-25 phantom circuits, respectively, and replace the 104E and 104F balancing networks. The 115BP and BR networks are intended for

balancing the impedance of 13-gauge H-31 side and H-18 phantom circuits, respectively; and they replace the 107A and 107D balancing networks.

1.07 The 115BS network has been provided for balancing the impedance of 16-gauge B-22-N cable and replaces the D-87801 balancing network. The other three new networks for terminating or balancing 15-kHz program transmission circuits are designated 115BH, BJ, and BK. They have been provided for use with 16- or 19-gauge pairs having a capacitance of 0.062 μF per mile and equipped with 3000-7.5, 1000-7.5, and 1500-11 loading systems. In the above loading systems the first figure represents the loading spacing in feet, and the second figure represents the inductance of the loading in millihenries. The principal use of these networks will be for the termination of the loading systems when making impedance runs to check the loading layout. However, they can also be used as balancing networks if it is desired to apply 2-wire repeaters to the program circuits for temporary use as message circuits.

1.08 These three networks will also be suitable for test terminations in connection with impedance measurements on 15-kHz program transmission circuits in exchange cables that have their loading spacing reduced to an equivalent of 0.062 μF per mile.

1.09 The 115BK network should also be satisfactory for terminating or balancing 19-gauge B-22 program transmission circuits in the frequency range of about 100 to 5000 Hz. If this network is not available, a suitable network for a 19-B-22 pair may be obtained by modifying the 115T network (Fig. 1) as follows: remove strap between terminals 2 and 3, connect 150 ohms between terminals 2 and 3, and strap between terminals 5 and 6.

2. DESCRIPTION OF NETWORKS

2.01 The 115-type network consists of various capacitors, resistors, and (usually) retardation coils, all potted as one assembly and contained under a common can cover. The network is 6-15/16 inches high, 4-3/8 inches deep, 1-5/8 inches wide and is arranged for single-side relay-rack stud mounting on 7-inch vertical and 1-3/4 inch horizontal centers. The network terminals are in the rear. Each network contains a building-out capacitor, the terminals of which are in the front beneath the can cover. The code of the network is stamped on the cover and also on the rear of the network.

A. Open-Wire Networks

2.02 Separate networks are not provided for different spacings of conductors as was done with the older types. Instead, different spacings are cared for by suitable strapping of the network terminals, as indicated on the individual network drawings. The open-wire networks of the 115-type are listed in Table A.

2.03 The building-out capacitor is brought out to a separate terminal, No. 4, and a blank terminal, No. 2, is provided to facilitate the installation of building-out resistors, when necessary. Resistors of the 111-type are suitable for such use, since they can be supported on the network terminals by their leads. Since building-out resistors are seldom required, the networks come with terminals 2, 3, and 4 strapped.

B. Cable Networks

2.04 With the exception of the B-88-50 networks, which are designed to simulate half-coil circuit impedance, the cable networks are designed for basic end sections varying from 0.158 to 0.186 of full section. The design, however, includes resistance for half-section terminations so that optimum return loss is obtained when the circuits terminate at half-section and the building-out capacitance is made equal to the difference between half-section capacitance and the capacitance of the basic end section shown on the network drawings.

2.05 With the exception of the 115S network for B135-BSA circuits, the cable networks are designed fundamentally for cable having a nominal side capacitance of 0.062 μF per mile and a phantom capacitance of 0.10 μF per mile. Where the cable capacitance runs higher or lower than this, the adverse effect on return loss can be avoided by an adjustment of the resistance component of the network impedance. Since this effect is of importance principally in toll cables, provision has been made in the toll cable networks for adjustments to compensate for it. The adjustments are indicated on the network drawings.

3. BALANCE CONSIDERATIONS

A. Return-Loss Performance—Design Values

3.01 The drawing for each network shows the return loss between the network impedance, with allowance for manufacturing variations, and the characteristic impedance of the type of circuit concerned. With one or two exceptions mentioned below, this return loss is sufficiently high that its effect on the structural return loss of the circuit can be ignored.

3.02 The exceptions referred to above occur in the case of the D-specification networks for open-wire circuits of unusual gauges and materials. As covered in other information, a structural return loss of 25 dB is generally assumed for these circuits. In computations, the network design value should be used as the structural return loss wherever the design value is less than 25 dB. A reference to the figures will show that this occurs only at low frequencies for the networks for 109 and 134 steel circuits.

B. Building-Out Capacitance and Resistance Adjustments

3.03 The building-out element of the open-wire and toll entrance cable networks consists only of a building-out capacitor, and this is adjusted in the usual manner in specific cases. Resistance building-out is expected to be required only seldom, if ever. The terminal arrangements on the network, however, are such as to facilitate the addition of resistors (111-type), if required.

3.04 As mentioned previously, the toll cable networks, in addition to the customary building-out capacitor, include resistors to adjust the network impedance in case the cable capacitance departs from nominal. If the average capacitance of the cable for the first few loading sections from the office is higher than nominal, the impedance will be lower than nominal and can be corrected for by removing resistance from the network. Resistance is added in case the capacitance is less than nominal. The strappings for various average cable capacitances are shown on the network drawings attached.

3.05 Both the capacitance and resistance adjustments of the toll cable networks can be made on the basis of capacitance data for the cable in question where these are available. In absence of such data, the adjustments can be made by means of return-loss measurements over the frequency range. In general, the optimum adjustment of the building-out resistance should be obtained at about 500 Hz or lower, and that of the capacitance above about 1500 Hz. The impedance of several circuits compared with the network impedances for the various strappings will also indicate the best adjustments. When these methods are not feasible, the best procedure will be to assume that the cable capacitance is nominal; strap the resistors for nominal capacitance, as shown by the figures; and adjust the capacitor on the basis of the length of the end section.

4. EQUIPMENT CONSIDERATIONS

A. New Installations

4.01 The 115-type network is well adapted to new installations because of its compactness and terminal arrangements. A space of four 1-3/4 inch by 19-inch mounting plates will accommodate 10 networks, or 12 networks in case of 23-inch relay racks. The terminal arrangement is such that mounting bars can go across the center of the 7-inch mounting dimension to accommodate an assembly of miscellaneous apparatus where this is required.

4.02 The mounting of the 115-type network horizontally on the 600-type mounting plate will probably be rare in the toll plant; but, when required, this type mounting plate can be obtained with suitable drilling.

B. Additions to Installations of 113-Type Networks

4.03 The 115-type network is physically identical with the 113-type except that the network terminals are located near the top mounting stud instead of halfway between studs. As the wiring form customarily comes from the top of the bay, the new location of the terminals will cause no wiring difficulty.

C. Additions to Installations of the 102-, 103-, 104-, 107-, and 108-Type Networks

4.04 Additions to installations of these types can be accomplished by the use of the 38A bracket. This bracket consists essentially of a base of the older type networks with a right angle bracket with terminals in the same position as that

of the terminals of the older type. The 115-type network is mounted on this base and connected to the terminals of the bracket, which in turn are cabled in the same manner as the old type networks.

4.05 The 38A bracket has the disadvantages that the network cannot be mounted until the terminal strappings have been made and that it requires considerably more space than the 115-type network. Where practicable, therefore, it would be preferable to avoid its use by placing the 115-type networks in a new space on the rack rather than in the space of existing networks of the older types.

D. Additions to D-Specification Networks for B-88-50

4.06 The D-specification networks described in Section 332-851-102 for B-88-50 circuits are of such nature that the replacing 115-type cannot be readily mounted in the same space. These D-specification networks will be continued for additions and maintenance in those cases where the 115-type cannot be mounted in new space.

E. Coil-Rack Mounting

4.07 Coil-rack mounting, if required, can be accomplished by attaching the network to the 38A bracket as described above and then fastening this assembly to a mounting detail per D-77985.

TABLE A

115-TYPE OPEN-WIRE NETWORKS

Network Code	Gauge	For Facility as Follows: Material	Circuit	Spacing	Network Fig.	Replaces
115T *	104	Copper	Side or Phys	6, 8, 12, or 18-in.†	1	108A, 102A, 102B, 102C
115U *	128	Copper	Side or Phys	6, 8, 12, or 18-in.†	2	108B, 102H, 102J, 102K
115W *	165	Copper	Side or Phys	6, 8, 12, or 18-in.†	3	108C, 102E, 102F, 102G
115Y	104	Copper	Phantom	12-in.	4	102D
115AA	128 or 165	Cooper	Phantom	12-in.	5	102L, 103A
115AR *	080	Copper	Side or Phys	6, 8, or 12-in.	6	D-161328
115AS *	080	Copper	Phantom	8 or 12-in.	7	D-161329
115AW	109	High-Strength Steel	Side or Phys	12-in.	8	D-161386
115AY	109	High-Strength Steel	Phantom	12-in.	9	D-161387
115AT	134	Steel	Side or Phys	12-in.	10	D-161384
115AU	134	Steel	Phantom	12-in.	11	D-161385
115BA *	104	Copper-Steel ‡	Side or Phys	6, 8, or 12-in.	12	D-161804
115BD *	104	Copper-Steel ‡	Phantom	8 or 12-in.	13	D-161807
115BB *	128	Copper-Steel ‡	Side or Phys	6, 8, or 12-in.	14	D-161805
115BE *	128	Copper-Steel ‡	Phantom	8 or 12-in.	15	D-161808
115BC *	165	Copper-Steel ‡	Side or Phys	6, 8, or 12-in.	16	D-161806
115BF *	165	Copper-Steel ‡	Phantom	8 or 12-in.	17	D-161809

* Adjustable for various wire spacings. (See individual network figures.)

† These are pole pairs or half pole pairs.

‡ 40-percent conductivity wire.

TABLE B

115-TYPE NETWORKS FOR TOLL CABLE CIRCUITS

Network Code	For Facility			Network Fig.	
	Gauge	Loading	Circuit		
115P	19	H-88-50	Side	18	113P
115R	19	H-88-50	Phantom	19	113R
115AF	19	B-88-50	Side	20	D-92945
115AG	19	B-88-50	Phantom	21	D-92946
115AH	19	H-44-25	Side	22	13P and 17H
115AJ	19	H-44-25	Phantom	23	13S and 17J
115BM	10, 13, or 16	H-44-25	Side	24	104E
115BN	10, 13, or 16	H-44-25	Phantom	25	104F
115P	16 or 19	H-86-32	Side	18	113P
115BG	16 or 19	H-86-32	Phantom	26	D-176421
115AM	16 or 19	H-172-63	Side	27	104A and 104B
115AN	16 or 19	H-172-63	Phantom	28	104C and 104D
115AM	16 or 19	H-174-106	Side	27	104A and 104B
115AP	16 or 19	H-174-106	Phantom	29	13T and 22A
115S	22BSA	B-135	Pair	30	113S

TABLE C

115-TYPE NETWORKS FOR TOLL ENTRANCE CABLE

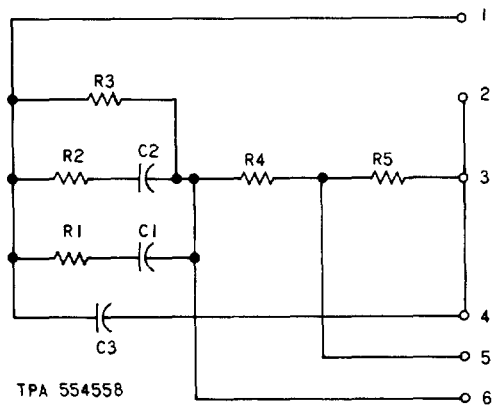
Network Code	For Facility			Network Fig.	Replaces
	Gauge	Loading	Circuit		
115AB	19	H-31-18	Side	31	107C
115AD	19	H-31-18	Phantom	32	107F
115AC	16	H-31-18	Side	33	107B
115AE	16	H-31-18	Phantom	34	107E
115BP	13	H-31-18	Side	35	107A
115BR	13	H-31-18	Phantom	36	107D

TABLE D

PROGRAM CIRCUIT NETWORKS

Network Code	For Facility			Network Fig.	Replaces
	Gauge	Loading	Circuit		
115BH	16 or 19	3000-7.5	Pair	37	New
115BJ	16 or 19	1000-7.5	Pair	38	New
115BK	16 or 19	1500-11	Pair	39	New
115BS	16	B-22-N	Pair	40	D-87801
115T *	19	B-22	Pair	1	-

* Requires modification as covered in 1.09.



OPEN WIRE .104-IN. COPPER SIDE & PHYSICAL

COMPONENT	VALUE
R1	1013 ohms
R2	2051
R3	4032
R4	79
R5	32
C1	0.4112 UF
C2	0.8577
C3	BO Cap.

