REISSUE GUIDE

X-75525 Issue 2
March 1966

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X-75525

ENGINEERING REFERENCE DATA

BELL SYSTEM RESISTORS

BELL TELEPHONE LABORATORIES INCORPORATED

CHECK LIST
For
X-75525, Issue 2
March 1966

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BELL SYSTEM
RESISTORS

1. INTRODUCTION

This is one of a series of Engineering Reference Data Bulletins containing information on apparatus designed by the Bell Telephone Laboratories, Incorporated for other than military applications, and manufactured by the Western Electric Company or by other suppliers in accordance with specifications prepared by the Laboratories. It is intended primarily for use by engineers of the Laboratories and contains information on apparatus which may be rated AT&TCo STANDARD, A&M Only, Component Part; codes classified ML except as noted; or codes designated for non-associate use. Codes rated Manufacture Discontinued and Component Part (ML) are not included.

Information given herein is intended to aid in development work. For any specific circuit arrangement, however, consideration should be given to the possible existence of new designs which may be smaller or less expensive, or may have more desireable characteristics.

TO OBTAIN THE LATEST INFORMATION AND COMPLETE CHARACTERISTICS FOR ANY APPLICATION, CONSULT THE COMPONENTS LABORATORY, RESISTORS GROUP.

All resistors contained in the bulletin are general use types, except those designated special use. Special use types are so described because they are highly specialized and of limited application. PREFERRED NUMBERS (Standard Resistance Values) are given in Table 1, page vii. These values should be used when specifying the desired value of resistance of Family Code type resistors. Resistance values should be limited, insofar as possible, to these PREFERRED NUMBERS because of manufacturing economies. For definitions and additional information concerning Family Codes, see 3.2.

2. CARD CATALOG RATINGS

It is planned to bring this bulletin up to date periodically. However, the information contained herein may not be complete and ratings of the items are not shown. Therefore, the final selection of apparatus should be made on the basis of the usual sources of information such as the Western Electric Apparatus Card Catalog, the manufacturing specifications, and price data. For information regarding the output of apparatus, refer to the Western Electric Report A-822.1.

The bulletin contains some codes of apparatus for which catalog cards will not be found in the Western Electric Apparatus Card Catalog. Such codes are in general rated "Component Part". This rating is applied to apparatus where it is believed that the associated companies will have no need for apparatus card catalog information and orders for the apparatus from the field are not expected.

When apparatus which is not listed on a white card in the Western Electric Apparatus Card Catalog is selected for use in new applications, the Head, Engineering Standards Department, Bell Telephone Laboratories, Incorporated, 463 West Street, New York 10014, N.Y. should be notified of the new use and probable demand so that consideration can be given to rerating the apparatus. When such new applications are made within the Laboratories, the selection should first be discussed with the Components Laboratory, Resistors Group.

3. DATA AND INDEX TABLES

Coded and KS-specification resistors are included in the bulletin. Two indices follow this introduction, (1) a numerical index by code type indicating whether the resistor is for General or Special use and in what section the code will be found, and (2) a numerical index of all codes and KS-specifications indicating the section, page, and where necessary, the line on the page on which the resistor data will be found.

Detailed information on the resistance values, mechanical form, dimensions, characteristics and circuit arrangements are given in the data tables.

3.1 Specific Resistance Codes

Data Tables are provided for coded resistors in which a specific code designation is assigned to a resistor having a specific resistance value (i.e. 19BA, 36A, etc.). The resistors are listed in these tables in the order of ascending values of resistance, to facilitate the selection of resistors for new applications. However, in several cases of resistors with more than one winding, the resistors are listed in alphabetical order of the code letter.

3.2 Family Codes

A Family Code applies where the resistor code number must be followed by a nominal resistance value to complete the description and ordering information. Family code specifications cover a range of resistance values rather than specifying an individual resistance value as in the specific resistance codes. The marking on the resistor includes the code number followed by its nominal resistance value in ohms, for example; "106A 100" or KS-8512L5 1000". Family codes are of two classes, as described below, RESTRICTED and NON-RESTRICTED.

3.21 Resistance Values

A family coded resistor may be obtained in any value within the range specified in its data table. However, effort shall be made to choo se a resistance value and tolerance from Table 1, page vii, of STANDARD RESISTANCE VALUES in order to take advantage of manufacturing economies.

3.22 Restricted Family Codes

For restricted family codes, the nominal values of resistance in current production by the Western Electric Company are listed on its Western Electric Company Apparatus Card Catalog card under the headings PREFERRED and NON-PREFERRED. Wherever possible the engineer should specify the PREFERRED values. These values are in accordance with Table 1, page vii, of STANDARD RESISTANCE VALUES. The NON-PREFERRED values are those within the prescribed range of values for the code but not in accordance with the STANDARD RESISTANCE VALUES Table in either/or resistance or tolerance.

New values in accordance with STANDARD RESISTANCE VALUES Table will be added to the list of PREFERRED values on the card catalog card by the Western Electric Company Technical Publications Organization, Apparatus Card Catalog, upon written request from the engineer. The new value may then be used in specifications, drawings, and orders. New values will be added to the list of NON-PREFERRED values on the card catalog card by the Western Electric Company Technical Pub-

lications Organization, Apparatus Card Catalog, upon written request from the engineer. This request should contain the reasons for requiring the NON-PREFERRED value as well as drawing and specification references for the circuit application of the resistor. The new value should not be referred to in specifications, drawings, and orders until approval has been received from the Standards Engineering Coding Group. This procedure is also required for new applications of a NON-PREFERRED value already listed in the Western Electric Apparatus Card Catalog.

3.23 Non-Restricted Family Codes

For non-restricted family codes, the nominal values of resistance in current production by the Western Electric Company are not listed in the Western Electric Apparatus Card Catalog and the procedures necessary to restricted family codes do not apply. However, it is recommended that resistance values in agreement with the STANDARD RESISTANCE VALUES Table be specified for use with these codes wherever possible.

3.24 Family Codes - Wire Wound

Most of the family code-type wire wound resistors are in the PRECISION wire wound classification. These resistors are all available in ±1% tolerances and some are also available in tolerances as close as ±0.1% of nominal resistance value. Others are available in tolerances of ±2% and ±5% for use in applications for which closer tolerances are not required and a saving in manufacturing costs is desired. Precision resistors are distinguished from power resistors in wattage rating, resistor tolerance, size, and construction material, although there is some overlapping of precision and power resistors in all these features.

4. RESISTOR SELECTION AND APPLICATION GUIDE

The following recommended practices will contribute to reliability, standardization, and least cost in the application of resistors:

4.1 Resistance Values and Tolerances

4.11 Nominal resistance value for family coded resistors shall be selected from the STANDARD RESISTANCE VALUES Table, page vii. (See 4.12).

4.12 In the case of the following resistor types only, the nominal resistance value shall be selected from the industry tables of recommended values shown in the individual KS-specification:

Carbon Composition Types		Wire Wound Types
KS-13490	KS-16645	KS-13609
KS-13491		KS-13809
KS-13492		

4.13 Whenever possible, the broadest possible initial tolerance should be specified to achieve the lowest resistor cost.

4.2 Wattage and Derating Characteristics - Normal Operation

4.21 The wattage rating should never be exceeded (See 4.41). For operation at higher ambient temperatures, the maximum permissible power shall be decreased in accordance with the

specified power-temperature derating curve.

4.22 Maximum permissible power shall be reduced further if air flow is restricted by an enclosure, or if a number of resistors dissipating power are grouped together.

4.23 In critical applications where long term reliability and stability are essential, it is recommended that a resistor be selected such that its power rating is at least twice the power to be dissipated. This of course will result in a physically larger and more expensive resistor in most cases.

4.24 The vitreous enamel resistors of the KS varieties should be operated at 1/2 of their rated power to limit the surface temperature for personnel safety, or supplementary protection should be provided. When the option of reduced power is used, further reduction in accordance with 4.23 is not necessary.

4.25 The normal rating of the coded vitreous enamel resistors has been established to control the surface temperature for personnel safety. For this reason, further reduction of power dissipation in accordance with 4.23 is not necessary.

4.3 Wattage Characteristics - Trouble Conditions

4.31 The trouble wattage should not exceed twice the rated wattage. (The trouble wattage should not exceed the specified rated wattage in the case of the KS vitreous enamel resistors).

4.32 Some resistors, under high overload conditions, will burst into flame. If trouble conditions of this type cannot be avoided, spacing should be provided between the resistor and other flammable parts. This application should be brought to the attention of the Components Laboratory, Resistors Group.

4.4 Voltage Ratings

4.41 The maximum continuous voltage rating (DC or AC RMS) should never be exceeded, regardless of the voltage as calculated from the formula $E = RP$, where R = Resistance in ohms and P = Power in watts.

4.42 For short duration pulse operation, it is recommended that the peak voltage exceed 2 times the rated continuous working voltage. (See 4.63).

4.5 Mounting of Resistors

4.51 Other components susceptible to heat damage shall be spaced away from heat producing resistors.

4.52 When voltages in excess of maximum DC or AC RMS values exist between the resistor and a conducting surface, supplementary insulation shall be provided to insure protection against breakdown.

4.53 Resistors larger than 1/2" in diameter or larger than 2" in length shall not be mounted on their terminal leads. Resistors shall never be mounted by their terminal lugs.

4.54 Resistor terminal leads shall never be bent closer than 1/16" from the resistor body.

4.55 The length of the resistor lead between the resistor body and point of application of solder shall be 1/2" nominal, 3/8" minimum. For critical applications where short lead lengths are essential, the problems should be discussed with the Components Laboratory, Resistors Group.

4.56 No finish should be applied over the resistor body after assembly into equipment in order to prevent possible damage to the resistive element, or deterioration of the finish due to resistor heat.

4.6 Selection and Application

4.61 Only coded or KS resistors should be specified on drawings for Bell System use.

4.62 New resistor types, available from outside suppliers, should be discussed with the Components Laboratory, Resistors Group prior to using in circuit applications.

4.63 Special applications or situations (temperature coefficient, frequency performance, ratings under pulse conditions, cost, stability, etc.) should be discussed with the Components Laboratory, Resistors Group.

4.64 It is suggested that all resistor applications in a new circuit or system be reviewed with the Components Laboratory, Resistors Group prior to final issuance of the manufacturing drawings.

TABLE 1

STANDARD RESISTANCE VALUES

(PREFERRED NUMBERS)

Tolerance				Tolerance				Tolerance			
±1%	±2%	±5%	±10%	±1%	±2%	±5%	±10%	±1%	±2%	±5%	±10%
100	100	100	100	162	162	162	162	261	261	261	261
101				164				264			
102	102			165	165			267	267		
104				167				271			
105	105	105		169	169	169		274	274	274	
106				172				277			
107	107			174	174			280	280		
109				176				284			
110	110	110	110	178	178	178	178	287	287	287	287
111				180				291			
113	113			182	182			294	294		
114				184				298			
115	115	115		187	187	187	187	301	301	301	
117				189				305			
118	118			191	191			309	309		
120				193				312			
121	121	121	121	196	196	196	196	316	316	316	316
123				198				320			
124	124			200	200			324	324		
126				203				328			
127	127	127		205	205	205		332	332	332	
129				208				336			
130	130			210	210			340	340		
132				213				344			
133	133	133	133	215	215	215	215	348	348	348	348
135				218				352			
137	137			221	221			357	357		
138				223				361			
140	140	140		226	226	226		365	365	365	
142				229				370			
143	143			232	232			374	374		
145				234				379			
147	147	147	147	237	237	237	237	383	383	383	383
149				240				388			
150	150			243	243			392	392		
152				246				397			
154	154	154		249	249	249		402	402	402	
156				252				407			
158	158			255	255			412	412		
160				258				417			

TABLE 1 (CONT.)

STANDARD RESISTANCE VALUES

(PREFERRED NUMBERS)

Tolerance				Tolerance				Tolerance			
±1%	±2%	±5%	±10%	±1%	±2%	±5%	±10%	±1%	±2%	±5%	±10%
422	422	422	422	562	562	562	562	750	750	750	750
427				569				759			
432	432			576	576			768	768		
437				583				777			
442	442	442		590	590	590		787	787	787	
448				597				796			
453	453			(4)				806	806		
459				604	604			816			
464	464	464	464	612				825	825	825	825
470				619	619	619	619	835			
475	475			626				845	845		
481				634	634			856			
487	487	487		642				866	866	866	
493				649	649	649		876			
499	499			657				887	887		
(4)				665	665			898			
505				673				909	909	909	909
511	511	511	511	681	681	681	681	920			
517				690				931	931		
523	523			698	698			942			
530				706				953	953	953	
536	536	536		715	715	715		965			
542				723				976	976		
549	549			732	732			988			
556				741							

NOTES:

1. The values given in this table have been chosen as standard for resistances having limits of ±1%, ±2%, ±5%, and ±10% as indicated in the respective columns headed by these percentage figures.

2. The table gives the first three significant figures only and the decimal point should be placed as necessary, within the range specified for the desired type of resistor.

3. In the case of resistors with accuracy limits closer than ±1% it is recommended that nominal values for the first three significant figures be chosen to agree with the figures in the ±1% column of the table where practicable and that these nominal values be specified to not more than four significant figures.

4. Standard values significant figures 500 and 600 are limited to 50 and 600 ohms in ±1% tolerances. Other values whose first three significant figures are 500 and 600 (such as 500 ohms and 60 ohms) are not standard.

CODED RESISTORS

KS-SPECIFICATION RESISTORS

* MANUFACTURE DISCONTINUED

CODED RESISTORS

CODED RESISTORS

CODED RESISTORS

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CODED RESISTORS

CODED RESISTORS

CODED RESISTORS

KS-SPECIFICATION RESISTORS

* MANUFACTURE DISCONTINUED

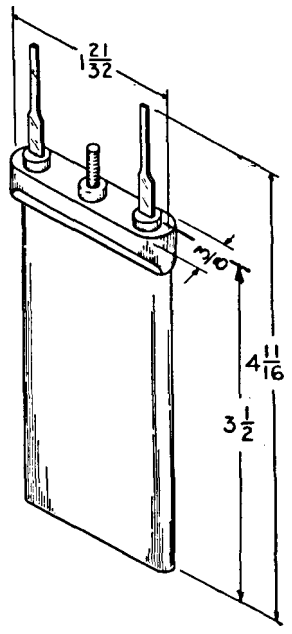
KS-SPECIFICATION RESISTORS

DESCRIPTION

The resistors have one winding on a metal card. Heat resistant insulating material is used over the winding. The terminals and mounting stud pass through the mounting panel from which they are insulated by sleeves which are integral parts of the molded phenolic terminal head assembly. Terminals are tinned and are arranged for mechanically wrapped connections. Closest recommended mounting centers are 7/16 inch by 1-3/4 inches.

The power rating at 150°F ambient temperature is 5.1 watts for normal operating conditions and at 75°F, 12 watts for trouble conditions. They are derated to 0 watts at 250°F ambient temperature for normal conditions and 275°F ambient temperature for trouble conditions.

The maximum voltage across the resistor shall not exceed 350 volts.



Line No.	CODE NO.	RESISTANCE OHMS	TOLERANCE ±5% or as shown
1	18HH	0.3	±2
2	18HJ	0.5	±2
3	18CS	0.6	
4	18CU	0.8	±3
5	18KW	1.1	±1
6	18CH	1.2	±1
7	18CW	1.6	±3
8	18HK	1.8	±1
9	18HL	2.0	±1
10	18BB	2.0	
11	18AY	2.4	±3
12	18HM	2.9	±1
13	18GC	3.2	
14	18GR	3.5	±2
15	18AL	4.0	
16	18GS	4.5	±2
17	18CJ	5.0	
18	18GW	5.4	±1
19	18FT	6.0	±1
20	18KG	6.8	
21	18GU	8.0	±1
22	18FW	8.0	
23	18R	10.0	
24	18HN	12.0	±.25
25	18DD	12.0	±4
26	18JT	13.5	±.25
27	18DJ	15.0	±1
28	18DY	17.1	±2
29	18DP	18.75	±.5
30	18BE	20.0	±1
31	18S	20.0	
32	18JL	21.34	±.25
33	18FU	22.0	±1
34	18EG	22.0	
35	18DK	25.0	±1
36	18J	30.0	
37	18A	37.0	
38	18HP	38.0	±.1
39	18KM	38.0	±1
40	18AW	40.0	±1
41	18B	40.0	
42	18FF	43.2	±2
43	18AB	45.0	
44	18GB	50.0	±1
45	18T	50.0	
46	18M	53.0	
47	18FH	56.0	
48	18BR	60.0	±1
49	18AK	60.0	
50	18Z	67.0	

18-Type RESISTOR - Phenolic Insulation

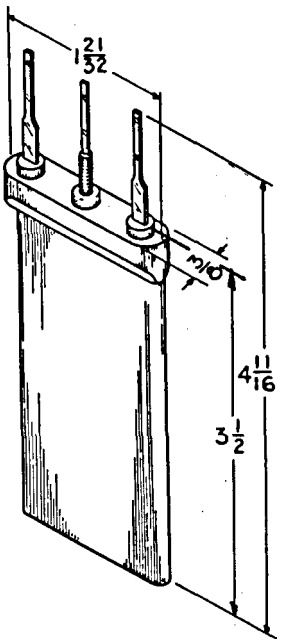
Line No.	CODE NO.	RESISTANCE OHMS	TOLERANCE ±5% or as shown
1	18JJ	67.65	±.1
2	18JS	67.65	±.25
3	18FE	68.0	±2
4	18ET	70.0	
5	18DM	72.4	±2
6	18ED	75.0	±1
7	18K	80.0	
8	18C	83.0	
9	18EB	84.0	±1
10	18BS	90.0	±1
11	18Y	90.0	
12	18AA	95.0	
13	18BW	100.0	±1
14	18U	100.0	
15	18Q	110.0	
16	18DL	111.0	±2
17	18EL	112.0	±1
18	18DW	112.5	±2
19	18HR	119.4	±.1
20	18EP	120.0	±1
21	18D	120.0	
22	18GJ	121.0	±.5
23	18HS	121.2	±.1
24	18EE	128.0	±1
25	18P	130.0	
26	18ER	133.0	±1
27	18W	133.0	
28	18JP	135.0	±1
29	18E	140.0	
30	18GD	142.0	±1
31	18F	150.0	
32	18HT	155.8	±.1
33	18L	170.0	
34	18N	180.0	
35	18JM	190.2	±.1
36	18KL	195.1	±.25
37	18BT	200.0	±1
38	18G	200.0	
39	18GP	208.0	±1
40	18JF	209.4	±.1
41	18FD	210.0	±1
42	18H	210.0	
43	18JG	220.4	±.1
44	18JR	220.4	±.25
45	18AG	226.0	
46	18AD	240.0	
47	18HU	245.5	±.1
48	18AM	250.0	
49	18LA	250.0	±1
50	18JH	268.1	±.1
51	18FA	270.0	±1
52	18EJ	270.0	
53	18HW	281.6	±.1
54	18JN	282.8	±.25
55	18BF	284.0	
56	18JK	289.5	±.1
57	18DF	290.0	
58	18HY	294.0	±.1
59	18JA	296.0	±.1
60	18HD	300.0	±.1
61	18BU	300.0	±1
62	18AF	300.0	
63	18AH	320.0	
64	18DC	325.0	±1
65	18BN	340.0	±1
66	18AS	350.0	±1
67	18AN	350.0	
68	18KH	367.5	±1
69	18AU	380.0	±1
70	18AR	380.0	
71	18BG	400.0	±1
72	18AJ	400.0	
73	18JB	421.6	±.1
74	18GK	422.0	±.5
75	18DG	426.0	±1
76	18CK	440.0	
77	18BC	470.0	
78	18JY	480.0	±1
79	18EU	500.0	±.5
80	18AP	500.0	±1
81	18AC	500.0	
82	18FY	510.0	±1
83	18HG	540.0	±.1
84	18GY	540.0	±1
85	18KD	568.0	

Phenolic Insulation - 18-Type RESISTOR

Line No.	CODE NO.	RESISTANCE OHMS	TOLERANCE ±5 %or as shown
1	18GG	575.0	±1
2	18HF	580.0	±.1
3	18BD	580.0	±1
4	18JC	600.0	±.1
5	18GH	600.0	±1
6	18AE	600.0	
7	18BY	605.0	±.5
8	18CF	610.0	±1
9	18FL	620.0	±1
10	18EN	630.0	
11	18KC	670.0	±1
12	18KE	700.0	±1
13	18DH	700.0	
14	18DR	750.0	±1
15	18BL	750.0	
16	18GF	800.0	±1
17	18CN	800.0	
18	18KR	887.0	±1
19	18FB	900.0	
20	18DE	930.0	±1
21	18CB	955.0	±1
22	18BM	1000.0	±1
23	18BH	1000.0	
24	18HA	1070.0	±1
25	18KS	1108.0	±1
26	18JD	1194.0	±.1
27	18KY	1200.0	±1
28	18BJ	1200.0	
29	18CP	1260.0	±1
30	18BK	1300.0	±1
31	18GN	1340.0	±2
32	18KN	1449.0	±1
33	18CT	1481.0	±1
34	18DA	1510.0	±1
35	18CY	1585.0	±1
36	18GE	1600.0	±1
37	18AT	1600.0	
38	18DS	1700.0	±1
39	18KK	1725.0	±1
40	18EY	1800.0	
41	18FN	1900.0	±1
42	18JU	1920.0	±1
43	18CR	2000.0	±1
44	18BA	2000.0	
45	18KP	2053.0	±1
46	18HB	2200.0	±1
47	18EH	2400.0	
48	18EF	2500.0	
49	18KA	2583.0	±1
50	18GM	2755.0	±2
51	18EK	2898.0	±1
52	18HC	3000.0	±2
53	18DB	3000.0	
54	18JE	3050.0	±1
55	18DU	3100.0	±1
56	18FK	3150.0	
57	18FR	3200.0	±1
58	18DN	3200.0	
59	18KT	3458.0	±1
60	18FC	4000.0	
61	18FS	4250.0	±1
62	18KU	4500.0	±1
63	18KB	4800.0	±.5
64	18ES	4800.0	
65	18FJ	5000.0	±3
66	18EW	5000.0	
67	18GT	5243.0	
68	18GL	5545.0	±2
69	18EC	6000.0	
70	18FP	6350.0	
71	18KJ	6500.0	
72	18HE	7835.0	±1
73	18FG	8080.0	
74	18EM	8600.0	
75	18EA	9000.0	
76	18KF	10000.0	±1
77	18JW	10000.0	

DESCRIPTION

The resistors have two windings on a metal card, one winding superimposed on the other. Heat resistant material is used over the metal card, between the windings, and over the outer winding. The terminals and mounting stud pass through the mounting panel from which they are insulated by sleeves which are integral parts of the molded phenolic terminal head assembly. The mounting stud has an extension the same size and shape as the outer ends of the terminals and serves as a common terminal for the two windings. Terminals are tinned and are arranged for mechanically wrapped connections. The closest recommended mounting centers are 7/16 inch by 1-3/4 inch.



The power rating at 150°F ambient temperature is 5.1 watts for the two resistor sections in combination or 5 watts for either section provided that the other section is used at not more than 1/10 watt. The corresponding rating for trouble conditions is 12 watts at 75°F. They are derated to 0 watts in an ambient temperature of 250°F for normal operating conditions and 275°F ambient temperature for trouble conditions.

The maximum voltage across the resistor shall not exceed 350 volts.

NOTES: (These notes apply to the tables following.)

R. 5.1 watts maximum distributed over the two resistor sections in combination or 5 watts for either section provided that the other section is used at no more than 1/10 watt.

S. Normal power rating of the high resistance section is equal to the difference between the power dissipation in low resistance section, up to its normal power rating, and 5.1 watts.

ON THE FOLLOWING PAGES ALL 19-TYPE RESISTORS ARE LISTED IN ASCENDING NUMERICAL ORDER OF RESISTANCE VALUE OF EACH WINDING. THEREFORE, EACH RESISTOR IS LISTED TWICE.