Freq Range (Hz)		Return Loss * (dB)
Non-Pole Pair	(200 to 250	30
	(250 to 500	35
	(500 to 2000	40
	(2000 to 3000	35
	(3000 to 3500	30
PP and ½ PP	(200 to 400	30
	(400 to 3000	35
	(3000 to 3500	30

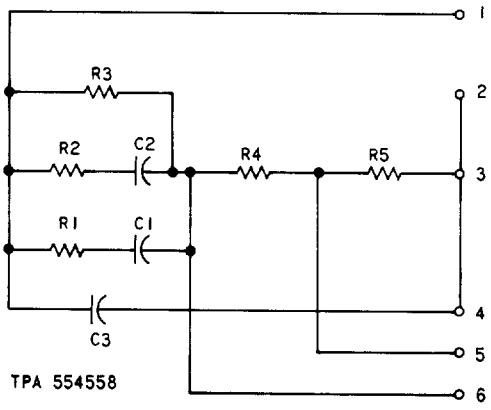
* Return loss of network, including manufacturing tolerances against theoretical line.

Line Construction	Strap Terminals
12-in. Nonpole Pair	5-6
8-in. Nonpole Pair	5-6
6-in. Nonpole Pair	3-6
12-in. Pole Pair	None
12-in. Half Pole Pair	None

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP	12-in. PP & ½ PP
100	1017 - j849	1049 - j849	1096 - j849	1128 - j849
200	791 - j537	823 - j537	870 - j537	902 - j537
300	704 - j402	736 - j402	783 - j402	815 - j402
500	636 - j264	668 - j264	715 - j264	747 - j264
1000	597 - j137	629 - j137	676 - j137	708 - j137
1500	589 - j93	621 - j93	668 - j93	700 - j93
2000	587 - j70	619 - j70	665 - j70	697 - j70
2500	586 - j56	618 - j56	665 - j56	697 - j56
3000	585 - j47	617 - j47	664 - j47	696 - j47
3500	586 - j41	617 - j41	664 - j41	696 - j41
4000	585 - j38	617 - j38	664 - j38	696 - j38

Fig. 1—115T Network—Engineering Information



OPEN WIRE .128-IN. COPPER SIDE & PHYSICAL

COMPONENT	VALUE
R1	1073 ohms
R2	1752
R3	3363
R4	79
R5	32
C1	0.5275 UF
C2	1.138
C3	BO Cap.

Freq Range (Hz)		Return Loss * (dB)
Non-Pole Pair	(200 to 250	30
	(250 to 500	35
	(500 to 2000	40
	(2000 to 3000	35
	(3000 to 3500	30
PP and ½ PP	(200 to 400	30
	(400 to 3000	35
	(3000 to 3500	30

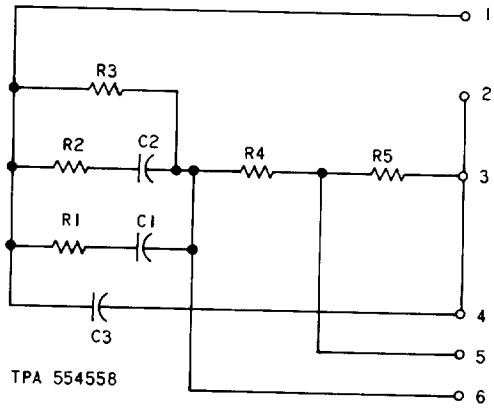
* Return loss of network, including manufacturing tolerances, against theoretical line.

Line Construction	Strap Terminal
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	5-6
6-in. Nonpole Pair	3-6
12-in. Pole Pair	None
12-in. Half Pole Pair	None

Nominal Impedance of Network
(Between terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP	12-in. PP & ½ PP
100	843 - j642	875 - j642	922 - j642	954 - j642
200	681 - j392	713 - j392	760 - j392	792 - j392
300	622 - j285	656 - j285	703 - j285	735 - j285
500	585 - j182	617 - j182	664 - j182	696 - j182
1000	564 - j94	596 - j94	643 - j94	675 - j94
1500	560 - j63	592 - j63	639 - j63	671 - j63
2000	559 - j47	591 - j47	638 - j47	670 - j47
2500	558 - j38	590 - j38	637 - j38	669 - j38
3000	558 - j32	590 - j32	637 - j32	669 - j32
3500	557 - j27	589 - j27	636 - j27	668 - j27
4000	557 - j24	589 - j24	636 - j24	668 - j24

Fig. 2—115U Network—Engineering Information



OPEN WIRE .165-IN. COPPER SIDE & PHYSICAL

COMPONENT	VALUE
R1	1175 ohms
R2	1467
R3	2766
R4	79
R5	32
C1	0.7162 UF
C2	1.653
C3	BO Cap.

Freq Range (Hz)		Return Loss * (dB)
Non-Pole Pair	200 to 250	30
	250 to 500	35
	500 to 2000	40
	2000 to 3000	35
	3000 to 3500	30
PP and ½ PP	200 to 400	30
	400 to 3000	35
	3000 to 3500	30

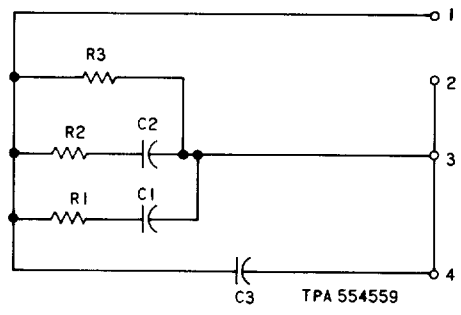
* Return loss of network, including manufacturing tolerances, against theoretical line.

Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	5-6
6-in. Nonpole Pair	3-6
12-in. Pole Pair	None
12-in. Half Pole Pair	None

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP	12-in. PP & ½ PP
100	687 - j446	719 - j446	766 - j446	798 - j446
200	588 - j258	620 - j258	667 - j258	699 - j258
300	558 - j181	590 - j181	637 - j181	669 - j181
500	540 - j112	572 - j112	619 - j112	651 - j112
1000	531 - j57	563 - j57	610 - j57	642 - j57
1500	529 - j38	561 - j38	608 - j38	640 - j38
2000	529 - j29	561 - j29	608 - j29	640 - j29
2500	528 - j23	560 - j23	607 - j23	639 - j23
3000	528 - j19	560 - j19	607 - j19	639 - j19
3500	528 - j16	560 - j16	607 - j16	639 - j16
4000	528 - j14	560 - j14	607 - j14	639 - j14

Fig. 3—115W Network—Engineering Information



OPEN WIRE .104-IN. COPPER PHANTOM

COMPONENT	VALUE
R1	758.3 ohms
R2	1336.0
R3	2647
C1	0.7162 UF
C2	1.872
C3	BO Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 250	25
250 to 500	30
500 to 2000	32
2000 to 3000	30
3000 to 3500	25

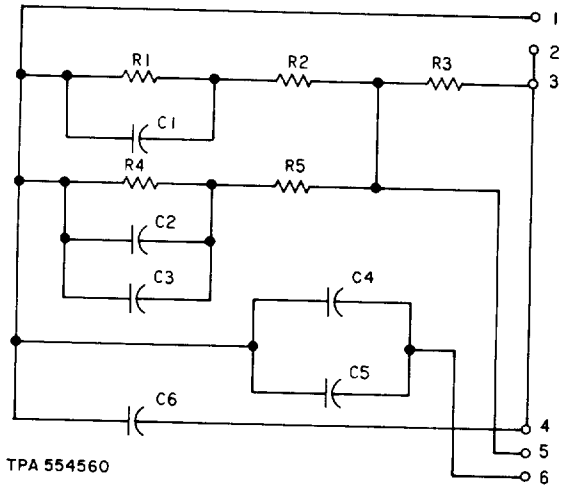
* Return loss of network, including manufacturing tolerances, against theoretical line.

Line Construction	Adjustment
104-in. - 12-in. Nonpole Pair	None

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	
100	636 - j449
200	515 - j289
300	468 - j215
500	433 - j137
1000	416 - j72
1500	412 - j48
2000	411 - j36
2500	410 - j28
3000	409 - j24
3500	409 - j21
4000	409 - j18

Fig. 4—115Y Network—Engineering Information



OPEN WIRE .128- & .165-IN. COPPER PHANTOM

COMPONENT	VALUE
R1	8271 ohms
R2	1638
R3	362
R4	3956
R5	35
C1	2.16 UF
C2	2.16
C3	1.08
C4	2.16
C5	0.54
C6	BO Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	25
250 to 500	30
500 to 2000	32
2000 to 3000	30
3000 to 3500	25

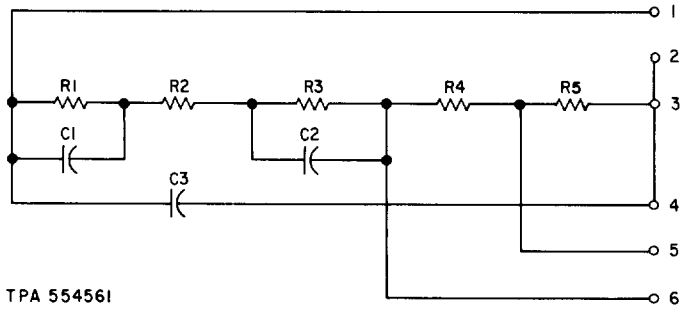
* Return loss of network, including manufacturing tolerances, against theoretical line.

Line Construction	Strap Terminals
.128-in. - 12-in. Nonpole Pair	None
.165-in. - 12-in. Nonpole Pair	5-6

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	.128 in.	.165 in.
100	521 - j393	418 - j245
200	438 - j223	386 - j130
300	416 - j153	379 - j88.7
500	404 - j93.8	374 - j54.6
1000	398 - j47.3	372 - j29.6
1500	397 - j31.6	371 - j21.8
2000	397 - j23.7	370 - j18.0
2500	396 - j19.0	368 - j15.7
3000	396 - j15.8	367 - j14.1
3500	396 - j13.5	367 - j12.8
4000	396 - j11.8	366 - j11.9

Fig. 5—115AA Network—Engineering Information



OPEN WIRE .080-IN. COPPER SIDE & PHYSICAL

COMPONENT	VALUE
R1	3448 ohms
R2	590
R3	263
R4	79
R5	32
C1	1.08 UF
C2	2.16
C3	BO Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 1000	25
1000 to 3500	30

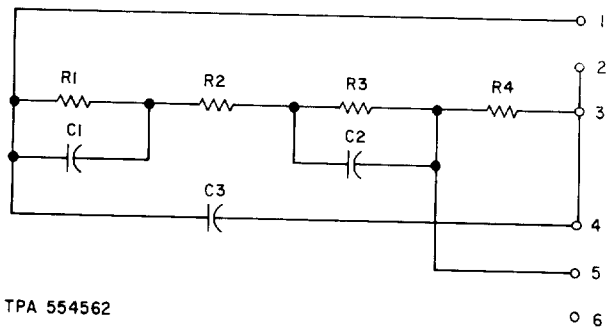
* Return loss of network, including manufacturing tolerances, against theoretical line.

Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	5-6
6-in. Nonpole Pair	3-6

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP
100	1388 - j1329	1420 - j1329	1467 - j1329
200	947 - j829	979 - j829	1026 - j829
300	813 - j613	845 - j613	892 - j613
500	710 - j405	742 - j405	789 - j405
1000	647 - j215	679 - j215	726 - j215
1500	633 - j146	665 - j146	712 - j146
2000	628 - j110	660 - j110	707 - j110
2500	626 - j88	658 - j88	705 - j88
3000	625 - j73	657 - j73	704 - j73
3500	624 - j63	656 - j63	703 - j63
4000	623 - j55	655 - j55	702 - j55

Fig. 6—115AR Network—Engineering Information



TPA 554562

OPEN WIRE .080-IN. COPPER PHANTOM

Component	Value
R1	1000 ohms
R2	420
R3	263
R4	25
C1	2.16 UF
C2	4.32
C3	BO Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 1000	25
1000 to 3500	30

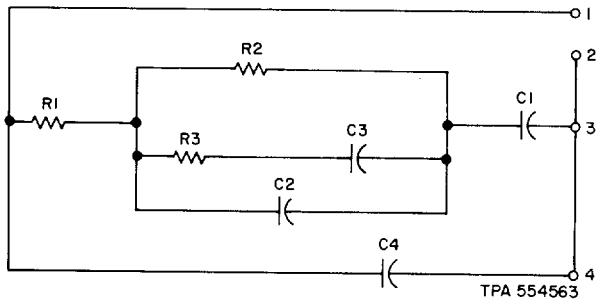
* Return loss of network, including manufacturing tolerances, against theoretical line.

Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	None

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	8-in. NPP	12-in. NPP
100	971 - j602	946 - j602
200	651 - j448	626 - j448
300	524 - j332	524 - j332
500	482 - j213	457 - j213
700	441 - j155	441 - j155
1000	455 - j109	430 - j109
1500	450 - j73	425 - j73
2000	448 - j55	423 - j55
2500	447 - j44	422 - j44
3000	446 - j37	421 - j37
3500	446 - j32	421 - j32
4000	446 - j28	421 - j28

Fig. 7—115AS Network—Engineering Information



OPEN WIRE .109-IN. STEEL (H.S.) SIDE & PHYSICAL

Component	Value
R1	800 ohms
R2	1820
R3	1000
C1	1.08 UF
C2	0.08600
C3	0.1590
C4	BO Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 300	20
300 to 500	25
500 to 1000	30
1000 to 3000	40
3000 to 4000	30

* Return loss of network, including manufacturing tolerances, against theoretical line.

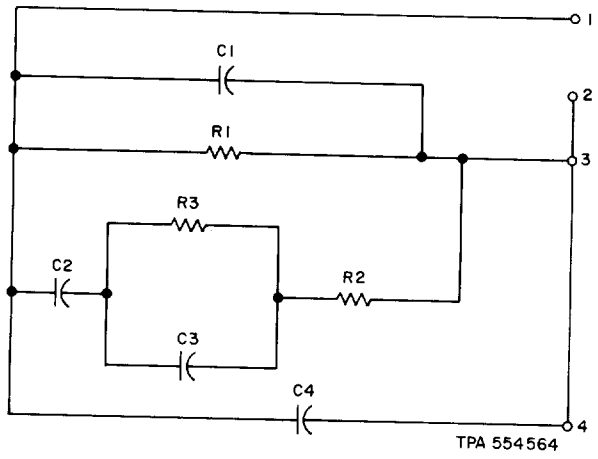
Line Construction

12-in. Nonpole Pair, High-Strength (H.S.) Steel Conductors

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	
200	2148 - j1425
300	1870 - j1231
500	1542 - j957
700	1389 - j779
1000	1281 - j624
1500	1193 - j501
2000	1136 - j442
2500	1090 - j407
3000	1051 - j381
3500	1016 - j357
4000	987 - j338

Fig. 8—115AW Network—Engineering Information



OPEN WIRE .109-IN. STEEL (H.S.) PHANTOM

Component	Value
R1	3760 ohms
R2	720
R3	400
C1	0.007640 UF
C2	0.5040
C3	0.4970
C4	80 Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 2500	30
2500 to 3000	35
3000 to 4000	30

* Return loss of network, including manufacturing tolerances, against theoretical line.

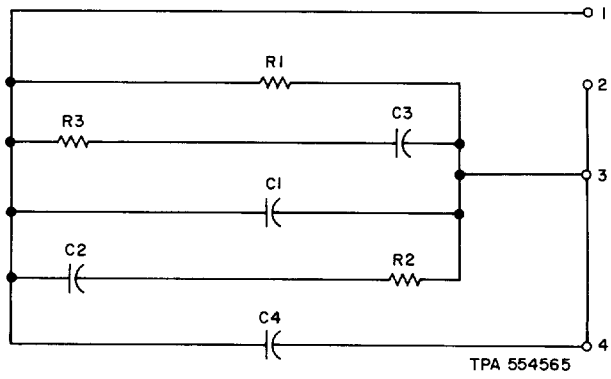
Line Construction

12-in. Nonpole Pair, High-Strength (H.S.) Steel Conductors

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	
200	1138 - j902
300	980 - j684
500	858 - j503
700	790 - j423
1000	723 - j352
1500	660 - j281
2000	629 - j238
2500	611 - j210
3000	600 - j193
3500	592 - j182
4000	586 - j175

Fig. 9—115AY Network—Engineering Information



OPEN WIRE .134-IN. STEEL SIDE & PHYSICAL

Component	Value
R1	3060 ohms
R2	4140
R3	2120
C1	0.004280 UF
C2	0.1290
C3	0.04410
C4	BO Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 300	18
300 to 500	20
500 to 1000	25
1000 to 3000	30
3000 to 4000	35

* Return loss of network, including manufacturing tolerances, against theoretical line.

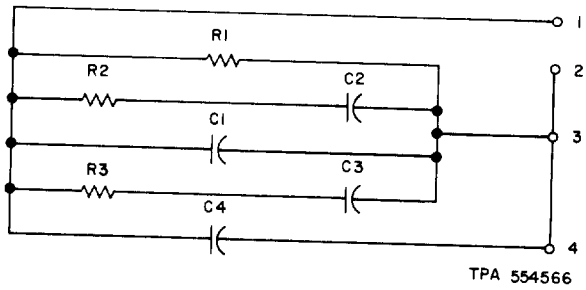
Line Construction

12-in. Nonpole Pair

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	
200	2082 - j879
300	1777 - j829
500	1524 - j697
700	1381 - j628
1000	1243 - j556
1500	1110 - j465
2000	1040 - j400
2500	1000 - j355
3000	975 - j324
3500	958 - j303
4000	946 - j289

Fig. 10—115AT Network—Engineering Information



OPEN WIRE .134-IN. STEEL PHANTOM

Component	Value
R1	1760 ohms
R2	2000
R3	1360
C1	0.006820 UF
C2	0.2490
C3	0.06170
C4	BO Cap.

Frequency Range (Hz)	Return Loss * (dB)
200 to 300	18
300 to 500	20
500 to 1000	25
1000 to 2000	30
2000 to 4000	35

* Return loss of network, including manufacturing tolerances, against theoretical line.

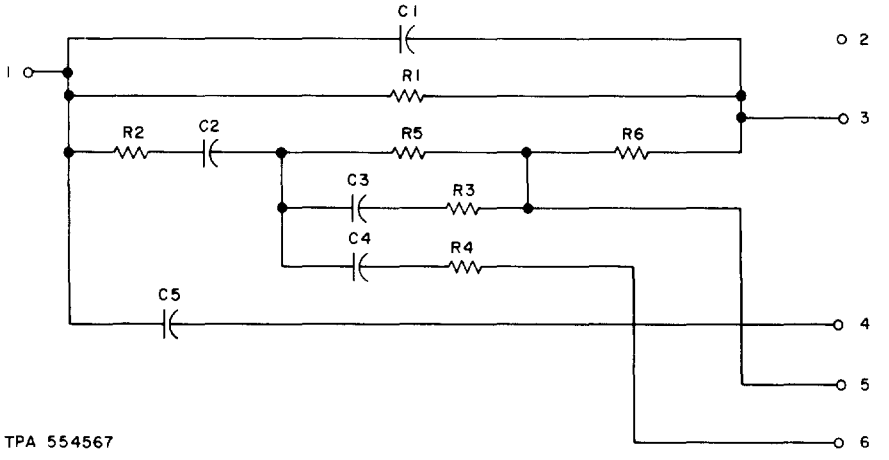
Line Construction

12-in. Nonpole pair

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	
200	1178 - j509
300	1010 - j462
500	864 - j381
700	792 - j338
1000	724 - j300
1500	654 - j257
2000	613 - j225
2500	588 - j202
3000	573 - j185
3500	562 - j173
4000	554 - j165

Fig. 11—115AU Network—Engineering Information



OPEN WIRE .104-IN. COPPER-STEEL▲ SIDE & PHYSICAL

Component	Value
R1	4545 ohms
R2	586
R3	161
R4	8700
R5	576
R6	58
C1	0.00120 UF
C2	0.54
C3	0.54
C4	0.0364
C5	B0 Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	30
250 to 500	35
500 to 2000	40
2000 to 3000	35
3000 to 3500	30

* Return loss of network, including manufacturing tolerances, against theoretical line.

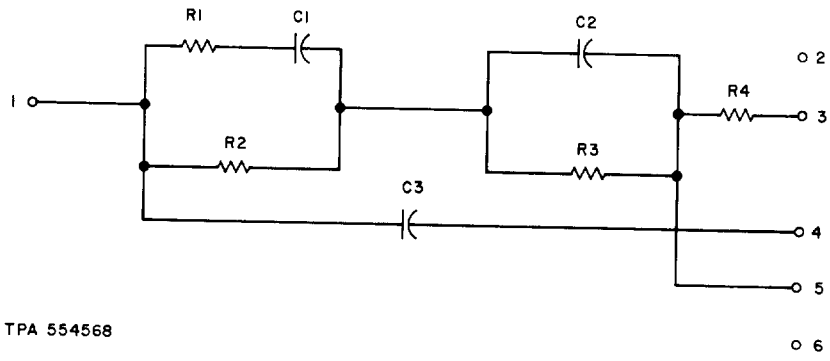
Line Construction	Strap Terminals
12-in. Nonpole Pair	None
8-in. Nonpole Pair	3-5
6-in. Nonpole Pair	3-5; 1-6

▲ Wires having 40% conductivity relative to standard annealed copper.

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP
100	1632 - j1479	1720 - j1517	1736 - j1493
200	1108 - j961	1160 - j998	1186 - j978
300	944 - j743	983 - j770	1016 - j755
500	790 - j538	823 - j555	859 - j544
700	713 - j424	743 - j437	783 - j428
1000	657 - j320	686 - j329	727 - j322
1500	619 - j225	648 - j231	690 - j227
2000	605 - j174	633 - j179	675 - j176
2500	598 - j143	626 - j147	668 - j145
3000	594 - j122	621 - j125	664 - j124
3500	591 - j107	619 - j110	662 - j110
4000	590 - j96	617 - j99	660 - j99

Fig. 12—115BA Network—Engineering Information



OPEN WIRE .104-IN. COPPER-STEEL ▲ PHANTOM

Component	Value
R1	495 ohms
R2	2305
R3	200
R4	28
C1	1.08 UF
C2	2.16
C3	80 Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	25
250 to 500	30
500 to 2000	32
2000 to 3000	30
3000 to 3500	25

* Return loss of network, including manufacturing tolerances, against theoretical line.

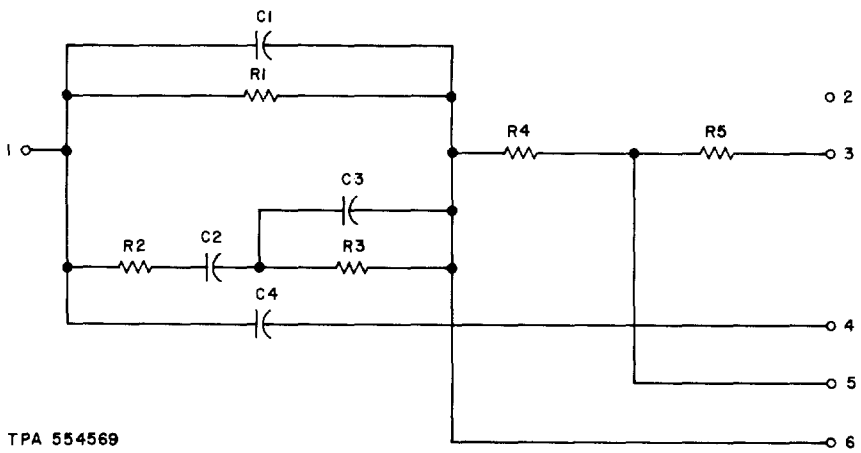
Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	None

▲ Wires having 40% conductivity relative to standard annealed copper.

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above)

Freq (Hz)	8-in. NPP	12-in. NPP
100	1033 - j833	1005 - j833
200	713 - j551	685 - j551
300	610 - j416	582 - j416
500	527 - j293	499 - j293
700	490 - j224	462 - j224
1000	465 - j164	437 - j164
1500	449 - j112	421 - j112
2000	443 - j84.7	415 - j84.7
2500	440 - j68.1	412 - j68.1
3000	439 - j57.5	411 - j57.5
3500	438 - j48.9	410 - j48.9
4000	438 - j43.2	410 - j43.2

Fig. 13—115BD Network—Engineering Information



OPEN WIRE .128-IN. COPPER-STEEL ▲ SIDE & PHYSICAL

Component	Value
R1	3390 ohms
R2	660
R3	220
R4	79
R5	38
C1	0.001150 UF
C2	0.6470
C3	1.540
C4	BO Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	30
250 to 500	35
500 to 2000	40
2000 to 3000	35
3000 to 3500	30

* Return loss of network, including manufacturing tolerances, against theoretical line.