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19ABN	0.20	0.55	0.77		R	R
2	19DM	0.20	0.40	0.60	±10	R	R
3	19DB	0.225	0.225	0.45	±10	R	R
4	19DP	0.25	0.50	0.75		R	R
5	19DM	0.40	0.20	0.60	±10	R	R
6	19DP	0.50	0.25	0.75		R	R
7	19KW	0.50	1.00	1.50		R	R
8	19ABN	0.55	0.20	0.77		R	R
9	19TG	0.60	1.20	1.80	±4.2	R	R
10	19BL	1.00	1.00	2.00		R	R
11	19DR	1.00	2.00	3.00		R	R
12	19KW	1.00	0.50	1.50		R	R
13	19LU	1.00	8.00	9.00		(S)1.7	(S)3.4
14	19UC	1.00	3.00	4.00		(S)3.8	(S)1.3
15	19TG	1.20	0.60	1.80	±4.2	R	R
16	19UW	1.20	9.60	10.80		(S)1.7	(S)3.4
17	19DR	2.00	1.00	3.00		R	R
18	19KU	2.00	4.00	6.00		R	R
19	19UT	2.00	6.00	8.00		(S)3.8	(S)1.3
20	19TH	2.40	4.80	7.20	±1	R	R
21	19AW	2.50	2.50	5.00		R	R
22	19LW	3.00	8.00	11.00		(S)4.2	(S)0.9
23	19UC	3.00	1.00	4.00		(S)1.3	(S)3.8
24	19MF	3.50	10.00	13.50	±1	(S)4.0	(S)1.1
25	19KU	4.00	2.00	6.00		R	R
26	19TY	4.00	93.00	97.00	±1	(S)0.6	(S)4.5
27	19TH	4.80	2.40	7.20	±1	R	R
28	19N	5.00	8.00	13.00		R	R
29	19UT	6.00	2.00	8.00		(S)1.3	(S)3.8
30	19PA	7.00	11.00	18.00		R	R
31	19WB	7.80	2345.00	2352.80	±1	(S)0.1	(S)5.0
32	19GG	7.90	7.90	15.80	±2	R	R
33	19N	8.00	5.00	13.00		R	R
34	19LU	8.00	1.00	9.00		(S)3.4	(S)1.7
35	19LW	8.00	3.00	11.00		(S)0.9	(S)4.2
36	19WS	8.00	16.00	24.00		R	R
37	19ER	9.50	9.50	19.00	±.5	R	R
38	19UW	9.60	1.20	10.80		(S)3.4	(S)1.7
39	19J	10.00	40.00	50.00		(S)3.0	(S)2.1
40	19W	10.00	10.00	20.00		R	R
41	19BT	10.00	640.00	650.00	±1	(S)0.2	(S)4.9
42	19HP	10.00	40.00	50.00	±1	(S)3.1	(S)2.0
43	19MF	10.00	3.50	13.50	±1	(S)1.1	(S)4.0
44	19NJ	11.00	11.00	22.00	±1	R	R
45	19PA	11.00	7.00	18.00		R	R

Phenolic Insulation - 19-Type RESISTOR

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19RU	11.80	17.70	29.50		R	R
2	19GU	13.00	31.00	44.00		(S)4.5	(S)0.6
3	19FB	13.50	15.00	28.50	±1	R	R
4	19RW	13.60	17.65	31.25	±.5	R	R
5	19EF	14.00	14.00	28.00	±1	R	R
6	19KD	14.00	54.00	68.00	±1	(S)3.1	(S)2.0
7	19UM	14.00	84.00	98.00	±1	(S)2.2	(S)2.9
8	19Y	15.00	15.00	30.00		R	R
9	19EK	15.00	30.00	45.00	±1	R	R
10	19FB	15.00	13.50	28.50	±1	R	R
11	19GW	15.00	17.00	32.00	±1	R	R
12	19LS	16.00	17.00	33.00	±1	R	R
13	19WS	16.00	8.00	24.00		R	R
14	19FD	17.00	19.50	36.50	±1	R	R
15	19GW	17.00	15.00	32.00	±1	R	R
16	19LS	17.00	16.00	33.00	±1	R	R
17	19YP	17.20	17.20	34.40	±1	R	R
18	19TK	17.30	34.40	51.70	±1	R	R
19	19RW	17.65	13.60	31.25	±.5	R	R
20	19RU	17.70	11.80	29.50		R	R
21	19GY	18.00	19.00	37.00	±1	R	R
22	19KE	18.00	39.00	57.00	±1	(S)2.5	(S)2.6
23	19GY	19.00	18.00	37.00	±1	R	R
24	19KF	19.00	37.00	56.00	±1	R	R
25	19FD	19.50	17.00	36.50	±1	R	R
26	19M	20.00	20.00	40.00		R	R
27	19P	20.00	130.00	150.00		(S)2.0	(S)3.1
28	19BN	20.00	185.00	205.00	±1	(S)3.5	(S)1.6
29	19BS	20.00	400.00	420.00	±1	(S)0.7	(S)4.4
30	19EB	20.00	330.00	350.00		(S)0.9	(S)4.2
31	19HC	20.00	93.00	113.00	±1	(S)2.7	(S)2.4
32	19HU	20.00	280.00	300.00	±1	(S)1.0	(S)4.1
33	19HY	20.00	630.00	650.00	±1	(S)0.9	(S)4.2
34	19JB	20.00	150.00	170.00	±1	(S)1.8	(S)3.3
35	19MG	20.00	5590.00	5610.00	±1	(S)0.1	(S)5.0
36	19AAJ	20.00	55.00	75.00	±1	(S)4.1	(S)1.0
37	19NR	21.50	64.00	85.50		(S)3.9	(S)1.2
38	19FE	22.00	25.00	47.00	±1	R	R
39	19NC	22.00	22.00	44.00	±1	R	R
40	19MH	22.40	6400.00	6422.40	±1	(S)0.1	(S)5.0
41	19SC	23.80	90.80	114.60	(a)	(S)3.2	(S)1.9
42	19T	25.00	25.00	50.00		R	R
43	19FE	25.00	22.00	47.00	±1	R	R
44	19NS	25.00	50.00	75.00	±1	R	R
45	19PT	25.40	25.40	50.80	±.5	R	R

(a) ±.25 for 23.8, ±.1 for 90.8

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19YR	25.90	25.90	51.80	±1	R	R
2	19NA	27.00	221.00	248.00	±1	(S)1.7	(S)3.4
3	19FC	28.50	32.00	60.50	±1	R	R
4	19E	30.00	30.00	60.00		R	R
5	19BE	30.00	90.00	120.00		(S)3.8	(S)1.3
6	19EK	30.00	15.00	45.00	±1	R	R
7	19HR	30.00	200.00	230.00	±1	(S)2.0	(S)3.1
8	19HS	30.00	170.00	200.00	±1	(S)2.3	(S)2.8
9	19NY	30.00	30.00	60.00	±1	R	R
10	19PH	30.00	60.00	90.00	±1	R	R
11	19GU	31.00	13.00	44.00		(S)0.6	(S)4.5
12	19FC	32.00	28.50	60.50	±1	R	R
13	19EJ	33.00	35.00	68.00	±1	R	R
14	19ET	33.00	950.00	983.00	±1	(S)0.6	(S)4.5
15	19CT	34.00	400.00	434.00		(S)1.2	(S)3.9
16	19DE	34.00	986.00	1020.00	±1	(S)0.5	(S)4.6
17	19TK	34.40	17.30	51.70	±1	R	R
18	19LR	34.50	34.50	69.00	±1	R	R
19	19EJ	35.00	33.00	68.00	±1	R	R
20	19ES	35.00	38.00	73.00	±1	R	R
21	19FA	36.50	41.00	77.50	±1	R	R
22	19A	37.00	37.00	74.00		R	R
23	19KF	37.00	19.00	56.00	±1	R	R
24	19LJ	37.00	37.00	74.00	±1	R	R
25	19WU	37.00	74.00	110.00	±1	R	R
26	19ABH	37.00	1800.00	1837.00	±1	(S)0.3	(S)4.8
27	19EH	38.00	950.00	988.00	±1	(S)0.6	(S)4.5
28	19ES	38.00	35.00	73.00	±1	R	R
29	19KE	39.00	18.00	57.00	±1	(S)2.6	(S)2.5
30	19B	40.00	40.00	80.00		R	R
31	19C	40.00	83.00	123.00		R	R
32	19F	40.00	60.00	100.00		R	R
33	19G	40.00	100.00	140.00		(S)4.4	(S)0.7
34	19H	40.00	120.00	160.00		(S)3.8	(S)1.3
35	19J	40.00	10.00	50.00		(S)2.1	(S)3.0
36	19AL	40.00	68.00	108.00		R	R
37	19BK	40.00	500.00	540.00		(S)1.1	(S)4.0
38	19CS	40.00	125.00	165.00	±1	(S)3.7	(S)1.4
39	19HP	40.00	10.00	50.00	±1	(S)2.0	(S)3.1
40	19HW	40.00	50.00	90.00	±1	R	R
41	19JK	40.00	170.00	210.00	±1	(S)2.9	(S)2.2
42	19NB	40.00	44.00	84.00	±1	R	R
43	19WC	40.00	210.00	250.00		(S)2.4	(S)2.7
44	19FA	41.00	36.50	77.50	±1	R	R
45	19HA	42.00	195.00	237.00	±1	(S)2.7	(S)2.4

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19RS	42.00	1000.00	1042.00	±1	(S)0.6	(S)4.5
2	19WW	43.00	43.00	86.00	±1	R	R
3	19MJ	43.40	3210.00	3253.40	±1	(S)0.2	(S)4.9
4	19MK	44.00	3480.00	3524.00	±1	(S)0.2	(S)4.9
5	19NB	44.00	40.00	84.00	±1	R	R
6	19ND	44.00	44.00	88.00	±1	R	R
7	19KC	47.00	59.00	106.00	±1	R	R
8	19JU	48.00	300.00	348.00	±1	(S)2.1	(S)3.0
9	19AM	50.00	50.00	100.00		R	R
10	19AY	50.00	2000.00	2050.00		(S)0.4	(S)4.7
11	19BC	50.00	300.00	350.00		(S)2.2	(S)2.9
12	19DL	50.00	70.00	120.00	±1	R	R
13	19HB	50.00	194.00	244.00	±1	(S)3.1	(S)2.0
14	19HW	50.00	40.00	90.00	±1	R	R
15	19LY	50.00	550.00	600.00	±1	(S)1.3	(S)3.8
16	19NL	51.40	51.40	102.80	±1	R	R
17	19NS	50.00	25.00	75.00	±1	R	R
18	19TN	50.00	400.00	450.00	±1	(S)1.7	(S)3.4
19	19ST	52.80	1754.00	1806.80	±1	(S)0.4	(S)4.7
20	19GT	53.00	111.00	164.00	±1	R	R
21	19KD	54.00	14.00	68.00	±1	(S)2.0	(S)3.1
22	19ED	55.00	218.00	273.00	±1	(S)3.1	(S)2.0
23	19NF	55.00	500.00	555.00		(S)1.5	(S)3.6
24	19AAJ	55.00	20.00	75.00	±1	(S)1.0	(S)4.1
25	19KC	59.00	47.00	106.00	±1	R	R
26	19F	60.00	40.00	100.00		R	R
27	19L	60.00	60.00	120.00		R	R
28	19S	60.00	90.00	150.00		R	R
29	19AC	60.00	83.00	143.00		R	R
30	19AR	60.00	260.00	320.00		(S)2.9	(S)2.2
31	19AU	60.00	170.00	230.00		(S)4.0	(S)1.1
32	19CK	60.00	65.00	125.00	±1	R	R
33	19CM	60.00	1235.00	1295.00	±1	(S)0.7	(S)4.4
34	19FH	60.00	70.00	130.00	±1	R	R
35	19JR	60.00	400.00	460.00		(S)2.0	(S)3.1
36	19PH	60.00	30.00	90.00	±1	R	R
37	19WY	60.00	60.00	120.00	±1	R	R
38	19ABF	60.40	140.00	200.40	±1	(S)4.6	(S)0.5
39	19PN	62.00	62.00	124.00	±1	R	R
40	19JW	64.00	252.00	316.00	±1	(S)3.1	(S)2.0
41	19NR	64.00	21.50	85.50		(S)1.2	(S)3.9
42	19CK	65.00	60.00	125.00	±1	R	R
43	19WK	65.00	160.00	225.00	±1	(S)4.4	(S)0.7
44	19EP	66.00	220.30	286.30	±2	(S)3.5	(S)1.6
45	19KS	67.00	67.00	134.00		R	R