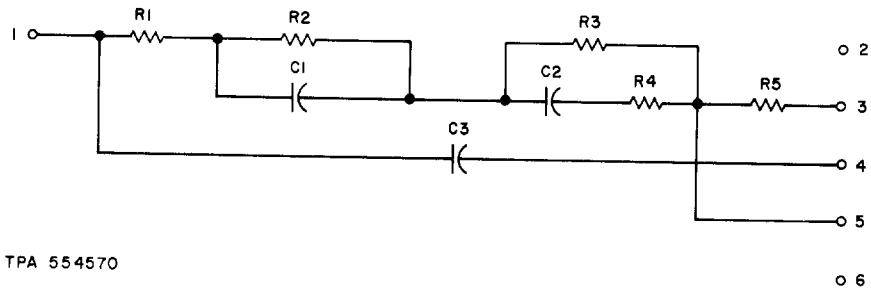
Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	5-6
6-in. Nonpole Pair	3-5-6

▲ Wires having 40% conductivity relative to standard annealed copper.

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP
100	1383 - j1179	1421 - j1179	1462 - j1179
200	912 - j766	950 - j766	991 - j766
300	781 - j571	819 - j571	860 - j571
500	678 - j394	716 - j394	757 - j394
700	631 - j305	669 - j305	710 - j305
1000	596 - j228	634 - j228	675 - j228
1500	573 - j160	611 - j160	652 - j160
2000	563 - j124	601 - j124	642 - j124
2500	559 - j102	597 - j102	638 - j102
3000	556 - j87.4	594 - j87.4	635 - j87.4
3500	555 - j77.1	593 - j771	634 - j77.1
4000	554 - j69.6	592 - j69.6	633 - j69.6

Fig. 14—115BB Network—Engineering Information



OPEN WIRE .128-IN. COPPER-STEEL ▲ PHANTOM

Component	Value
R1	338 ohms
R2	1250
R3	210
R4	69.8
R5	28.0
C1	2.16 UF
C2	2.16
C3	BO Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	25
250 to 500	30
500 to 2000	32
2000 to 3000	30
3000 to 3500	25

* Return loss of network, including manufacturing tolerances, against theoretical line.

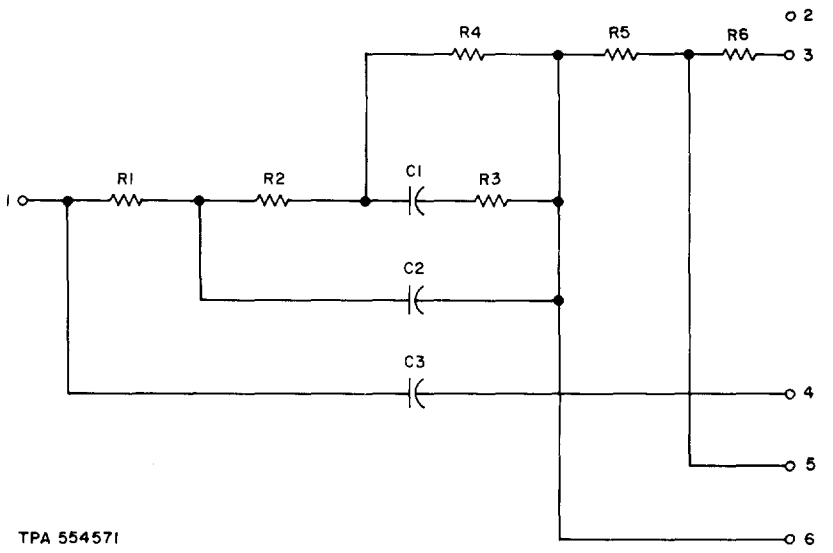
Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	None

▲ Wires having 40% conductivity relative to standard annealed copper.

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above.)

Freq (Hz)	8-in. NPP	12-in. NPP
100	878 - j599	850 - j599
200	618 - j415	590 - j415
300	533 - j315	505 - j315
500	469 - j210	441 - j210
700	447 - j157	419 - j157
1000	433 - j112	405 - j112
1500	425 - j75.8	397 - j75.8
2000	422 - j57.2	394 - j57.2
2500	420 - j45.9	392 - j45.9
3000	420 - j38.2	392 - j38.2
3500	419 - j32.8	391 - j32.8
4000	419 - j28.7	391 - j28.7

Fig. 15—115BE Network—Engineering Information



OPEN WIRE .165-IN. COPPER-STEEL ▲ SIDE & PHYSICAL

Component	Value
R1	520 ohms
R2	857
R3	317
R4	2595
R5	75
R6	36
C1	1.08 UF
C2	1.08
C3	BO Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	30
250 to 500	35
500 to 2000	40
2000 to 3000	35
3000 to 3500	30

* Return loss of network, including manufacturing tolerances, against theoretical line.

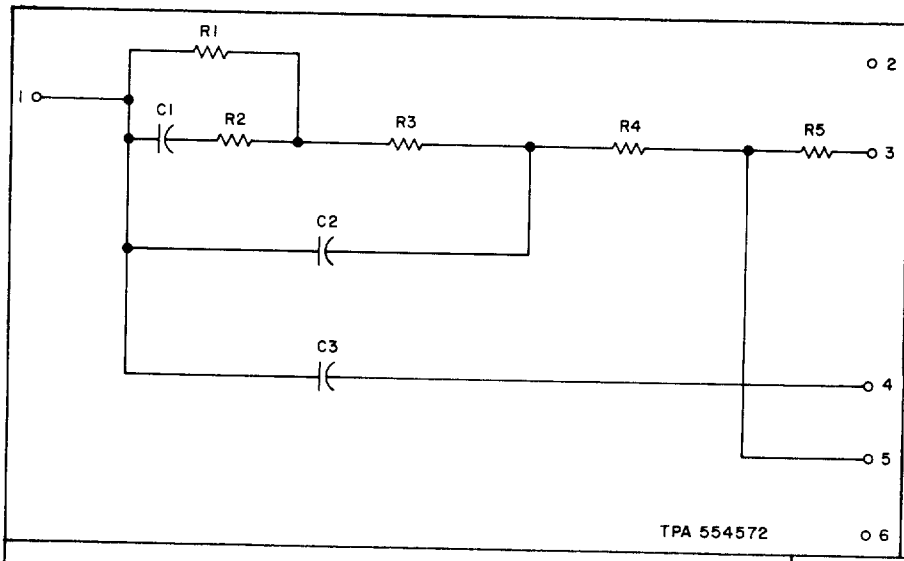
Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	5-6
6-in. Nonpole Pair	3-5-6

▲ Wires having 40% conductivity relative to standard annealed copper.

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping Indicated Above.)

Freq (Hz)	6-in. NPP	8-in. NPP	12-in. NPP
100	937 - j850	973 - j850	1012 - j850
200	731 - j524	767 - j524	806 - j524
300	652 - j396	688 - j396	727 - j396
500	582 - j267	618 - j267	657 - j267
700	555 - j200	591 - j200	630 - j200
1000	538 - j143	574 - j143	613 - j143
1500	528 - j97.0	564 - j97.0	603 - j97.0
2000	525 - j73.1	561 - j73.1	600 - j73.1
2500	523 - j58.7	559 - j58.7	598 - j58.7
3000	522 - j49.0	558 - j49.0	597 - j49.0
3500	522 - j42.0	558 - j42.0	597 - j42.0
4000	521 - j36.8	557 - j36.8	596 - j36.8

Fig. 16—115BC Network—Engineering Information



OPEN WIRE .165-IN. COPPER-STEEL ▲ PHANTOM

Component	Value
R1	1820 ohms
R2	490
R3	418
R4	368
R5	28
C1	2.16 UF
C2	2.16
C3	80 Cap.

Freq Range (Hz)	Return Loss * (dB)
200 to 250	25
250 to 500	30
500 to 2000	32
2000 to 3000	30
3000 to 3500	25

* Return loss of network, including manufacturing tolerances, against theoretical line.

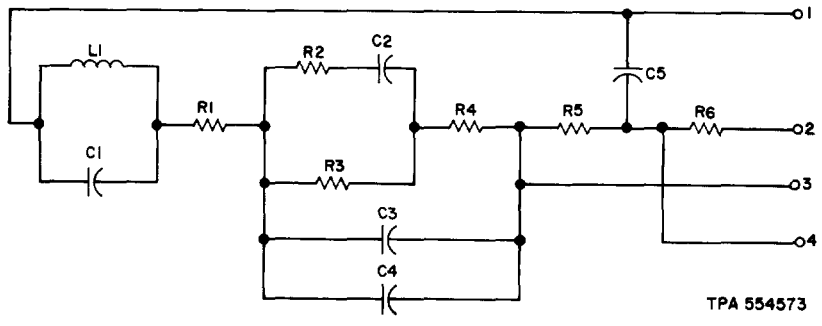
Line Construction	Strap Terminals
12-in. Nonpole Pair	3-5
8-in. Nonpole Pair	None

▲ Wires having 40% conductivity relative to standard annealed copper.

Nominal Impedance of Network
(Between Terminals 1 and 2. Strapping as Indicated Above)

Freq (Hz)	8-in. NPP	12-in. NPP
100	627 - j453	599 - j453
200	504 - j292	476 - j292
300	456 - j217	428 - j217
500	421 - j140	393 - j140
700	409 - j103	381 - j103
1000	403 - j72.7	375 - j72.7
1500	399 - j48.8	371 - j48.8
2000	398 - j36.7	370 - j36.7
2500	397 - j29.4	369 - j29.4
3000	397 - j24.5	369 - j24.5
3500	397 - j21.0	369 - j21.0
4000	396 - j18.4	368 - j18.4

Fig. 17—115BF Network—Engineering Information



19-GAUGE CABLE
H-88 SIDE

Component	Value
L1	0.0288 H
R1	1135 ohms
R2	1226
R3	4150
R4	1450
R5	40
R6	20
C1	0.0325 UF
C2	1.08
C3	0.54
C4	1.08
C5	BO Cap.

Basic End Section	0.18
Midsection BOC	0.0226 UF
Nominal Cable Cap./mi	0.062 UF (0.0704 UF/sect.)

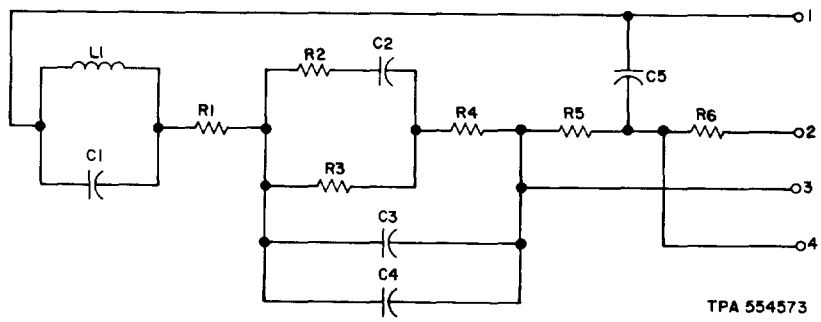
Freq Range (Hz)	Return Loss * (dB)
100 to 200	38
200 to 300	40
300 to 3000	44
3000 to 3500	32

* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Cap. Per Section (UF)	Strap Terminals
Below 0.0676	None
0.0680 to 0.0694	2-4
0.0694 to 0.0708	3-4
Above 0.0708	2-3

	Nominal Midsection Impedance of Network (Between Terminals 1 and 2)				
BOR - ohms	0	20	40	60	Basic Net.
BOC - UF	0.0226	0.0226	0.0216	0.0216	None
Term. Strapped	2-3-4	3-4	2-4	None	2-3-4
Freq (Hz)					
100	1369 - j809	1389 - j809	1409 - j809	1429 - j809	1400 - j791
140	1272 - j621	1292 - j621	1313 - j621	1333 - j621	1303 - j595
200	1204 - j459	1224 - j459	1245 - j460	1265 - j460	1235 - j422
300	1161 - j317	1181 - j317	1201 - j319	1221 - j319	1190 - j262
500	1139 - j195	1159 - j195	1179 - j197	1199 - j197	1164 - j103
700	1138 - j139	1158 - j139	1178 - j144	1198 - j144	1156 - j10
1000	1150 - j99	1170 - j99	1189 - j104	1209 - j104	1152 + j90
1500	1193 - j66	1213 - j66	1230 - j72	1250 - j72	1152 + j231
2000	1271 - j47	1291 - j47	1307 - j54	1327 - j54	1153 + j375
2500	1412 - j41	1432 - j41	1443 - j48	1463 - j48	1157 + j549
2800	1550 - j55	1570 - j55	1576 - j59	1596 - j59	1162 + j678
3000	1677 - j853	1697 - j83	1699 - j84	1719 - j84	1166 + j780
3200	1842 - j143	1862 - j143	1861 - j136	1881 - j136	1171 + j900
3500	2181 - j366	2201 - j366	2198 - j334	2218 - j334	1183 + j1128

Fig. 18—115P Network—Engineering Information



19-GAUGE CABLE H-50 PHANTOM

Component	Value
L1	0.0163 H
R1	666 ohms
R2	1750
R3	1175
R4	800
R5	30
R6	15
C1	0.0524 UF
C2	1.08
C3	1.08
C4	2.16
C5	BO Cap.