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19LD	67.00	67.00	134.00	±1	R	R
2	19AL	68.00	40.00	108.00		R	R
3	19MS	69.60	5245.00	5314.60	±1	(S)0.1	(S)5.0
4	19AK	70.00	70.00	140.00		R	R
5	19DL	70.00	50.00	120.00	±1	R	R
6	19FF	70.00	100.00	170.00	±1	R	R
7	19FH	70.00	60.00	130.00	±1	R	R
8	19KA	70.00	685.00	755.00	±1	(S)1.4	(S)3.7
9	19LK	73.00	73.00	146.00	±1	R	R
10	19WU	74.00	37.00	111.00	±1	R	R
11	19GC	75.00	110.00	185.00	±1	R	R
12	19YS	76.00	76.00	152.00	±1	R	R
13	19GB	80.00	85.00	165.00	±1	R	R
14	19JJ	80.00	80.00	160.00	±1	R	R
15	19MD	80.00	600.00	680.00		(S)1.8	(S)3.3
16	19RR	80.00	1000.00	1080.00	±1	(S)1.1	(S)4.0
17	19C	83.00	40.00	123.00		R	R
18	19D	83.00	83.00	166.00		R	R
19	19AC	83.00	60.00	143.00		R	R
20	19KM	84.00	6350.00	6434.00		(S)0.2	(S)4.9
21	19LG	84.00	84.00	168.00	±1	R	R
22	19UM	84.00	14.00	98.00	±1	(S)2.9	(S)2.2
23	19GB	85.00	80.00	165.00	±1	R	R
24	19KT	85.00	1800.00	1885.00		(S)0.7	(S)4.4
25	19UL	85.00	845.00	930.00	±1	(S)1.4	(S)3.7
26	19WN	85.00	185.00	270.00	±1	(S)4.8	(S)0.3
27	19YY	87.60	4204.00	4291.60	±1	(S)0.3	(S)4.8
28	19S	90.00	60.00	150.00		R	R
29	19BE	90.00	30.00	120.00		(S)1.3	(S)3.8
30	19FK	90.00	110.00	200.00	±1	R	R
31	19JA	90.00	130.00	220.00	±1	R	R
32	19SC	90.80	23.80	114.60	(a)	(S)1.9	(S)3.2
33	19EE	91.00	208.00	299.00		(S)4.7	(S)0.4
34	19YT	92.00	92.00	184.00	±1	R	R
35	19HC	93.00	20.00	113.00	±1	(S)2.4	(S)2.7
36	19TY	93.00	4.00	97.00	±1	(S)4.5	(S)0.6
37	19GS	95.00	190.00	285.00		R	R
38	19MM	97.00	1740.00	1837.00	±1	(S)0.8	(S)4.3
39	19DK	97.00	120.00	217.00	±1	R	R
40	19GR	98.00	586.00	684.00		(S)2.2	(S)2.9
41	19G	100.00	40.00	140.00		(S)0.7	(S)4.4
42	19K	100.00	100.00	200.00		R	R
43	19BD	100.00	380.00	480.00		(S)3.2	(S)1.9
44	19BH	100.00	500.00	600.00		(S)2.5	(S)2.6
45	19CH	100.00	125.00	225.00	±1	R	R

(a) ±.25 for 23.80, ±.1 for 90.8

Phenolic Insulation - 19-Type RESISTOR

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19CN	100.00	200.00	300.00		R	R
2	19DN	100.00	100.00	200.00	±1	R	R
3	19DU	100.00	1000.00	1100.00		(S)1.4	(S)3.7
4	19FF	100.00	70.00	170.00	±1	R	R
5	19FG	100.00	100.00	200.00	±1	R	R
6	19JF	100.00	220.00	320.00	±1	(S)4.8	(S)0.3
7	19LC	100.00	100.00	200.00	±.25	R	R
8	19NP	100.00	390.00	490.00	(b)	(S)3.1	(S)2.0
9	19NU	100.00	200.00	300.00	±1	R	R
10	19RB	100.00	1300.00	1400.00	±1	(S)1.1	(S)4.0
11	19RJ	100.00	600.00	700.00	±1	(S)2.2	(S)2.9
12	19TD	100.00	175.00	275.00	±1	R	R
13	19UD	100.00	900.00	1000.00	±1	(S)1.4	(S)3.7
14	19UY	100.00	350.00	450.00	±1	(S)3.4	(S)1.7
15	19PC	102.60	3509.00	3611.60	±.5	(S)0.4	(S)4.7
16	19KB	104.00	141.00	245.00	±1	R	R
17	19ML	105.00	1685.00	1790.00	±1	(S)0.9	(S)4.2
18	19WA	105.00	105.00	210.00	±1	R	R
19	19YC	105.70	3509.00	3614.70	±1	(S)0.5	(S)4.6
20	19FJ	110.00	130.00	240.00	±1	R	R
21	19FK	110.00	90.00	200.00	±1	R	R
22	19GC	110.00	75.00	185.00	±1	R	R
23	19HM	110.00	900.00	1010.00	±1	(S)1.7	(S)3.4
24	19HN	110.00	540.00	650.00	±1	(S)2.6	(S)2.5
25	19GT	111.00	53.00	164.00	±1	R	R
26	19HH	112.00	1000.00	1112.00		(S)1.7	(S)3.4
27	19HJ	112.00	2600.00	2712.00		(S)0.6	(S)4.5
28	19MA	112.00	615.00	727.00		(S)2.4	(S)2.7
29	19EA	115.00	115.00	230.00	±1	R	R
30	19DJ	117.00	903.00	1020.00	±1	(S)1.7	(S)3.4
31	19JT	118.00	175.00	293.00	±1	R	R
32	19H	120.00	40.00	160.00		(S)1.3	(S)3.8
33	19Z	120.00	120.00	240.00		R	R
34	19AB	120.00	210.00	330.00		R	R
35	19AG	120.00	160.00	280.00		R	R
36	19CU	120.00	1050.00	1170.00	±1	(S)1.5	(S)3.6
37	19CW	120.00	122.00	242.00	±1	R	R
38	19DK	120.00	97.00	217.00	±1	R	R
39	19EL	120.00	120.00	240.00		R	R
40	19ABE	120.00	280.00	400.00	±1	(S)4.6	(S)0.5
41	19MY	120.50	539.00	659.50	±1	(S)2.8	(S)2.3
42	19CW	122.00	120.00	242.00	±1	R	R
43	19DF	122.00	158.00	280.00	±1	R	R
44	19AAA	124.20	3019.00	3143.20	±1	(S)0.5	(S)4.6
45	19CB	125.00	345.00	470.00	±1	(S)4.1	(S)1.0

(b) ±5 for 100.0, ±1 for 390.0.

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19CD	125.00	1095.00	1220.00	±1	(S)1.6	(S)3.5
2	19CE	125.00	510.00	635.00	±1	(S)3.0	(S)2.1
3	19CH	125.00	100.00	225.00	±1	R	R
4	19CL	125.00	895.00	1020.00	±1	(S)1.9	(S)3.2
5	19CS	125.00	40.00	165.00	±1	(S)1.4	(S)3.7
6	19EM	125.00	170.00	295.00	±1	R	R
7	19PK	125.00	250.00	375.00	±1	R	R
8	19PP	125.00	125.00	250.00	±1	R	R
9	19RA	125.00	660.00	785.00	±1	(S)2.4	(S)2.7
10	19TT	129.00	129.00	258.00	±1	R	R
11	19P	130.00	20.00	150.00		(S)3.1	(S)2.0
12	19FJ	130.00	110.00	240.00	±1	R	R
13	19FY	130.00	150.00	280.00	±1	R	R
14	19JA	130.00	90.00	220.00	±1	R	R
15	19MT	131.60	2472.00	2603.60	±1	(S)0.8	(S)4.3
16	19BU	132.00	158.00	290.00	±1	R	R
17	19DG	133.00	770.00	903.00	±1	(S)2.2	(S)2.9
18	19NN	135.00	280.00	415.00		R	R
19	19TP	135.00	135.00	270.00	±1	R	R
20	19AF	140.00	140.00	280.00		R	R
21	19HT	140.00	420.00	560.00	±1	(S)3.8	(S)1.3
22	19RY	140.00	840.00	980.00		(S)2.3	(S)2.8
23	19ABF	140.00	60.40	200.40	±1	(S)0.5	(S)4.6
24	19KB	141.00	104.00	245.00	±1	R	R
25	19YU	143.00	2652.00	2795.00	±1	(S)0.8	(S)4.3
26	19LL	145.00	145.00	290.00	±1	R	R
27	19LT	145.00	150.00	295.00	±1	R	R
28	19PM	145.00	500.00	645.00	±.5	(S)3.4	(S)1.7
29	19KN	146.00	651.00	797.00	±2	(S)2.8	(S)2.3
30	19AD	150.00	150.00	300.00		R	R
31	19DT	150.00	300.00	450.00		R	R
32	19FS	150.00	190.00	340.00	±1	R	R
33	19FY	150.00	130.00	280.00	±1	R	R
34	19JB	150.00	20.00	170.00	±1	(S)3.3	(S)1.8
35	19LB	150.00	150.00	300.00	±1	R	R
36	19LT	150.00	145.00	295.00	±1	R	R
37	19NH	150.00	6350.00	6500.00		(S)0.3	(S)4.8
38	19SL	150.00	250.00	400.00	±1	R	R
39	19KK	152.00	3160.00	3312.00	±2	(S)0.7	(S)4.4
40	19NM	156.00	156.00	312.00	±1	R	R
41	19PL	156.00	156.00	312.00	±.5	R	R
42	19BU	158.00	132.00	290.00	±1	R	R
43	19DF	158.00	122.00	280.00	±1	R	R
44	19DD	159.00	1500.00	1659.00	±1	R	R
45	19AG	160.00	120.00	280.00		R	R

Phenolic Insulation - 19-Type RESISTOR

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19JH	160.00	850.00	1010.00	±1	(S)2.4	(S)2.7
2	19KG	160.00	2990.00	3150.00	±2	(S)0.8	(S)4.3
3	19WK	160.00	65.00	225.00	±1	(S)0.7	(S)4.4
3	19AAB	162.50	2368.00	2530.50	±1	(S)1.0	(S)4.1
5	19WF	165.00	165.00	330.00	±1	R	R
6	19RF	168.00	2140.00	2308.00	±.5	(S)1.1	(S)4.0
7	19UK	168.00	168.00	336.00	±1	R	R
8	19AS	170.00	170.00	340.00		R	R
9	19AU	170.00	60.00	230.00		(S)1.1	(S)4.0
10	19EM	170.00	125.00	295.00	±1	R	R
11	19EN	170.00	175.00	345.00	±1	R	R
12	19HS	170.00	30.00	200.00	±1	(S)2.8	(S)2.3
13	19JK	170.00	40.00	210.00	±1	(S)2.2	(S)2.9
14	19EN	175.00	170.00	345.00	±1	R	R
15	19JT	175.00	118.00	293.00	±1	R	R
16	19TD	175.00	100.00	275.00	±1	R	R
17	19AP	180.00	180.00	360.00		R	R
18	19FU	180.00	220.00	400.00	±1	R	R
19	19NE	180.00	265.00	445.00		R	R
20	19SU	180.00	360.00	540.00	±1	R	R
21	19WE	180.00	180.00	360.00	±1	R	R
22	19UP	182.00	182.00	364.00	±1	R	R
23	19YW	182.00	2142.00	2324.00	±1	(S)1.2	(S)3.9
24	19BN	185.00	20.00	205.00	±1	(S)1.6	(S)3.5
25	19CA	185.00	770.00	955.00	±1	(S)3.0	(S)2.1
26	19WN	185.00	85.00	270.00	±1	(S)0.3	(S)4.8
27	19FP	190.00	230.00	420.00	±1	R	R
28	19FS	190.00	150.00	340.00	±1	R	R
29	19GS	190.00	95.00	285.00		R	R
30	19SK	190.20	190.20	380.40	±.5	R	R
31	19MN	191.00	920.00	1111.00	±1	(S)2.6	(S)2.5
32	19HB	194.00	50.00	244.00	±1	(S)2.0	(S)3.1
33	19HA	195.00	42.00	237.00	±1	(S)2.4	(S)2.7
34	19UR	198.00	198.00	386.00	±1	R	R
35	19PD	199.40	1806.00	2005.40	±.5	(S)1.5	(S)3.6
36	19AJ	200.00	200.00	400.00		R	R
37	19BG	200.00	400.00	600.00		R	R
38	19CN	200.00	100.00	300.00		R	R
39	19HR	200.00	30.00	230.00	±1	(S)3.1	(S)2.0
40	19NU	200.00	100.00	300.00	±1	R	R
41	19PY	200.00	600.00	800.00		(S)3.8	(S)1.3
42	19SM	200.00	650.00	850.00	±1	(S)3.6	(S)1.5
43	19WT	200.00	300.00	500.00	±1	R	R
44	19AAH	200.00	200.00	400.00	±1	R	R
45	19AAC	203.00	1958.00	2161.00	±1	(S)1.4	(S)3.7