Basic End Section	0.18
Midsection BOC	0.0372 UF
Nominal Cable Cap./mi	0.102 UF (0.116 UF/sect.)

Freq Range (Hz)	Return Loss * (dB)
100 to 200	38
200 to 300	40
300 to 3000	44
3000 to 3500	32

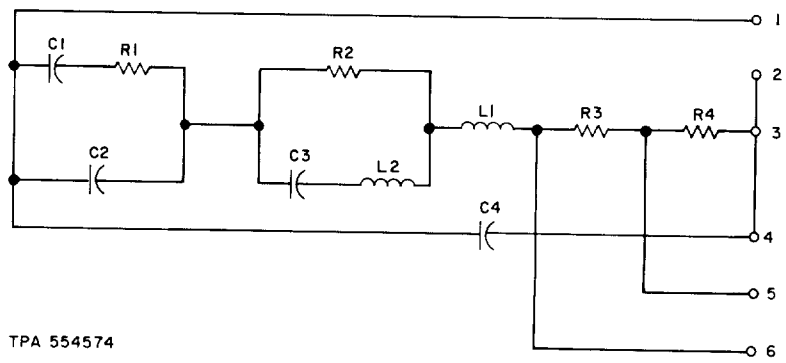
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Cap. Per Section (UF)	Strap Term.
Below 0.109	None
0.109 to 0.112	2-4
0.112 to 0.114	3-4
Above 0.114	2-3

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOR - Ohms	0	15	30	46	Basic Net.
BOC - UF	0.0372	0.0372	0.0355	0.0355	None
Term. Strapped	2-3-4	3-4	2-4	None	2-3-4
Freq (Hz)					
100	786 - j436	801 - j436	816 - j436	831 - j436	802 - j426
140	730 - j327	745 - j327	760 - j328	775 - j328	746 - j313
200	696 - j237	711 - j237	726 - j238	741 - j238	711 - j216
300	676 - j161	691 - j161	706 - j163	721 - j163	691 - j130
500	668 - j98	683 - j98	698 - j100	713 - j100	679 - j46
700	669 - j71	684 - j71	698 - j74	713 - j74	677 + j3
1000	675 - j50	690 - j50	705 - j55	720 - j55	675 + j57
1500	699 - j34	714 - j34	727 - j40	742 - j40	675 + j134
2000	740 - j24	755 - j24	766 - j33	781 - j33	676 + j212
2500	812 - j21	827 - j21	835 - j31	850 - j31	678 + j303
2800	880 - j27	895 - j27	900 - j37	915 - j37	680 + j372
3000	940 - j38	955 - j38	958 - j47	973 - j47	681 + j424
3200	1019 - j60	1034 - j60	1034 - j67	1049 - j67	684 + j485
3500	1181 - j141	1196 - j141	1190 - j139	1205 - j139	689 + j596

Fig. 19—115R Network—Engineering Information



19-GAUGE CABLE B-88 SIDE

Component	Value
R1	3290 ohms
R2	1540
R3	50
R4	25
L1 & L2	28.2 mH
C1	4.32 UF
C2	2.16
C3	0.0132
C4	BO Cap.

Basic End Section	Half Coil
Nominal Cable Cap./mi	0.062 UF (0.0352 UF/sect.)

Freq Range (Hz)	Return Loss * (dB)
100 to 200	38
200 to 300	40
300 to 3000	44
3000 to 3500	35

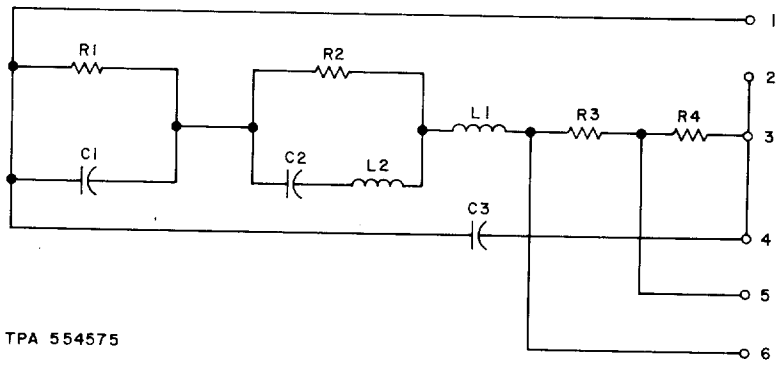
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Cap. Per Section (UF)	Strap Terminals
Below 0.0336	None
0.0336 to 0.0345	3-5
0.0345 to 0.0355	5-6
Above 0.0355	3-6

Nominal Impedance of Network
(Between Terminals 1 and 2 With Terminals 5 and 6 Strapped.)

Freq (Hz)	Impedance
100	1716 - j689
200	1607 - j366
500	1568 - j157
1000	1544 - j93
1500	1509 - j76
2000	1461 - j70.5
2500	1397 - j66.2
3000	1315 - j58.8
3500	1214 - j43.2
4000	1093 - j14.2

Fig. 20—115AF Network—Engineering Information



19-GAUGE CABLE B-50 PHANTOM

Component	Value
R1	1700 ohms
R2	917
R3	30
R4	15
L1 & L2	16.5 mH
C1	4.32 UF
C2	0.0203
C3	BO Cap.

Basic End Section	Half Coil
Nominal Cable Cap./mi	0.102 UF (0.058 UF/sect.)

Freq Range (Hz)	Return Loss * (dB)
100 to 200	38
200 to 300	40
300 to 3000	44
3000 to 3500	35

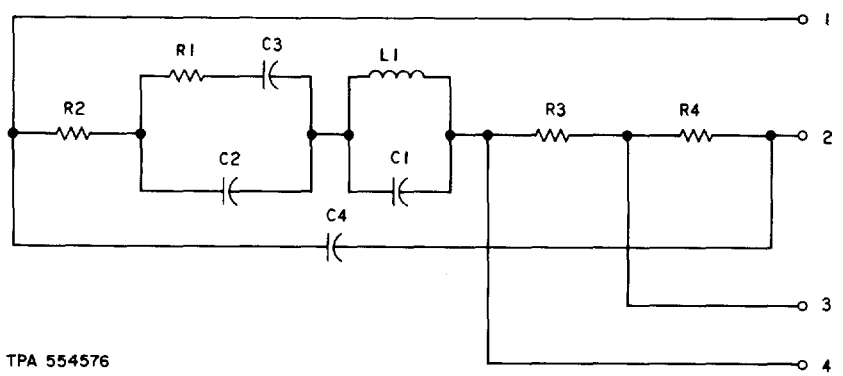
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Cap. Per Section (UF)	Strap Terminals
Below 0.0543	None
0.0549 to 0.0560	3-5
0.0560 to 0.0571	5-6
Above 0.0571	3-6

Nominal Impedance of Network
(Between Terminals 1 and 2 With Terminals 5 and 6 Strapped.)

Freq (Hz)	Impedance
100	1010 - j352
200	953 - j183
500	934 - j75
1000	921 - j40
1500	905 - j29
2000	880 - j23.5
2500	847 - j19.1
3000	808 - j14.7
3500	756 - j6.1
4000	694 + j7.3

Fig. 21—115AG Network—Engineering Information



19-GAUGE CABLE H-44 SIDE

Component	Value
L1	0.01540 H
R1	1882 ohms
R2	800
R3	30
R4	15
C1	0.02741 UF
C2	1.182
C3	1.581
C4	BO Cap.

Basic End Section	0.168
Midsection BOC	0.0234 UF
Nominal Cable Cap./mi	0.062 UF (0.0704 UF/sect.)

Freq Range (Hz)	Return Loss * (dB)
100 to 200	36
200 to 300	40
300 to 2900	44
2900 to 3500	35

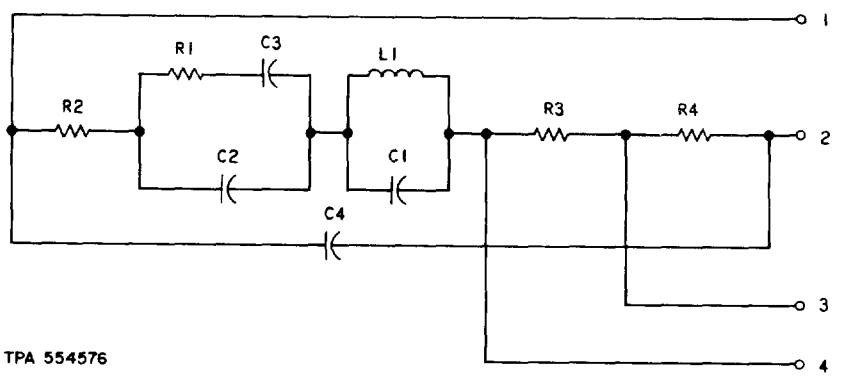
* Return loss of network, including manufac-turing tolerances, against theoretical line.

Cable Cap. Per Section (UF)	Strap Terminals
Less than 0.069	None
0.069 to 0.0715	2-3
0.0715 to 0.0745	3-4
Greater than 0.0745	2-4

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOR - Ohms	0	15	30	45	Basic Net.
BOC - UF	0.0251	0.0242	0.0233	0.0225	None
Term. Strapped	2-4	3-4	2-3	None	2-4
Freq (Hz)					
100	1147 - j875	1163 - j875	1179 - j875	1194 - j875	1194 - j865
200	943 - j564	959 - j564	974 - j564	990 - j644	991 - j544
300	861 - j410	877 - j410	893 - j410	908 - j410	910 - j381
500	808 - j260	824 - j261	840 - j261	855 - j261	854 - j211
700	794 - j190	809 - j190	825 - j190	840 - j190	837 - j120
1000	790 - j135	806 - j135	821 - j135	837 - j136	827 - j34.9
1500	801 - j92.7	816 - j92.7	831 - j92.5	846 - j92.6	822 + j61.5
2000	823 - j72.1	838 - j71.9	853 - j71.4	868 - j71.1	820 + j140
2500	859 - j61.4	873 - j60.6	887 - j59.4	900 - j58.4	820 + j216
3000	911 - j58.5	924 - j56.7	938 - j54.2	951 - j52.8	820 + j297
3500	988 - j66.6	1000 - j62.7	1011 - j58.0	1024 - j54.8	821 + j387

Fig. 22—115AH Network—Engineering Information



19-GAUGE CABLE H-25 PHANTOM

COMPONENT	VALUE
L1	9.22 mH
R1	1088 ohms
R2	481
R3	20
R4	10
C1	0.03453 UF
C2	2.150
C3	2.720
C4	BOC

Basic End Section	0.166
Midsection BOC	0.0387 UF
Nominal Cable Cap./mi	0.102 UF (0.116 UF/sect.)

Freq Range (Hz)	Return Loss *(dB)
100 to 200	38
200 to 300	40
300 to 3000	44
3000 to 3500	35

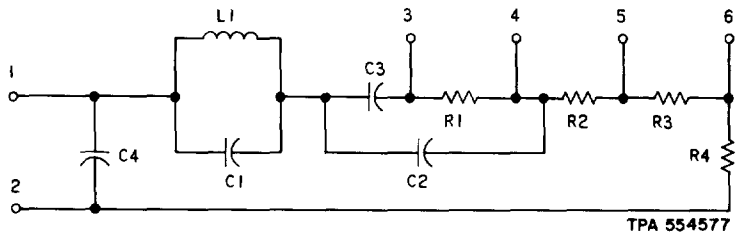
*Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Cap. Per Section (UF)	Strap Terminals
Less than 0.107	None
0.107 to 0.112	2-3
0.112 to 0.116	3-4
Greater than 0.116	2-4

Nominal Midsection Impedance of Network
(Between Terminals 1 and 2)

BOR - ohms	0	10	20	30	Basic Net.
BOC - UF	0.0397	0.0380	0.0366	0.0352	None
Term. Strapped	2-4	3-4	2-3	None	2-4
Freq (Hz)					
100	669 - j492	679 - j492	690 - j492	701 - j492	695 - j487
200	557 - j313	568 - j313	578 - j313	589 - j313	585 - j302
300	514 - j226	524 - j226	534 - j226	545 - j226	541 - j209
500	486 - j143	496 - j143	506 - j142	517 - j143	512 - j114
700	478 - j103	489 - j103	499 - j103	509 - j103	503 - j63.1
1000	477 - j72.4	487 - j52.5	497 - j72.5	508 - j72.5	497 - j14.7
1500	483 - j48.1	493 - j48.0	503 - j48.0	513 - j48.0	495 + j40.3
2000	496 - j36.2	506 - j35.9	516 - j35.8	525 - j35.7	494 + j85.1
2500	516 - j30.3	525 - j29.3	534 - j29.2	544 - j28.9	494 + j128
3000	543 - j28.7	552 - j27.0	561 - j26.5	569 - j25.6	494 - j171
3500	581 - j33.2	589 - j30.2	598 - j28.9	606 - j27.1	494 + j219

Fig. 23—115AJ Network—Engineering Information



10-, 13-, AND 16-GAUGE CABLE H-44 SIDE

Component	Value
L1	15.4 mH
C1	0.295 UF
C2, C3	2.16
R1	1595 ohms
R2	795
R3	15
R4	30
C4	BO Cond

Basic End Section	0.175
Midsection BOC	0.0229 UF
Nominal Cable Cap./mi	0.062 UF

Frequency Range (Hz)	Return Loss * (dB) 10 GA	13 GA	16 GA
200	25	35	40
300	28	40	40
500	32	40	40
1000 to 2000	40	40	40
2000 to 3000	35	35	37

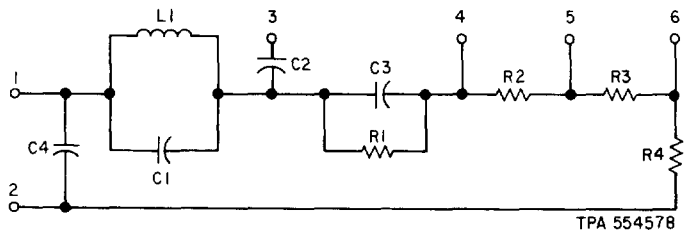
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Section)	Strap Term.
Below 0.0663	None
0.0663 to 0.0691	5-6
0.0691 to 0.0719	2-6
Above 0.0719	2-5-6

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	10- and 13-Gauge 0.0229 (2-6)(3-4)	16-Gauge 0.0229 (2-6)
Freq (Hz)		
200	805 - j183	867 - j335
300	805 - j121	832 - j234
500	807 - j72	812 - j143
1000	815 - j34	811 - j70
1500	832 - j19	825 - j43
2000	857 - j11	849 - j28
2500	895 - j4	886 - j18
3000	950 + j0.4	941 - j10
3500	1034 - j0.5	1024 - j9

Fig. 24—115BM Network—Engineering Information



10-, 13-, AND 16-GAUGE CABLE H-25 PHANTOM

Component	Value
L1	0.00922 H
C1	0.0428 UF
C2, C3	4.32
R1	1226 ohms
R2	472
R3	10
R4	20
C4	BO Cond

Basic End Section	0.148
Midsection BOC	0.04 UF
Nominal Cable Cap./mi	0.10 UF

Frequency Range (Hz)	Return Loss * (dB) 10 GA	13 GA	16 GA
200	26	29	40
300	29	40	40
500	33	40	40
1000 to 2000	40	40	40
2000 to 3000	35	36	36

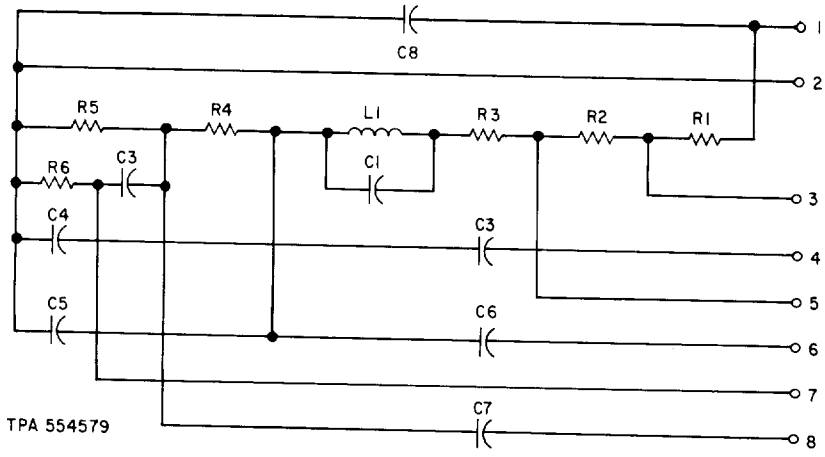
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Section)	Strap Term.
Below 0.1067	None
0.1067 to 0.1113	5-6
0.1113 to 0.1158	2-6
Above 0.1158	2-5-6

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	10- and 13-Gauge 0.04 (2-6)(3-4)	16-Gauge 0.04 (2-6)
Freq (Hz)		
200	462 - j86	502 - j179
300	480 - j61	486 - j121
500	481 - j37	483 - j74
1000	484 - j19	483 - j37
1500	498 - j14	491 - j25
2000	505 - j10	505 - j18
2500	532 - j9	526 - j16
3000	560 - j10	560 - j16

Fig. 25—115EN Network—Engineering Information



16- AND 19-GAUGE CABLE H-86-32 PHANTOM

Component	Value
R1	20
R2	10
R3	536
R4	743
R5	848
R6	1045
L1	10.55 mH
C1	0.0524 UF
C2, C7	1.08
C3, C5	0.45
C4, C6	2.16
C8	BOC

Basic End Section	0.1725
Midsection BOC	0.0372 UF
Nominal Cable Cap./mi	0.10 UF

Frequency Range (Hz)	Return Loss * (dB) 16-GA	19-GA
100	24	25
200 to 300	35	38
300 to 1500	35	40
1500 to 2500	39	40
2500 to 3000	39	35
3000 to 4000	30	35

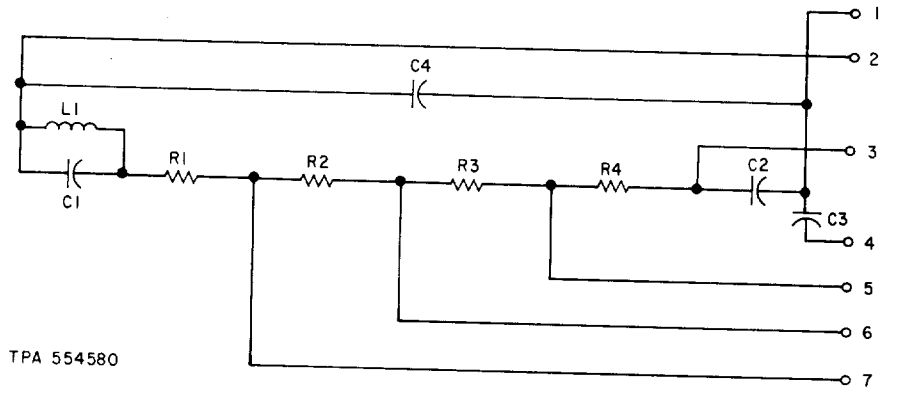
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Sect.)	Strapping 16-GA	19-GA
Below 0.1075	(2-4-6)(7-8)	-
0.1075 to 0.1115	(2-4-6)(7-8)(3-5)	(3-5)
0.1115 to 0.1157	(2-4-6)(7-8)(1-3)	(1-3)
Above 0.1157	(2-4-6)(7-8)(1-5)	(1-5)

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

	19-Gauge	19-Gauge Basic Net.	16-Gauge	16-Gauge Basic Net.
BOR - Ohms	10	10	10	10
BOC - UF	0.0372	None	0.0372	None
Terminals Strapped	(1-3)	(1-3)	(1-3)(2-4-6)(7-8)	(1-3)(2-4-6)(7-8)
Freq (Hz)				
100	736 - j491	752 - j483	606 - j283	614 - j276
200	599 - j283	614 - j269	558 - j150	566 - j136
300	566 - j196	580 - j176	550 - j102	556 - j81
500	544 - j121	560 - j88	543 - j62	551 - j28
1000	546 - j64	551 + j7	549 - j33	549 + j37
1500	556 - j48	549 + j60	559 - j28	548 + j80
2000	574 - j34	549 + j115	579 - j20	548 + j130
2500	600 - j27	549 + j168	608 - J16	548 + j180
3000	644 - j24	548 + j228	651 - j16	548 + j238
3500	712 - j26	548 + j299	722 - J21	548 + j308
4000	829 - j55	548 + j393	840 - j47	548 + j400

Fig. 26—115BG Network—Engineering Information



CABLE 16- AND 19-GAUGE H-172 SIDE

Component	Value
R1	1556 ohms
R2	16.7
R3	50
R4	25
L1	54.2 mH
C1	0.0364 UF
C2	2.16
C3	1.76
C4	BO Cond

Basic End Section	0.1835
Midsection BOC	0.0223 UF
Nominal Cable Cap./mi	0.062 UF

Frequency Range (Hz)	Return Loss * (dB)
200 to 1200	40
1200 to 2000	35
2000 to 2400	30

* Return loss of network, including manufacturing tolerances, against theoretical line.

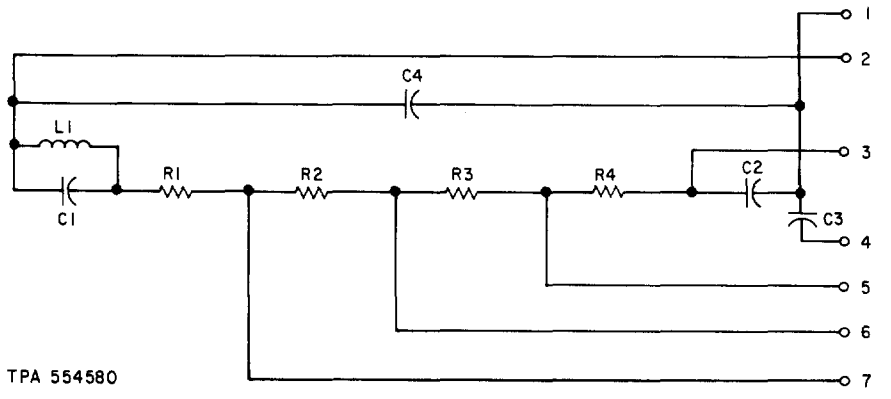
Cable Capacity (UF/Loading Sect.)	Strap Terminals
Below 0.0672	-
0.0672 to 0.0694	3-5
0.0694 to 0.0716	5-6
Above 0.0716	3-6

For 16-gauge, strap terminals 3-4 and 6-7.

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	16-Gauge 0.0223 (3-4)(5-6-7)	16-Gauge Basic Net. None (3-4)(5-6-7)	19-Gauge 0.0223 (5-6)	19-Gauge Basic Net. None (5-6)
Freq (Hz)				
200	1572 - j204	1587 - j135	1572 - j368	1602 - j300
500	1588 - j83	1587 + j94	1588 - j152	1602 + j26
800	1621 - j54	1588 + j236	1620 - j98	1603 + j195
1200	1703 - j30	1589 + j426	1701 - j64	1604 + j399
1600	1861 - j10	1591 + j655	1856 - j39	1606 + j634
2000	2183 - j10	1596 + j968	2172 - j35	1610 + j952
2400	2924 - j221	1604 + j1464	2897 - j246	1620 + j1450

Fig. 27—115AM Network—Engineering Information



CABLE 16- AND 19-GAUGE H-63 PHANTOM

Component	Value
R1	751 ohms
R2	4.83
R3	30
R4	15
L1	21.3 mH
C1	0.0456 UF
C2	3.32
C3	2.47
C4	BO Cond

Basic End Section	0.1763
Midsection BOC	0.0368 UF
Nominal Cable Cap./mi	0.100 UF

Frequency Range (Hz)	Return Loss * (dB) 16 GA	19 GA
200	40	32
200 to 2600	40	40
2600 to 2800	35	35

* Return loss of network, including manufacturing tolerances, against theoretical line.

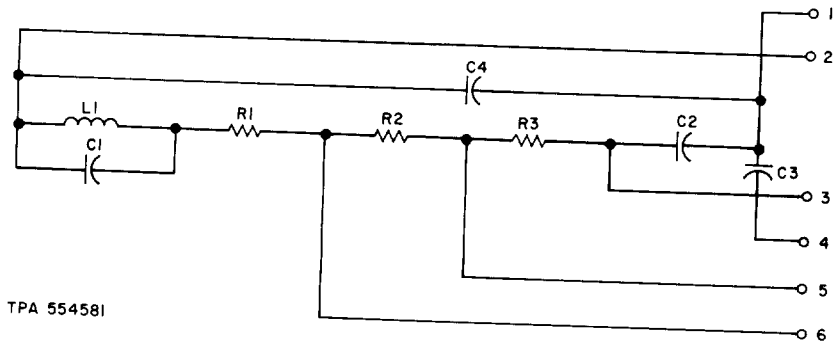
Cable Capacity (UF/Loading Sect.)	Strap Terminals
Below 0.1071	-
0.1071 to 0.1115	3-5
0.1115 to 0.1159	5-6
Above 0.1159	3-6

For 16-gauge, strap terminals 3-4 and 6-7.