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19BR	205.00	225.00	430.00	±1	R	R
2	19EE	208.00	91.00	299.00		(S)0.4	(S)4.7
3	19MP	209.00	890.00	1099.00	±1	(S)2.2	(S)2.9
4	19SF	209.40	209.40	418.80	±.5	R	R
5	19AB	210.00	120.00	330.00		R	R
6	19NK	210.00	320.00	530.00		R	R
7	19RK	210.00	210.00	420.00	±1	R	R
8	19SY	210.00	400.00	610.00	±1	R	R
9	19UF	210.00	3900.00	4110.00	±1	(S)0.8	(S)4.3
10	19UG	210.00	3100.00	3310.00	±1	(S)1.0	(S)4.1
11	19WC	210.00	40.00	250.00		(S)2.7	(S)2.4
12	19AAE	210.00	326.00	536.00	±1	R	R
13	19PB	217.00	217.00	434.00	±1	R	R
14	19WJ	217.90	217.90	435.80	±.5	R	R
15	19ED	218.00	55.00	273.00	±1	(S)2.0	(S)3.1
16	19BY	220.00	1075.00	1295.00	±1	(S)2.6	(S)2.5
17	19FU	220.00	180.00	400.00	±1	R	R
18	19JF	220.00	100.00	320.00	±1	(S)0.3	(S)4.8
19	19EP	220.30	66.00	286.30	±2	(S)1.6	(S)3.5
20	19NA	221.00	27.00	248.00	±1	(S)3.4	(S)1.7
21	19YD	224.00	1806.00	2030.00	±1	(S)1.7	(S)3.4
22	19BR	225.00	205.00	430.00	±1	R	R
23	19US	225.00	225.00	450.00	±1	R	R
24	19FP	230.00	190.00	420.00	±1	R	R
25	19DA	232.00	270.00	502.00		R	R
26	19ABK	233.00	233.00	466.00	±1	R	R
27	19MU	236.20	1094.00	1330.20	±1	(S)2.7	(S)2.4
28	19SW	237.00	430.00	667.00	±1	R	R
29	19GD	240.00	250.00	490.00	±1	R	R
30	19AH	240.00	240.00	480.00		R	R
31	19JG	240.00	720.00	960.00	±1	(S)3.8	(S)1.3
32	19LE	240.00	240.00	480.00	±1	R	R
33	19LH	245.00	245.00	490.00	±.5	R	R
34	19AAL	246.00	1670.00	1916.00	±1	(S)2.0	(S)3.1
35	19CJ	250.00	750.00	1000.00	±1	(S)3.7	(S)1.4
36	19GD	250.00	240.00	490.00	±1	R	R
37	19HD	250.00	250.00	500.00	±1	R	R
38	19JC	250.00	350.00	600.00		R	R
39	19PK	250.00	125.00	375.00	±1	R	R
40	19SL	250.00	150.00	400.00	±1	R	R
41	19JW	252.00	64.00	316.00	±1	(S)2.0	(S)3.1
42	19AN	260.00	260.00	520.00		R	R
43	19AR	260.00	60.00	320.00		(S)2.2	(S)2.9
44	19FN	260.00	290.00	550.00	±1	R	R
45	19WL	260.00	260.00	520.00	±1	R	R

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19NE	265.00	180.00	445.00		R	R
2	19JY	268.00	488.00	756.00	±1	R	R
3	19SG	268.10	268.10	536.20	±.5	R	R
4	19KL	269.00	1490.00	1759.00	±2	(S)2.3	(S)2.8
5	19YB	269.00	1569.00	1838.00	±1	(S)2.2	(S)2.9
6	19BP	270.00	375.00	645.00	±1	R	R
7	19CG	270.00	270.00	540.00		R	R
8	19DA	270.00	232.00	502.00		R	R
9	19LM	275.00	275.00	550.00	±1	R	R
10	19DH	280.00	1330.00	1610.00	±1	(S)2.7	(S)2.4
11	19HU	280.00	20.00	300.00	±1	(S)4.1	(S)1.0
12	19NN	280.00	135.00	415.00		R	R
13	19ABE	280.00	120.00	400.00	±1	(S)0.5	(S)4.6
14	19CF	284.00	284.00	568.00		R	R
15	19UN	284.00	284.00	568.00	±1	R	R
16	19PE	285.70	1260.00	1545.70	±.5	(S)2.8	(S)2.3
17	19KH	286.00	1325.00	1611.00	±2	(S)2.7	(S)2.4
18	19SH	289.50	289.50	579.00	±.5	R	R
19	19FN	290.00	260.00	550.00	±1	R	R
20	19FT	290.00	300.00	590.00	±1	R	R
21	19PG	290.00	290.00	580.00	±1	R	R
22	19AAM	291.00	1470.00	1761.00	±1	(S)2.5	(S)2.6
23	19SJ	296.60	296.60	593.20	±.5	R	R
24	19BB	300.00	2300.00	2600.00		R	R
25	19BC	300.00	50.00	350.00		(S)2.9	(S)2.2
26	19DT	300.00	150.00	450.00		R	R
27	19FT	300.00	290.00	590.00	±1	R	R
28	19GJ	300.00	500.00	800.00		R	R
29	19GK	300.00	2500.00	2800.00		R	R
30	19GL	300.00	300.00	600.00		R	R
31	19GN	300.00	600.00	900.00		R	R
32	19HE	300.00	1900.00	2200.00		(S)2.1	(S)3.0
33	19HK	300.00	300.00	600.00	±.5	R	R
34	19JD	300.00	400.00	700.00		R	R
35	19JL	300.00	2460.00	2760.00	±1	(S)1.6	(S)3.5
36	19JU	300.00	48.00	348.00	±1	(S)3.0	(S)2.1
37	19LA	300.00	300.00	600.00	±1	R	R
38	19WT	300.00	200.00	500.00	±1	R	R
39	19DW	307.00	307.00	614.00	±1	R	R
40	19PU	312.00	1155.00	1467.00	±1	(S)3.3	(S)1.8
41	19YA	317.00	1394.00	1711.00	±1	(S)2.8	(S)2.3
42	19NK	320.00	210.00	530.00		R	R
43	19GP	325.00	475.00	800.00	±1	R	R
44	19AAE	326.00	210.00	536.00	±1	R	R
45	19EB	330.00	20.00	350.00		(S)4.2	(S)0.9

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19FM	330.00	350.00	680.00	±1	R	R
2	19TW	330.00	330.00	660.00	±1	R	R
3	19UJ	336.00	336.00	672.00	±1	R	R
4	19MR	340.00	395.00	735.00	±1	R	R
5	19CB	345.00	125.00	470.00	±1	(S)1.0	(S)4.1
6	19BJ	350.00	350.00	700.00		R	R
7	19DS	350.00	350.00	700.00	±1	R	R
8	19FM	350.00	330.00	680.00	±1	R	R
9	19JC	350.00	250.00	600.00		R	R
10	19TM	350.00	1000.00	1350.00	±1	(S)4.0	(S)1.1
11	19UY	350.00	100.00	450.00	±1	(S)1.7	(S)3.4
12	19PF	359.10	1003.00	1362.10	±.5	(S)4.0	(S)1.1
13	19FR	360.00	370.00	730.00	±1	R	R
14	19SU	360.00	180.00	540.00	±1	R	R
15	19MB	362.00	362.00	724.00	±1	R	R
16	19FL	370.00	460.00	830.00	±1	R	R
17	19FR	370.00	360.00	730.00	±1	R	R
18	19ME	370.00	1300.00	1670.00	±1	(S)3.4	(S)1.7
19	19AAN	370.00	1260.00	1630.00	±1	(S)3.5	(S)1.6
20	19CY	373.00	530.00	903.00	±1	R	R
21	19BP	375.00	270.00	645.00	±1	R	R
22	19BD	380.00	100.00	480.00		(S)1.9	(S)3.2
23	19BW	380.00	750.00	1130.00		R	R
24	19CC	380.00	900.00	1280.00	±1	(S)4.6	(S)0.5
25	19CR	380.00	450.00	830.00		R	R
26	19EU	380.00	580.00	960.00	±1	R	R
27	19MW	385.00	423.00	808.00	±1	R	R
28	19TA	387.50	387.50	775.00	±1	R	R
29	19NP	390.00	100.00	490.00	(b)	(S)2.0	(S)3.1
30	19MR	395.00	340.00	735.00	±1	R	R
31	19BG	400.00	200.00	600.00		R	R
32	19BS	400.00	20.00	420.00	±1	(S)4.4	(S)0.7
33	19CT	400.00	34.00	434.00		(S)3.9	(S)1.2
34	19GA	400.00	600.00	1000.00	±1	R	R
35	19GM	400.00	1000.00	1400.00		(S)4.4	(S)0.7
36	19JD	400.00	300.00	700.00		R	R
37	19JR	400.00	60.00	460.00		(S)3.1	(S)2.0
38	19NT	400.00	800.00	1200.00	±1	R	R
39	19SY	400.00	210.00	610.00	±1	R	R
40	19TN	400.00	50.00	450.00	±1	(S)3.4	(S)1.7
41	19ABR	400.00	400.00	800.00	±1	R	R
42	19FW	410.00	420.00	830.00	±1	R	R
43	19FW	420.00	410.00	830.00	±1	R	R
44	19HT	420.00	140.00	560.00	±1	(S)1.3	(S)3.8
45	19MW	423.00	385.00	808.00	±1	R	R

(b) ±5 for 100.0, ±1 for 390.0.

Line No.	CODE NO.	RESISTANCE-OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19GH	425.00	425.00	850.00	±1	R	R
2	19YM	427.00	1155.00	1582.00	±1	(S)4.1	(S)1.0
3	19SW	430.00	237.00	667.00	±1	R	R
4	19LP	445.00	878.00	1323.00		R	R
5	19CR	450.00	380.00	830.00		R	R
6	19MC	450.00	450.00	900.00	±1	R	R
7	19DC	456.00	530.00	986.00	±1	R	R
8	19FL	460.00	370.00	830.00	±1	R	R
9	19LN	465.00	465.00	930.00	±1	R	R
10	19KJ	467.00	512.00	979.00	±2	R	R
11	19GP	475.00	325.00	800.00	±1	R	R
12	19JY	488.00	268.00	756.00	±1	R	R
13	19RD	491.00	491.00	982.00	±1	R	R
14	19AAP	493.00	1070.00	1563.00	±1	(S)4.8	(S)0.3
15	19BH	500.00	100.00	600.00		(S)2.6	(S)2.5
16	19BK	500.00	40.00	540.00		(S)4.0	(S)1.1
17	19DY	500.00	500.00	1000.00		R	R
18	19GE	500.00	1500.00	2000.00		(S)3.8	(S)1.3
19	19GJ	500.00	300.00	800.00		R	R
20	19KP	500.00	3500.00	4000.00		(S)1.9	(S)3.2
21	19NF	500.00	55.00	555.00		(S)3.6	(S)1.5
22	19NW	500.00	500.00	1000.00	±1	R	R
23	19PJ	500.00	1000.00	1500.00	±.5	R	R
24	19PM	500.00	145.00	645.00	±.5	(S)1.7	(S)3.4
25	19TF	500.00	700.00	1200.00	±1	R	R
26	19CE	510.00	125.00	635.00	±1	(S)2.1	(S)3.0
27	19RT	510.00	5700.00	6210.00	±1	(S)1.3	(S)3.8
28	19KJ	512.00	467.00	979.00	±2	R	R
29	19SP	525.00	5700.00	6225.00	±1	(S)1.3	(S)3.8
30	19CY	530.00	373.00	903.00	±1	R	R
31	19DC	530.00	456.00	986.00	±1	R	R
32	19MY	539.00	120.50	659.50	±1	(S)2.3	(S)2.8
33	19HN	540.00	110.00	650.00	±1	(S)2.5	(S)2.6
34	19HL	545.00	545.00	1090.00		R	R
35	19LY	550.00	50.00	600.00	±1	(S)3.8	(S)1.3
36	19YK	560.00	1002.00	1562.00	±1	R	R
37	19WP	570.00	1200.00	1770.00		(S)4.9	(S)0.2
38	19EU	580.00	380.00	960.00	±1	R	R
39	19GR	586.00	98.00	684.00		(S)2.9	(S)2.2
40	19BF	600.00	1600.00	2200.00		(S)4.2	(S)0.9
41	19EG	600.00	1800.00	2400.00		(S)3.8	(S)1.3
42	19EY	600.00	600.00	1200.00		R	R
43	19GA	600.00	400.00	1000.00	±1	R	R
44	19GN	600.00	300.00	900.00		R	R
45	19JN	600.00	1200.00	1800.00		R	R

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19MD	600.00	80.00	680.00		(S)3.3	(S)1.8
2	19PY	600.00	200.00	800.00		(S)1.3	(S)3.8
3	19RC	600.00	4400.00	5000.00	±1	(S)1.8	(S)3.3
4	19RJ	600.00	100.00	700.00	±1	(S)2.9	(S)2.2
5	19SR	600.00	800.00	1400.00	±1	R	R
6	19TR	600.00	900.00	1500.00	±1	R	R
7	19UB	600.00	6000.00	6600.00	±1	(S)1.5	(S)3.6
8	19ABP	600.00	1000.00	1600.00		R	R
9	19NG	606.00	606.00	1012.00	±.5	R	R
10	19MA	615.00	112.00	727.00		(S)2.7	(S)2.4
11	19HY	630.00	20.00	650.00	±1	(S)4.2	(S)0.9
12	19ABG	634.00	634.00	1268.00	±1	R	R
13	19YE	636.00	946.00	1582.00	±1	R	R
14	19BT	640.00	10.00	650.00	±1	(S)4.9	(S)0.2
15	19EC	650.00	1600.00	2250.00		(S)4.4	(S)0.7
16	19SM	650.00	200.00	850.00	±1	(S)1.5	(S)3.6
17	19KN	651.00	146.00	797.00	±2	(S)2.8	(S)2.3
18	19RA	660.00	125.00	785.00	±1	(S)2.7	(S)2.4
19	19SE	660.00	1100.00	1760.00	±1	R	R
20	19YL	663.00	2985.00	3648.00	±1	(S)2.7	(S)2.4
21	19ABC	673.00	2670.00	3343.00	±1	(S)3.1	(S)2.0
22	19HF	675.00	925.00	1600.00	±1	R	R
23	19AAK	680.00	1900.00	2580.00	±1	(S)4.0	(S)1.1
24	19ABB	681.00	2370.00	3051.00	±1	(S)3.4	(S)1.7
25	19KA	685.00	70.00	755.00	±1	(S)3.7	(S)1.4
26	19WR	691.00	2108.00	2799.00	±1	(S)3.8	(S)1.3
27	19RL	700.00	700.00	1400.00		R	R
28	19TF	700.00	500.00	1200.00	±1	R	R
29	19TU	700.00	1700.00	2400.00	±1	(S)4.5	(S)0.6
30	19ABA	706.00	1870.00	2576.00	±1	(S)4.2	(S)0.9
31	19YJ	714.00	1718.00	2432.00	±1	(S)4.5	(S)0.6
32	19AAY	715.00	1670.00	2385.00	±1	(S)4.6	(S)0.5
33	19JG	720.00	240.00	960.00	±1	(S)1.3	(S)3.8
34	19AAR	723.00	898.00	1621.0	±1	R	R
35	19YH	733.00	1485.00	2218.00	±1	R	R
36	19BW	750.00	380.00	1130.00		R	R
37	19CJ	750.00	250.00	1000.00	±1	(S)1.4	(S)3.7
38	19CP	750.00	1000.00	1750.00		R	R
39	19UE	750.00	750.00	1500.00	±1	R	R
40	19AAW	750.00	1320.00	2070.00	±1	R	R
41	19AAD	760.00	2700.00	3460.00	±1	(S)3.3	(S)1.8
42	19YG	767.00	1208.00	1975.00	±1	R	R
43	19CA	770.00	185.00	955.00	±1	(S)2.1	(S)3.0
44	19DG	770.00	133.00	903.00	±1	(S)2.9	(S)2.2
45	19AAU	777.00	1170.00	1947.00	±1	R	R

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19RG	797.00	1041.00	1838.00	±1	R	R
2	19EW	800.00	800.00	1600.00		R	R
3	19JP	800.00	1600.00	2400.00		R	R
4	19NT	800.00	400.00	1200.00	±1	R	R
5	19SR	800.00	600.00	1400.00	±1	R	R
6	19UU	800.00	800.00	1600.00	±1	R	R
7	19AAS	816.00	856.00	1672.00	±1	R	R
8	19AAT	825.00	920.00	1745.00	±1	R	R
9	19WG	833.00	6580.00	7413.00	±3	(S)1.7	(S)3.4
10	19RY	840.00	140.00	980.00		(S)2.8	(S)2.3
11	19YF	842.00	851.00	1693.00	±1	R	R
12	19UL	845.00	85.00	930.00	±1	(S)3.7	(S)1.4
13	19JH	850.00	160.00	1010.00	±1	(S)2.7	(S)2.4
14	19YF	851.00	842.00	1693.00	±1	R	R
15	19AAS	856.00	816.00	1672.00	±1	R	R
16	19RE	877.00	1297.00	2174.00	±1	R	R
17	19LP	878.00	445.00	1323.00		R	R
18	19MP	890.00	209.00	1099.00	±1	(S)2.2	(S)2.9
19	19CL	895.00	125.00	1020.00	±1	(S)3.2	(S)1.9
20	19AAR	898.00	723.00	1621.00	±1	R	R
21	19BA	900.00	900.00	1800.00		R	R
22	19CC	900.00	380.00	1280.00	±1	(S)0.5	(S)4.6
23	19HM	900.00	110.00	1010.00	±1	(S)3.4	(S)1.7
24	19TR	900.00	600.00	1500.00	±1	R	R
25	19UD	900.00	100.00	1000.00	±1	(S)3.7	(S)1.4
26	19DJ	903.00	117.00	1020.00	±1	(S)3.4	(S)1.7
27	19MN	920.00	191.00	1111.00	±1	(S)2.5	(S)2.6
28	19AAT	920.00	825.00	1745.00	±1	R	R
29	19HF	925.00	675.00	1600.00	±1	R	R
30	19TB	940.00	7560.00	8500.00	(d)	(S)1.7	(S)3.4
31	19YE	946.00	636.00	1582.00	±1	R	R
32	19EH	950.00	38.00	988.00	±1	(S)4.5	(S)0.6
33	19ET	950.00	33.00	983.00	±1	(S)4.5	(S)0.6
34	19TS	970.00	970.00	1940.00	±1	R	R
35	19ABS	975.00	2400.00	3375.00	±1	R	R
36	19DE	986.00	34.00	1020.00	±1	(S)4.6	(S)0.5
37	19BM	1000.00	1000.00	2000.00		R	R
38	19CP	1000.00	750.00	1750.00		R	R
39	19DU	1000.00	100.00	1100.00		(S)3.7	(S)1.4
40	19GM	1000.00	400.00	1400.00		(S)0.7	(S)4.4
41	19HG	1000.00	1600.00	2600.00		R	R
42	19HH	1000.00	112.00	1112.00		(S)3.4	(S)1.7
43	19JS	1000.00	2500.00	3500.00		(S)4.4	(S)0.7
44	19PJ	1000.00	500.00	1500.00	±.5	R	R
45	19RN	1000.00	1000.00	2000.00	±1	R	R

(d) ±1% for 940.0, ±5% for 7560.0.

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19RR	1000.00	80.00	1080.00	±1	(S)1.1	(S)4.0
2	19RS	1000.00	42.00	1042.00	±1	(S)4.5	(S)0.6
3	19TM	1000.00	350.00	1350.00	±1	(S)1.1	(S)4.0
4	19ABP	1000.00	600.00	1600.00		R	R
5	19YK	1002.00	560.00	1562.00	±1	R	R
6	19PF	1003.00	359.10	1362.10	±.5	(S)1.1	(S)4.0
7	19RG	1041.00	797.00	1838.00	±1	R	R
8	19CU	1050.00	120.00	1170.00	±1	(S)3.6	(S)1.5
9	19AAP	1070.00	493.00	1563.00	±1	(S)0.3	(S)4.8
10	19BY	1075.00	220.00	1295.00	±1	(S)2.5	(S)2.6
11	19MU	1094.00	236.20	1330.20	±1	(S)2.4	(S)2.7
12	19CD	1095.00	125.00	1220.00	±1	(S)3.5	(S)1.6
13	19SE	1100.00	660.00	1760.00	±1	R	R
14	19SN	1100.00	2400.00	3500.00	±1	(S)4.8	(S)0.3
15	19TL	1150.00	1150.00	2300.00	±1	R	R
16	19PU	1155.00	312.00	1467.00	±1	(S)3.3	(S)1.8
17	19YM	1155.00	427.00	1582.00	±1	(S)1.0	(S)4.1
18	19AAU	1170.00	777.00	1947.00	±1	R	R
19	19JN	1200.00	600.00	1800.00		R	R
20	19PS	1200.00	1600.00	2800.00	±1	R	R
21	19SA	1200.00	5300.00	6500.00		(S)2.8	(S)2.3
22	19TE	1200.00	1900.00	3100.00	±1	R	R
23	19WP	1200.00	570.00	1770.00		(S)0.2	(S)4.9
24	19YG	1208.00	767.00	1975.00	±1	R	R
25	19CM	1235.00	60.00	1295.00	±1	(S)4.4	(S)0.7
26	19PE	1260.00	285.70	1545.70	±.5	(S)2.3	(S)2.8
27	19AAN	1260.00	370.00	1630.00	±1	(S)1.6	(S)3.5
28	19RE	1297.00	877.00	2174.00	±1	R	R
29	19ME	1300.00	370.00	1670.00	±1	(S)1.7	(S)3.4
30	19RB	1300.00	100.00	1400.00	±1	(S)4.0	(S)1.1
31	19AAW	1320.00	750.00	2070.00	±1	R	R
32	19KH	1325.00	286.00	1611.00	±2	(S)2.4	(S)2.7
33	19DH	1330.00	280.00	1610.00	±1	(S)2.4	(S)2.7
34	19RM	1350.00	1350.00	2700.00	±1	R	R
35	19YA	1394.00	317.00	1711.00	±1	(S)2.8	(S)2.3
36	19AAM	1470.00	291.00	1761.00	±1	(S)2.6	(S)2.5
37	19YH	1485.00	733.00	2218.00	±1	R	R
38	19KL	1490.00	269.00	1759.00	±2	(S)2.8	(S)2.3
39	19DD	1500.00	159.00	1659.00	±1	R	R
40	19GE	1500.00	500.00	2000.00		(S)1.3	(S)3.8
41	19KY	1500.00	1500.00	3000.00		R	R
42	19YB	1569.00	269.00	1838.00	±1	(S)2.9	(S)2.2
43	19BF	1600.00	600.00	2200.00		(S)0.9	(S)4.2
44	19EC	1600.00	650.00	2250.00		(S)0.7	(S)4.4
45	19HG	1600.00	1000.00	2600.00		R	R

Phenolic Insulation - 19-Type RESISTOR

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19JE	1600.00	1600.00	3200.00		R	R
2	19JP	1600.00	800.00	2400.00		R	R
3	19PS	1600.00	1200.00	2800.00	±1	R	R
4	19SD	1670.00	2460.00	4130.00	±1	R	R
5	19AAL	1670.00	246.00	1916.00	±1	(S)3.1	(S)2.0
6	19AAY	1670.00	715.00	2385.00	±1	(S)0.5	(S)4.6
7	19ML	1685.00	105.00	1790.00	±1	(S)4.2	(S)0.9
8	19TC	1700.00	3450.00	5150.00	(c)	R	R
9	19TU	1700.00	700.00	2400.00	±1	(S)4.5	(S)0.6
10	19TJ	1705.00	5200.00	6905.00	±1	(S)3.8	(S)1.3
11	19YJ	1718.00	714.00	2432.00	±1	(S)0.6	(S)4.5
12	19MM	1740.00	97.00	1837.00	±1	(S)4.3	(S)0.8
13	19ST	1754.00	52.80	1806.80	±1	(S)4.7	(S)0.4
14	19WD	1760.00	2000.00	3760.00	±1	R	R
15	19WH	1760.00	3075.00	4835.00	±3	R	R
16	19EG	1800.00	600.00	2400.00		(S)1.3	(S)3.8
17	19KT	1800.00	85.00	1885.00		(S)4.4	(S)0.7
18	19ABH	1800.00	37.00	1837.00	±1	(S)4.8	(S)0.3
19	19PD	1806.00	199.40	2005.40	±.5	(S)3.6	(S)1.5
20	19YD	1806.00	224.00	2030.00	±1	(S)3.4	(S)1.7
21	19ABA	1870.00	706.00	2576.00	±1	(S)0.9	(S)4.2
22	19HE	1900.00	300.00	2200.00		(S)3.0	(S)2.1
23	19TE	1900.00	1200.00	3100.00	±1	R	R
24	19AAK	1900.00	680.00	2580.00	±1	(S)1.1	(S)4.0
25	19ABL	1910.00	6810.00	8720.00	±1	(S)2.0	(S)3.1
26	19AAC	1958.00	203.00	2161.00	±1	(S)3.7	(S)1.4
27	19AY	2000.00	50.00	2050.00		(S)4.7	(S)0.4
28	19KR	2000.00	4000.00	6000.00		R	R
29	19WD	2000.00	1760.00	3760.00	±1	R	R
30	19YN	2000.00	2000.00	4000.00	±1	R	R
31	19WR	2108.00	691.00	2799.00	±1	(S)1.3	(S)3.8
32	19RF	2140.00	168.00	2308.00	±.5	(S)4.0	(S)1.1
33	19YW	2142.00	182.00	2324.00	±1	(S)3.9	(S)1.2
34	19ABD	2210.00	2610.00	4820.00	±1	R	R
35	19BB	2300.00	300.00	2600.00		R	R
36	19WB	2345.00	7.80	2352.80	±1	(S)5.0	(S)0.1
37	19AAB	2368.00	162.50	2530.50	±1	(S)4.1	(S)1.0
38	19ABB	2370.00	681.00	3051.00	±1	(S)1.7	(S)3.4
39	19JM	2400.00	4800.00	7200.00		R	R
40	19SN	2400.00	1100.00	3500.00	±1	(S)0.3	(S)4.8
41	19ABJ	2400.00	2400.00	4800.00		R	R
42	19ABS	2400.00	975.00	3375.00	±1	R	R
43	19JL	2460.00	300.00	2760.00	±1	(S)3.5	(S)1.6
44	19SD	2460.00	1670.00	4130.00	±1	R	R
45	19MT	2472.00	131.60	2603.60	±1	(S)4.3	(S)0.8

(c) ±1% for 1700.00, ±5% for 3450.00.