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	16-Gauge 0.0368 (3-4)(5-6-7)	16-Gauge Basic Net. None (3-4)(5-6-7)	19-Gauge 0.0368 (5-6)	19-Gauge Basic Net. None (5-6)
Freq (Hz)				
200	760 - j137	768 - j111	757 - j238	773 - j213
500	765 - j56	768 + j13	762 - j96	774 - j28
800	774 - j35	769 + j75	772 - j61	774 + j50
1200	796 - j24	769 + j147	794 - j42	774 + j130
1600	832 - j18	769 + j220	828 - j32	774 + j207
2000	888 - j16	770 + j302	884 - j28	775 + j292
2400	978 - j23	771 + j401	973 - j34	776 + j392
2600	1044 - j34	771 + j459	1037 - j45	776 + j451
2800	1127 - j58	772 + j526	1119 - j67	777 + j518

Fig. 28—115AN Network—Engineering Information



CABLE 16- AND 19-GAUGE H-106 PHANTOM

Component	Value
R1	980 ohms
R2	40
R3	20
L1	31.8 mH
C1	0.0605 UF
C2	4.32
C3	3.32
C4	BO Cond

Basic End Section	0.2055
Midsection BOC	0.0335 UF
Nominal Cable Cap./mi	0.100 UF

Frequency Range (Hz)	Return Loss * (dB) 16-GA	19-GA
200 to 800	35	42
800 to 1600	40	35
1600 to 2400	35	32
2600	-	23

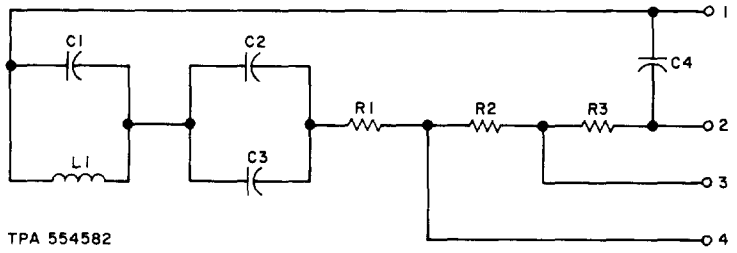
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Sect.)	Strap Terminals 16-GA	19-GA
Below 0.1071	(3-4)	-
0.1071 to 0.1115	(3-4-5)	(3-5)
0.1115 to 0.1159	(3-4)(5-6)	(5-6)
Above 0.1159	(3-4-6)	(3-6)

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	16-Gauge 0.0335 (3-4)(5-6)	16-Gauge Basic Net. None (3-4)(5-6)	19-Gauge 0.0335 (5-6)	19-Gauge Basic Net. None (5-6)
Freq (Hz)				
200	996 - j106	1004 - j64	990 - j185	1004 - j144
500	1005 - j46	1004 + j60	998 - j78	1004 + j28
800	1023 - j32	1004 + j142	1016 - j51	1004 + j122
1200	1068 - j20	1005 + j252	1060 - j33	1005 + j238
1600	1153 - j7	1006 + j384	1145 - j16	1006 + j374
2000	1325 + j4	1008 + j565	1316 - j2	1008 + j557
2400	1719 - j58	1013 + j847	1708 - j59	1013 + j840
2600	2101 - j254	1018 + j1065	2089 - j251	1018 + j1059

Fig. 29—115AP Network—Engineering Information



22-GAUGE CABLE B135-BSA

Component	Value
L1	41.8 mH
R1	1750 ohms
R2	37
R3	65
C1	0.02345 UF
C2	1.08
C3	0.54
C4	BOC

Basic End Section	0.186
Midsection BOC	0.0139 UF
Nominal Cable Cap./mi	0.078 UF(0.044 UF/sect.)

Freq Range (Hz)	Return Loss * (dB)
100 to 200	25
200 to 300	32
300 to 3000	34
3000 to 3200	30
3200 to 3500	24

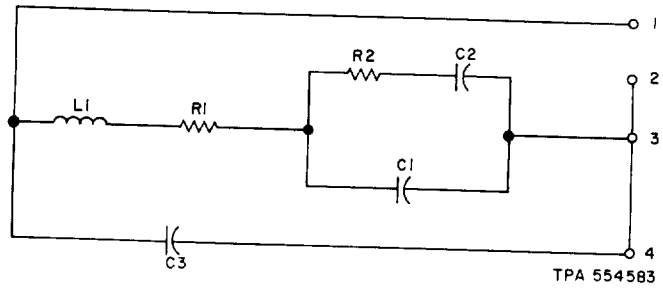
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity Per Section (UF)	Strap Terminals
0.042 or less	None
0.042 to 0.044	3-4
0.044 to 0.046	2-3
0.046 or more	2-4

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOR - ohms	0	37	102	Basic Net.
BOC - UF	0.01462	0.01391	0.01302	None
Terminals Strapped	2-4	2-3	None	None
Freq (Hz)				
100	1727 - j975.1	1765 - j975.3	1830 - j976.0	1860 - j955.9
250	1726 - j393.2	1764 - j392.8	1830 - j393.4	1858 - j326.7
300	1728 - j328.9	1765 - j328.4	1831 - j329.0	1858 - j247.7
500	1733 - j201.8	1771 - j200.7	1836 - j201.6	1857 - j62.72
1000	1765 - j108.6	1802 - j106.2	1866 - j107.4	1857 + j177.7
1500	1828 - j75.94	1864 - j71.32	1926 - j72.20	1858 + j370.6
2000	1943 - j54.60	1976 - j46.08	2035 - j44.81	1859 + j579.4
2400	2099 - j43.25	2129 - j28.79	2183 - j22.81	1861 + j780.2
2600	2212 - j43.65	2241 - j24.08	2290 - j13.84	1863 + j898.9
2800	2361 - j54.33	2387 - j27.39	2432 - j10.11	1866 + j1035.0
3000	2560 - j85.61	2583 - j47.22	2521 - j18.49	1869 + j1194.0
3200	2828 - j162.0	2849 - j104.9	2881 - j56.35	1874 + j1383.0
3600	3649 - j716.1	3698 - j575.2	3737 - j425.9	1891 + j1906.0

Fig. 30—115S Network—Engineering Information



19-GAUGE CABLE H-31 SIDE

Component	Value
L1	11.95 mH
R1	702 ohms
R2	1430
C1	0.975 UF
C2	1.200
C3	BOC

Basic End Section	0.164
Midsection BOC	0.0237 UF
Nominal Cable Cap./mi	0.062 UF(0.0704 UF/Sect.)

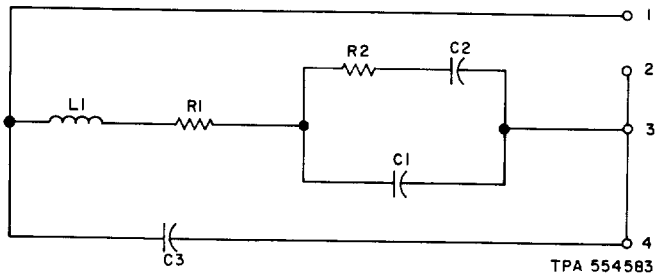
Freq Range (Hz)	Return Loss * (dB)
100 to 200	24
200 to 300	34
300 to 2800	40
2800 to 3500	34

* Return loss of network, including manufacturing tolerances, against theoretical line.

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	Basic End Section Impedance	Midsection Impedance
100	1055 - j892	1027 - j896
200	929 - j568	898 - j583
300	844 - j425	812 - j447
500	767 - j263	736 - j299
1000	721 - j84.5	695 - j157
1500	711 + j4.9	695 - j106
2000	708 + j69.0	705 - j81.4
2500	706 + j123	721 - j69.6
3000	706 + j171	741 - j68.0
3500	705 + j216	764 - j73.0

Fig. 31—115AB Network—Engineering Information



19-GAUGE CABLE H-18 PHANTOM

Component	Value
L1	6.80 mH
R1	420 ohms
R2	925
C1	1.940 UF
C2	2.340
C3	BOC

Basic End Section	0.166
Midsection BOC	0.0387 UF
Nominal Cable Cap./mi	0.102 UF (0.116 UF/Sect.)

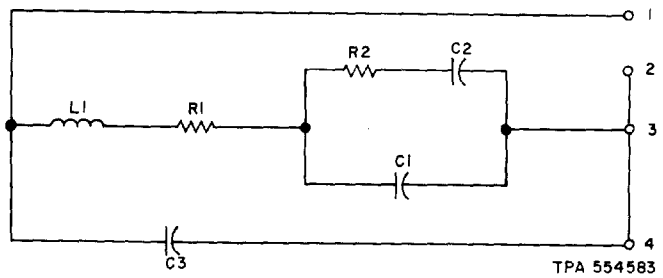
Freq Range (Hz)	Return Loss * (dB)
100 to 200	24
200 to 300	34
300 to 2800	40
2800 to 3500	34

* Return loss of network, including manufacturing tolerances, against theoretical line.

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	Basic End Section Impedance	Midsection Impedance
100	621 - j491	607 - j494
200	532 - j308	516 - j316
300	484 - j227	468 - j239
500	447 - j134	432 - j155
1000	428 - j38.2	416 - j80.0
1500	424 + j9.8	417 - j53.8
2000	423 + j44.6	424 - j41.8
2500	422 + j74.1	432 - j36.3
3000	422 + j101	443 - j35.6
3500	422 + j126	456 - j39.0

Fig. 32—115AD Network—Engineering Information



16-GAUGE CABLE H-31 SIDE

Component	Value
L1	11.95 mH
R1	684 ohms
R2	1550
C1	1.940 UF
C2	2.450
C3	BOC

Basic End Section	0.158
Midsection BOC	0.0242 UF
Nominal Cable Cap./mi	0.062 UF (0.0704 UF/sect.)

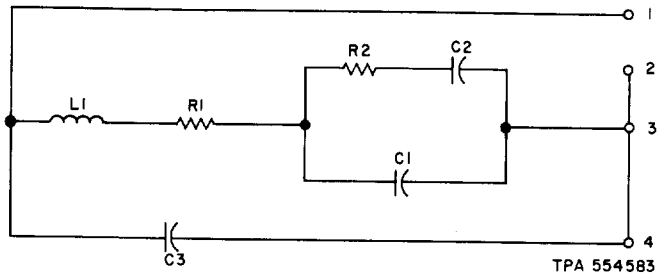
Freq Range (Hz)	Return Loss * (dB)
100 to 200	24
200 to 300	34
300 to 2800	40
2800 to 3500	34

* Return loss of network, including manufacturing tolerances, against theoretical line.

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	Basic End Section Impedance	Midsection Impedance
100	914 - j597	898 - j604
200	774 - j353	757 - j367
300	729 - j237	713 - j258
500	702 - j123	687 - j158
1000	690 - j6.5	681 - j77.6
1500	687 + j58.0	688 - j50.1
2000	687 + j109	702 - j38.4
2500	686 + j155	719 - j33.8
3000	686 + j198	741 - j36.3
3500	686 + j239	767 - j45.5

Fig. 33—115AC Network—Engineering Information



16-GAUGE CABLE H-18 PHANTOM

Component	Value
L1	6.80 mH
R1	411 ohms
R2	870
C1	3.70 UF
C2	4.50
C3	BOC

Basic End Section	0.166
Midsection BOC	0.0387 UF
Nominal Cable Cap./mi	0.102 UF (0.116 UF/sect.)

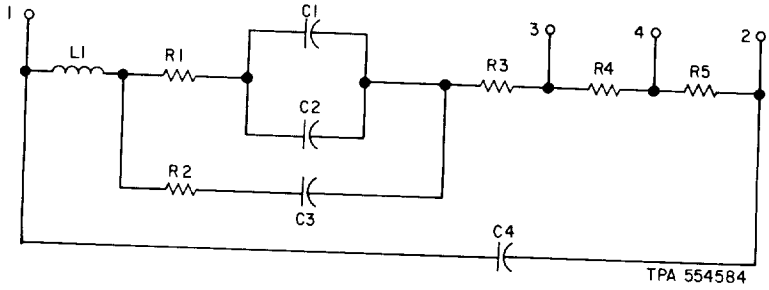
Freq Range (Hz)	Return Loss * (dB)
100 to 200	24
200 to 300	34
300 to 2800	40
2800 to 3500	34

* Return loss of network, including manufacturing tolerances, against theoretical line.