19-Type RESISTOR - Phenolic Insulation

Line No.	CODE NO.	RESISTANCE - OHMS Wdg.	Wdg.	Total	TOLERANCE ±5% or as shown	RATING-WATTS Wdg.	Wdg.
1	19GK	2500.00	300.00	2800.00		R	R
2	19JS	2500.00	1000.00	3500.00		(S)0.7	(S)4.4
3	19SS	2500.00	2500.00	5000.00		R	R
4	19WM	2500.00	5100.00	7600.00		R	R
5	19UA	2500.00	2500.00	5000.00	±1	R	R
6	19HJ	2600.00	112.00	2712.00		(S)4.5	(S)0.6
7	19ABD	2610.00	2210.00	4820.00	±1	R	R
8	19YU	2652.00	143.00	2795.00	±1	(S)4.3	(S)0.8
9	19ABC	2670.00	673.00	3343.00	±1	(S)2.0	(S)3.1
10	19AAD	2700.00	760.00	3460.00	±1	(S)1.8	(S)3.3
11	19YL	2985.00	663.00	3648.00	±1	(S)2.4	(S)2.7
12	19KG	2990.00	160.00	3150.00	±2	(S)4.3	(S)0.8
13	19RP	3000.00	3000.00	6000.00	±1	R	R
14	19AAA	3019.00	124.20	3143.20	±1	(S)4.6	(S)0.5
15	19WH	3075.00	1760.00	4835.00	±3	R	R
16	19UG	3100.00	210.00	3310.00	±1	(S)4.1	(S)1.0
17	19KK	3160.00	152.00	3312.00	±2	(S)4.4	(S)0.7
18	19MJ	3210.00	43.40	3253.40	±1	(S)4.9	(S)0.2
19	19TC	3450.00	1700.00	5150.00	(c)	R	R
20	19MK	3480.00	44.00	3524.00	±1	(S)4.9	(S)0.2
21	19KP	3500.00	500.00	4000.00		(S)3.2	(S)1.9
22	19PC	3509.00	102.60	3611.10	±.5	(S)4.7	(S)0.4
23	19YC	3509.00	105.70	3614.70	±1	(S)4.6	(S)0.5
24	19UF	3900.00	210.00	4110.00	±1	(S)4.3	(S)0.8
25	19KR	4000.00	2000.00	6000.00		R	R
26	19YY	4204.00	87.60	4291.60	±1	(S)4.8	(S)0.3
27	19RC	4400.00	600.00.	5000.00	±1	(S)3.3	(S)1.8
28	19JM	4800.00	2400.00	7200.00		R	R
29	19ABM	5000.00	5000.00	10000.00		R	R
30	19WM	5100.00	2500.00	7600.00		R	R
31	19TJ	5200.00	1705.00	6905.00	±1	(S)1.3	(S)3.8
32	19MS	5245.00	69.60	5314.60	±1	(S)5.0	(S)0.1
33	19SA	5300.00	1200.00	6500.00		(S)2.3	(S)2.8
34	19MG	5590.00	20.00	5610.00	±1	(S)5.0	(S)0.1
35	19RT	5700.00	510.00	6210.00	±1	(S)3.8	(S)1.3
36	19SP	5700.00	525.00	6225.00	±1	(S)1.3	(S)3.8
37	19UB	6000.00	600.00	6600.00	±1	(S)3.6	(S)1.5
38	19KM	6350.00	84.00	6434.00		(S)4.9	(S)0.2
39	19MH	6400.00	22.40	6422.40	±1	(S)5.0	(S)0.1
40.	19NH	6350.00	150.00	6500.00		(S)4.8	(S)0.3
41	19WG	6580.00	833.00	7413.00	±3	(S)3.4	(S)1.7
42	19ABL	6810.00	1910.00	8720.00	±1	(S)3.1	(S)2.0
43	19TB	7560.00	940.00	8500.00	(d)	(S)3.4	(S)1.7

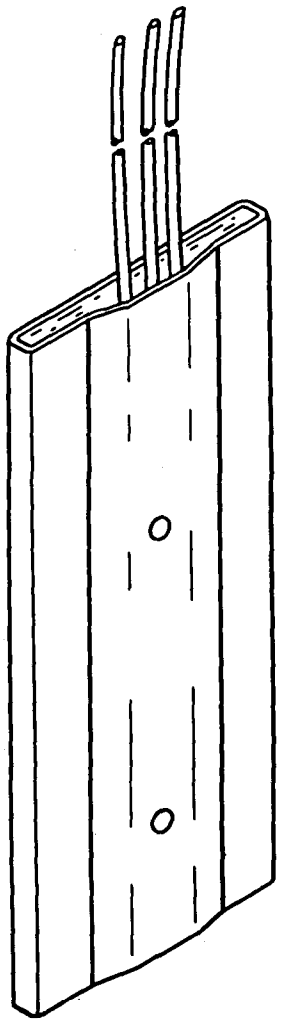
(c) ±1% for 1700.00, ±5% for 3450.00.
(d) ±1% for 940.00, ±5% for 7560.00.

DESCRIPTION

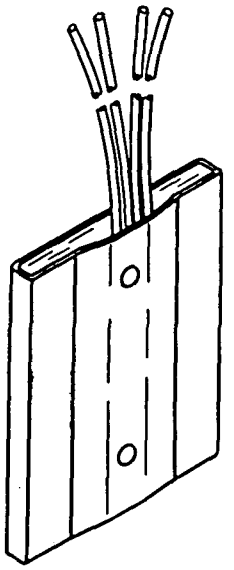
These are power type resistors in which the wire is wound on phenolized asbestos cards, and the windings are wrapped in a phenolized asbestos cover. They are component part resistors for which no provision is made for mounting. These resistors are suitable for assembling in a container with other components of approximately the same size. If used alone, mounting straps or devices may be required, depending on the use.

Power ratings given below are for continuous operation in an ambient of 150°F. The resistors are derated to 0 watts in an ambient of 250°F. When used in a container with or without other components, the power ratings do not apply.

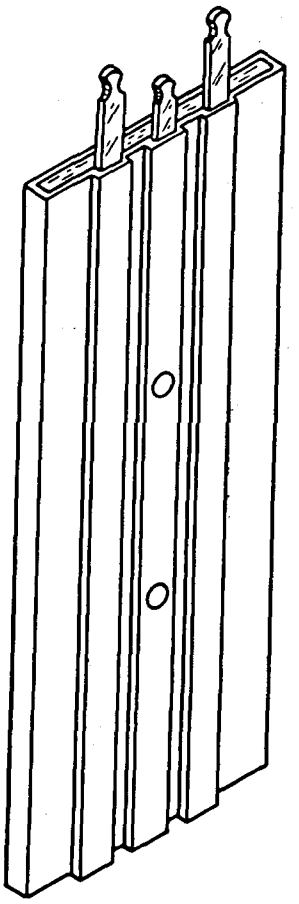
CODE TYPE	TERMINALS	DIMENSIONS (Not Including Terminals)	RATING WATTS
92	7" lead wires	3-5/16" x 1-13/32" x 5/32"	2.5
120	7" lead wires	1-5/8" x 1-13/32" x 5/32"	1.0
123	lugs	3-7/8" x 1-3/8" x 11/64"	2.5



92-Type



120-Type



123-Type

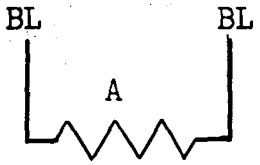


FIG. 1

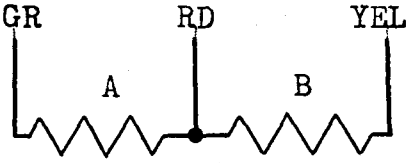


FIG. 2

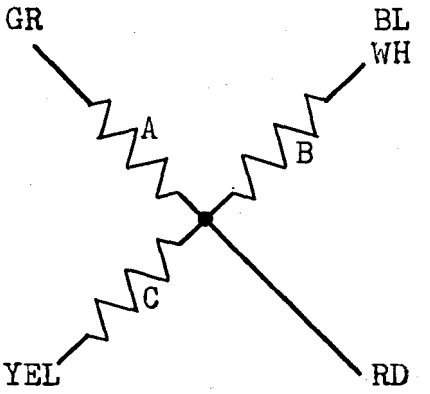


FIG. 3

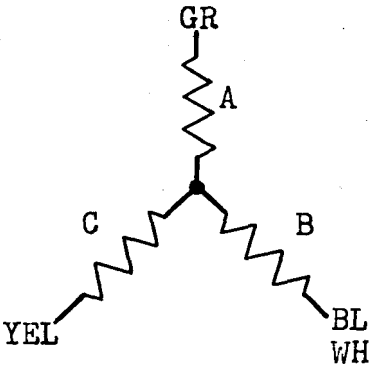


FIG. 4

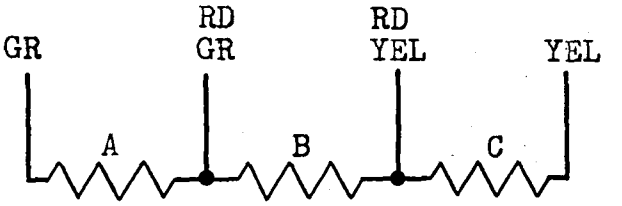


FIG. 5

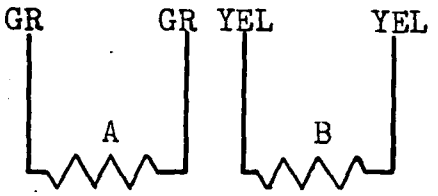


FIG. 6

FIG. 7

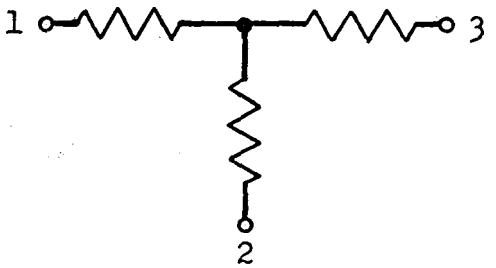


FIG. 8

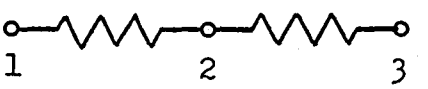


FIG. 9

SINGLE WINDING RESISTORS
FIGURE 1

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	92PT	1.12	1
2	92PM	2.24	2
3	92AH	2.70	1
4	92PP	3.10	1
5	92AG	3.80	1
6	92PJ	6.20	1
7	92AL	9.50	1
8	92AM	12.00	1
9	92AU	12.63	0.5
10	92AJ	16.70	0.5
11	92GW	28.75	1
12	92AW	31.41	0.5
13	92FP	37.00	2
14	92BC	43.50	0.5
15	92AY	45.81	0.5
16	92BJ	65.07	0.5
17	92BA	69.72	0.5
18	92BD	71.22	0.5
19	92N	86.00	2
20	92BH	87.87	0.5
21	92FR	90.00	2
22	92BE	96.00	0.5
23	92AN	100.00	1
24	92LR	137.70	0.5
25	92BF	139.40	0.5
26	92BG	147.90	0.5
27	92HN	189.00	1
28	92PF	400.00	1
29	92NY	495.00	1
30	92GJ	567.00	0.5
31	92ND	586.00	1
32	92PD	586.00	1
33	92AA	600.00	0.5
34	92GP	605.00	1
35	92CF	638.00	1
36	92MB	751.00	1
37	92P	950.00	1
38	92MC	980.00	1
39	92H	1195.00	0.5
40	92B	1205.00	0.5
41	92CG	1039.00	1
42	92A	1360.00	0.5
43	92T	1380.00	1
44	92F	1545.00	0.5
45	92MA	1556.00	1
46	92NU	1639.00	1
47	92R	1695.00	0.5
48	92GR	1750.00	0.5
49	92S	1910.00	1
50	92FM	2512.00	1
51	92CE	2628.00	1
52	92BW	2644.00	1
53	92BB	2845.00	1
54	92MM	3300.00	0.5
55	92BR	3648.00	1
56	92MW	3760.00	1
57	92FW	4000.00	3
58	92BT	4140.00	1
59	92BU	4220.00	1
60	92NC	4545.00	0.5
61	92AP	5000.00	2
62	92CD	5270.00	1
63	92BP	5560.00	1
64	92BS	5850.00	1
65	92FJ	6125.00	1
66	92HP	7270.00	2
67	92BM	7620.00	1
68	92LS	8160.00	2
69	92HW	8271.00	0.5
70	92NA	8700.00	0.5
71	92AR	9000.00	2