Nominal Impedance of Network (Between Terminals 1 and 2)

Freq (Hz)	Basic End Section Impedance	Midsection Impedance
100	529 - j320	521 - j324
200	458 - j180	450 - j188
300	434 - j124	426 - j136
500	420 - j63.2	413 - j83.3
1000	414 - j0.1	410 - j40.6
1500	413 + j35.5	414 - j26.2
2000	413 + j64.0	422 - j21.4
2500	412 + j89.6	431 - j18.7
3000	412 + j114	443 - j17.2
3500	412 + j137	457 - j16.1

Fig. 34—115AE Network—Engineering Information



13-GAUGE CABLE H-31 SIDE

Component	Value
R1	839 ohms
R2	1380
R3	586
R4	10
R5	20
C1	2.16 UF
C2	1.08
C3	4.32
L1	0.012 H
C4	BO Cond

Basic End Section	0.158
Midsection BOC	0.0242 UF
Nominal Cable Cap./mi	0.062 UF

Freq Range (Hz)	Return Loss * (dB)
100 to 3000	40
3000 to 3500	34

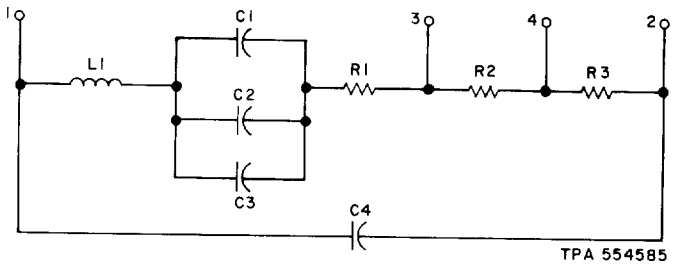
* Return loss of network, including manufacturing tolerances against theoretical line.

Cable Capacity (UF/Loading Section)	Strap Terminals
Below 0.0663	None
0.0663 to 0.0691	3-4
0.0691 to 0.0719	2-4
Above 0.0719	2-3-4

Nominal Impedance of Network
(Between Terminals 1 and 2) (2 and 4 Strapped)
(BOC - 0.0242 UF)

Freq (Hz)	Midsection Impedance
100	769 - j378
200	700 - j208
300	683 - j141
500	675 - j84
1000	677 - j39
1500	687 - j23
2000	701 - j17
2500	720 - j16
3000	742 - j20
3500	768 - j31
4000	798 - j48

Fig. 35—115BP Network—Engineering Information



13-GAUGE CABLE H-18 PHANTOM

Component	Value
R1	400 ohms
R2	10
R3	20
C1	3.60 UF
C2	3.33
C3	0.026
L1	0.0068 H
C4	BO Cond

Basic End Section	0.165
Midsection BOC	0.379 UF
Nominal Cable Cap./mi	0.10 UF

Freq Range (Hz)	Return Loss * (dB)
100 to 200	24
200 to 300	34
300 to 3500	40

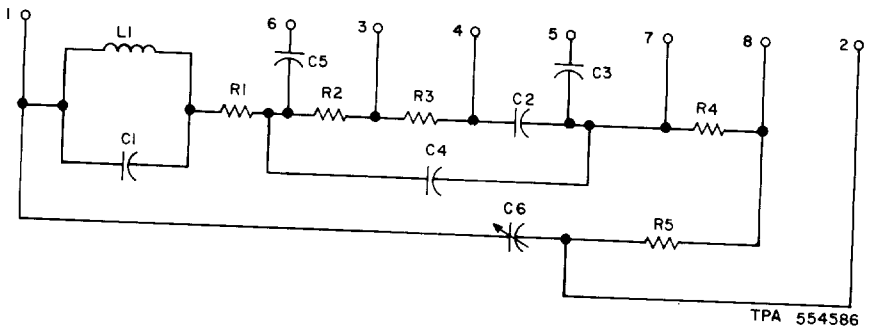
* Return loss of network, including manufacturing tolerances against theoretical line.

Cable Capacity (UF/Loading Section)	Strap Terminals
Below 0.1067	None
0.1067 to 0.1113	3-4
0.1113 to 0.1158	2-4
Above 0.1158	2-3-4

Nominal Impedance of Network
(Between Terminals 1 and 2) (2 and 4 Strapped)
(BOC - 0.0379 UF)

Freq (Hz)	Midsection Impedance
100	406 - j227
200	406 - j113
300	407 - j75
500	407 - j44
1000	410 - j20
1500	416 - j12
2000	424 - j9
2500	434 - j9
3000	446 - j11
3500	460 - j17
4000	476 - j25

Fig. 36—115BR Network—Engineering Information



CABLE QUADDED TOLL PAIRS 16- AND 19-GAUGE 3000-7.5 LOADING

Component	Value
R1	495 ohms
R2	1040
R3	288
R4	10
R5	20
C1	0.0134 UF
C2, C3	1.08 UF
C4	0.7145 UF
C5	0.6884 UF
C6	BO Cond
L1	2.55 mH

Basic End Section	0.21
Midsection BOC (16-Gauge)	0.0105 UF
Midsection BOC (19-Gauge)	0.0103 UF
Nominal Cable Cap./mi	0.062 UF

Freq Range (Hz)	Return Loss * (dB)	GA
200 - 15,000	35	16
200 - 10,000	35	19
10,000 - 15,000	30	19

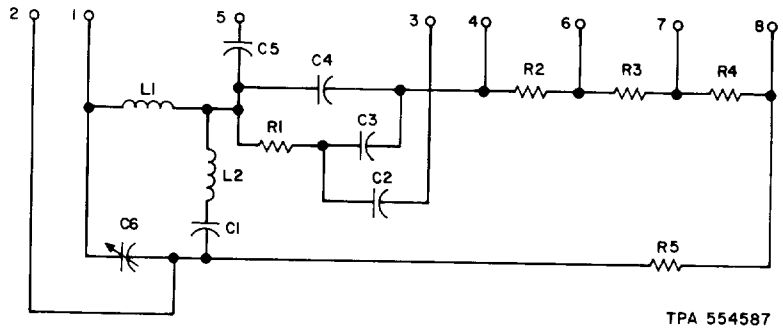
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Section)	Strapping 16-GA	Strapping 19-GA
Below 0.0331	(3-4-5)(6-7)	-
0.0331 to 0.0345	(3-4-5)(6-7)(7-8)	(7-8)
0.0345 to 0.0357	(3-4-5)(6-7)(2-8)	(2-8)
Above 0.0357	(3-4-5)(6-7)(2-7)	(2-7)

Nominal Midsection Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	16-Gauge 0.0105 (3-4-5)(6-7)(2-8)	19-Gauge 0.0103 (2-8)
Freq (Hz)		
200	671 - j413	812 - j670
300	600 - j319	716 - j535
500	543 - j211	607 - j381
1,000	511 - j111	527 - j213
2,000	503 - j57.9	503 - j110
3,000	504 - j39.8	500 - j74.4
5,000	512 - j25.8	506 - j45.3
10,000	566 - j8.2	556 - j22.4
15,000	730 - j26.0	714 - j36.0
20,000	1122 - j577	1113 - j552

Fig. 37—115BH Network—Engineering Information



CABLE QUADDED TOLL PAIRS 16- AND 19-GAUGE 1000-7.5 LOADING

Component	Value
R1	1659 ohms
R2	30
R3	15
R4	15
R5	805
C1	3800 pF
C2, C3	
C4, C5	1.08 UF
C6	BO Cond
L1	2.55 mH
L2	3.00 mH

Basic End Section	Midcoil
Nominal Cable Cap./mi	0.062 UF

Freq Range (Hz)	Return Loss * (dB)	Ga
200 to 15,000	35	16
200 to 15,000	35	19

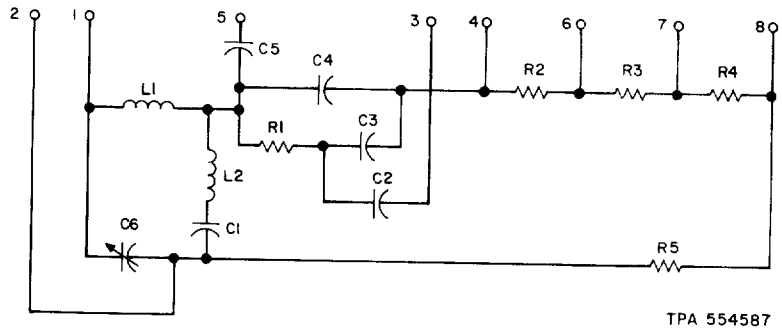
* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Sect.)	Strapping 16-Ga	Strapping 19-Ga
Below 0.0111	(3-4-5)	(7-8)
0.0111 to 0.0115	(3-4-5)(6-7)	(7-8)(6-7)
0.0115 to 0.0120	(3-4-5)(4-6)	(7-8)(4-6)
Above 0.0120	(3-4-5)(4-7)	(7-8)(4-7)

Nominal Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	16-Gauge 0 (3-4-5)(4-6)	19-Gauge 0 (7-8)(4-6)
Freq (Hz)		
200	902 - j338	1000 - j574
300	868 - j235	924 - j427
500	848 - j145	863 - j277
1,000	831 - j73.5	829 - j145
2,000	832 - j37.4	811 - j73.0
3,000	830 - j26.2	814 - j48.7
5,000	825 - j15.0	807 - j29.0
10,000	799 - j14.0	781 - j14.0
15,000	751 - j14.0	737 - j10.0
20,000	675 - j10.3	664 - j2

Fig. 38—115BJ Network—Engineering Information



CABLE QUADDED TOLL PAIRS 16- AND 19-GAUGE 1500-11 LOADING

COMPONENT	VALUE
R1	1639 ohms
R2	30
R3	15
R4	15
R5	795
C1	5695 pF
C2, C3	1.09 UF
C4, C5	1.09 UF
C6	BO cond
L1	3.74 mH
L2	4.40 mH

Basic End Section	Midcoil
Nominal Cable Cap./mi	0.062 UF

Freq Range (Hz)	Return Loss * (dB)	Ga
200 to 15,000	35	16
200 to 15,000	35	19

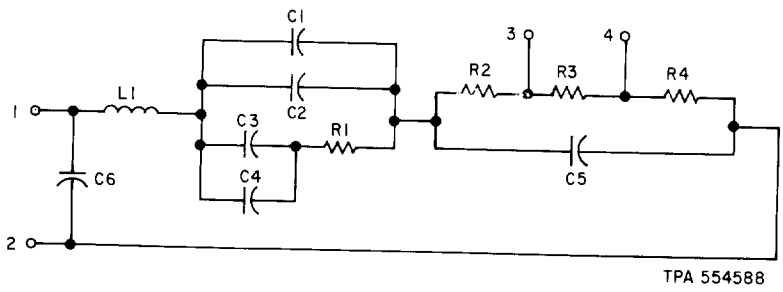
* Return loss of network including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Sect.)	Strapping 16-Gauge	Strapping 19-Gauge
Below 0.0166	(3-4-5)(none)	(7-8)(none)
0.0166 to 0.0173	(3-4-5)(6-7)	(7-8)(6-7)
0.0173 to 0.0179	(3-4-5)(4-6)	(7-8)(4-6)
Above 0.0179	(3-4-5)(4-7)	(7-8)(4-7)

Nominal Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	16-Gauge 0 (3-4-5)(4-6)	19-Gauge 0 (7-8)(4-6)
Freq (Hz)		
200	892 - j337	988 - j571
300	857 - j235	913 - j425
500	835 - j145	851 - j277
1,000	825 - j74.0	815 - j144
2,000	820 - j38.2	804 - j72.6
3,000	816 - j26.6	798 - j48.0
5,000	804 - j18.4	786 - j27.9
10,000	742 - j14.4	728 - j12.0
15,000	621 - j3.85	612 + j3.78
20,000	422 + j58.7	420 + j66.2

Fig. 39—115BK Network—Engineering Information



16-GAUGE CABLE B-22-N

Component	Value
R1	1662 ohms
R2	780
R3	15
R4	30
C1	0.718 UF
C2	1.66
C3	0.718
C4	1.88
C5	0.013
C6	BO Cond
L1	0.0082 H

Basic End Section — Midcoil
Nominal Cable Cap./mi — 0.062 UF

Freq Range (Hz)	Return Loss * (dB)
100 to 3500	40

* Return loss of network, including manufacturing tolerances, against theoretical line.

Cable Capacity (UF/Loading Sect.)	Strap Terminal
Below 0.0331	None
0.0331 to 0.0345	3-4
0.0345 to 0.0359	3-4
Above 0.0359	2-3-4

Nominal Impedance of Network (Between Terminals 1 and 2)

BOC - UF Terminals Strapped	0 2-4
Freq (Hz)	
100	968 - j538
200	852 - j312
300	825 - j216
500	807 - j133
1000	796 - j67.4
1500	790 - j45.2
2000	784 - j33.5
2500	776 - j25.6
3000	767 - j19.1
3500	757 - j13.1
4000	745 - j6.8
5000	719 + j7.6
6000	690 + j25.7

Fig. 40—115BS Network—Engineering Information