TWO WINDING RESISTORS WITH THREE LEADS
FIGURE 2

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	92PS	2.19	2	1.08	3
2	92PL	4.38	1	2.15	2
3	92PR	5.05	1	2.47	2
4	92PN	6.10	1	3.00	1
5	92PU	8.00	1	6.80	1
6	92LN	8.06	1	8.06	1
7	92DS	8.46	0.5	8.46	0.5
8	92PK	10.10	1	4.94	1
9	92PH	12.20	1	6.00	1
10	92CH	16.67	0.5	16.67	0.5
11	92DT	16.93	0.5	16.93	0.5
12	92CS	17.95	0.5	17.95	0.5
13	92PW	18.00	1	8.46	1
14	92AD	20.00	1	10.00	1
15	92LL	20.00	1	10.00	1
16	92C	21.00	4	21.00	4
17	92LM	21.88	1	21.88	1
18	92CL	22.33	0.5	22.33	0.5
19	92CT	23.47	0.5	23.47	0.5
20	92CY	26.20	0.5	26.20	0.5
21	92GE	30.00	2	15.00	2
22	92LJ	30.00	1	15.00	1
23	92GG	30.00	0.5	30.00	0.5
24	92CK	31.06	0.5	31.06	0.5
25	92DE	32.50	0.5	32.50	0.5
26	92DU	33.70	0.5	33.70	0.5
27	92GU	34.85	0.5	34.85	0.5
28	92CW	35.34	0.5	35.34	0.5
29	92DF	36.90	0.5	36.90	0.5
30	92RM	38.75	1	33.75	1
31	92G	40.00	5	20.00	5
32	92D	42.00	3	42.00	3
33	92KG	50.00	2	25.00	2
34	92GH	50.00	0.5	30.00	0.5
35	92CJ	50.00	0.5	50.00	0.5
36	92CU	59.50	0.5	59.50	0.5
37	92FN	62.50	1	62.50	1
38	92DW	66.67	0.5	66.67	0.5
39	92JM	79.00	2	32.00	2
40	92AE	80.00	1	40.00	1

TWO WINDING RESISTORS WITH THREE LEADS
FIGURE 2

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	92E	84.00	2	84.00	2
2	92AS	110.00	1	20.00	1
3	92RK	112.50	1	90.00	1
4	92MK	135.00	1	135.00	1
5	92RE	135.00	1	135.00	1
6	92NJ	200.00	1	28.00	1
7	92MN	300.00	0.5	300.00	0.5
8	92LU	324.00	1	130.00	1
9	92GM	342.00	0.5	342.00	0.5
10	92JB	362.00	1	35.00	2
11	92RL	364.50	1	291.60	1
12	92NN	368.00	1	28.00	1
13	92GK	401.50	1	401.50	1
14	92KJ	600.00	1	233.00	1
15	92JG	600.00	1	275.00	1
16	92W	600.00	0.5	600.00	0.5
17	92HA	677.00	1	157.00	1
18	92JH	686.50	1	600.00	1
19	92HB	713.00	1	480.50	1
20	92MY	720.00	1	400.00	1
21	92GS	725.00	0.5	496.00	0.5
22	92HC	737.00	1	121.00	1
23	92HD	752.50	1	638.00	1
24	92KA	758.00	0.5	472.00	0.5
25	92L	790.00	1	90.00	1
26	92NW	795.00	1	15.00	1
27	92NT	805.00	1	15.00	1
28	92JF	870.00	0.5	411.00	0.5
29	92JE	925.00	0.5	420.00	0.5
30	92HE	933.00	1	258.00	1
31	92RN	1012.00	1	877.60	1
32	92HF	1030.00	1	620.00	1
33	92PA	1040.00	1	288.00	1
34	92NS	1045.00	1	848.00	1
35	92LK	1088.00	0.5	481.00	0.5
36	92HG	1092.00	1	1048.00	1
37	92LP	1124.00	1	406.00	1
38	92GD	1175.00	2	800.00	2
39	92HH	1191.00	1	236.00	1
40	92PC	1226.00	1	472.00	1

92-TYPE RESISTOR - Phenolic Insulation

TWO WINDING RESISTORS WITH THREE LEADS
FIGURE 2

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	92GA	1226.00	2	1135.00	0.5
2	92NM	1250.00	1	338.00	1
3	92K	1300.00	2	225.00	2
4	92HJ	1313.00	1	428.00	1
5	92GL	1348.00	1	255.00	1
6	92GN	1378.00	1	364.00	1
7	92PE	1380.00	1	83.90	1
8	92JC	1430.00	0.5	702.00	0.5
9	92HK	1470.00	1	635.00	1
10	92KK	1545.00	1	560.00	1
11	92JD	1550.00	0.5	684.00	0.5
12	92PB	1595.00	1	795.00	1
13	92AB	1616.00	1	965.00	1
14	92PG	1662.00	1	780.00	1
15	92M	1675.00	2	200.00	2
16	92GC	1750.00	2	666.00	0.5
17	92LH	1882.00	0.5	800.00	0.5
18	92AT	2000.00	1	600.00	1
19	92MT	2000.00	1	1760.00	1
20	92HL	2196.00	1	428.00	1
21	92NK	2305.00	0.5	495.00	0.5
22	92J	2400.00	1	60.00	2
23	92KL	2880.00	1	125.00	1
24	92KB	3000.00	0.5	600.00	0.5
25	92MS	3060.00	1	2120.00	1
26	92KF	3290.00	0.5	1540.00	0.5
27	92NF	3390.00	0.5	660.00	0.5
28	92RT	3480.00	1	1170.00	1
29	92LW	3710.00	1	971.00	1
30	92HY	3956.00	0.5	1638.00	0.5
31	92GB	4150.00	2	1450.00	2
32	92GT	5150.00	2	3500.00	2

TWO WINDING RESISTORS WITH FOUR LEADS
FIGURE 6

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	92MD	1.74	2	1.74	2
2	92ME	2.74	2	2.74	2
3	92MF	4.99	1	4.99	1
4	92KN	5.00	5	5.00	5
5	92MG	6.26	1	6.26	1
6	92MH	7.15	1	7.15	1
7	92KP	10.00	5	10.00	5
8	92KR	15.00	5	15.00	5
9	92KS	20.00	5	20.00	5
10	92MJ	20.80	1	20.80	1
11	92KT	25.00	5	25.00	5
12	92KU	30.00	5	30;00	5
13	92KW	35.00	5	35.00	5
14	92KY	40.00	5	40.00	5
15	92LA	45.00	5	45.00	5
16	92LB	50.00	5	50.00	5
17	92LC	55.00	5	55.00	5
18	92LD	60.00	5	60.00	5
19	92LE	65.00	5	65.00	5
20	92LF	70.00	5	70.00	5
21	92RJ	135.00	1	33.75	1
22	92RF	314.00	1	56.25	1
23	92RH	675.00	1	168.80	1
24	92NR	743.00	1	536.00	0.5
25	92RG	2860.00	1	4.00	5
26	92RS	6000.00	0.5	3.00	2

THREE WINDING RESISTORS WITH FOUR LEADS
FIGURE 3

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOL. %	WINDING B NOMINAL RESISTANCE OHMS	TOL. %	WINDING C NOMINAL RESISTANCE OHMS	TOL. %
1	92NL	210.00	1	69.80	1	28.00	1
2	92RP	270.00	1	164.70	1	108.00	1
3	92LY	390.00	1	199.00	1	71.00	1
4	92NB	576.00	1	161.00	1	58.00	1
5	92JL	626.00	1	329.00	1	555.00	1
6	92RR	740.70	1	590.90	1	347.00	1
7	92MU	1820.00	1	1000.00	1	800.00	1
8	92HM	1957.00	2	496.00	1	496.00	1
9	92HU	2647.00	0.5	1336.00	0.5	758.30	0.5
10	92HT	2766.00	0.5	1467.00	0.5	1175.00	0.5
11	92HS	3363.00	0.5	1752.00	0.5	1073.00	0.5
12	92HR	4032.00	0.5	2051.00	0.5	1013.00	0.5

THREE WINDING RESISTORS WITH THREE LEADS
FIGURE 4

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOL %	WINDING B NOMINAL RESISTANCE OHMS	TOL %	WINDING C NOMINAL RESISTANCE OHMS	TOL %
1	92RD	48.80	0.5	109.00	0.5	109.00	0.5
2	92PY	55.10	0.5	104.70	0.5	104.70	0.5
3	92JT	74.50	1	68.70	1	30.70	1
4	92JN	81.50	1	35.20	1	51.60	1
5	92RC	141.90	0.5	64.54	0.5	64.54	0.5
6	92JJ	300.00	1	175.00	1	300.00	1
7	92KM	300.00	1	300.00	1	150.00	1
8	92RB	314.30	0.5	33.93	0.5	33.93	0.5
9	92ML	569.00	1	15.79	1	15.79	1
10	92RA	645.30	0.5	17.20	0.5	17.20	0.5
11	92NP	1820.00	0.5	490.00	0.5	418.00	0.5

THREE WINDING RESISTORS WITH FOUR LEADS
FIGURE 5

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOL %	WINDING B NOMINAL RESISTANCE OHMS	TOL %	WINDING C NOMINAL RESISTANCE OHMS	TOL %
1	92NE	220.0	1	79.0	1	38.0	1
2	92NG	317.0	1	75.0	1	36.0	1
3	92MR	420.0	1	263.0	1	25.0	1
4	92LT	522.0	1	3422.0	1	135.0	1
5	92JK	622.0	1	638.0	1	555.0	1
6	92JR	1665.0	1	482.0	1	482.0	1
7	92NH	2595.0	0.5	857.0	0.5	520.0	0.5
8	92MP	3448.0	1	590.0	1	263.0	1

SINGLE WINDING RESISTORS WITH TWO LEADS
FIGURE 1

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	120AB	75.0	0.9
2	120G	160.0	1
3	120H	300.0	1
4	120AG	400.0	1
5	120AF	600.0	1
6	120M	1500.0	0.5

TWO WINDING RESISTORS WITH THREE LEADS
FIGURE 2

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	120AC	1.55	2	0.78	4
2	120AD	6.11	1	3.11	1
3	120J	7.50	2	5.00	2
4	120K	20.00	1	10.00	2
5	120AE	24.40	1	12.22	1
6	120L	80.00	1	40.00	1

TWO WINDING RESISTORS WITH FOUR LEADS
FIGURE 6

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
26	120N	13.00	2	13.00	2

FIGURE 7

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS TERMS. 1-2	TOLERANCE %
1	123A	71.0	2
2	123AD	241.7	2
3	123AL	564.0	1
4	123AK	639.0	1
5	123AM	825.0	1
6	123AC	1099.0	2

123-TYPE RESISTOR - Phenolic Insulation

FIGURE 8

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS TERMS. 1-2	TOL. %	NOMINAL RESISTANCE OHMS TERMS. 2-3	TOL. %	NOMINAL RESISTANCE OHMS TERMS. 1-3	TOL. %
1	123AF	597.0	0.5	60.0	0.5	597.0	0.5
2	123AP	723.0	1	723.0	1	130.0	1
3	123AR	873.0	1	873.0	1	106.0	1
4	123AT	1169.5	1	1169.5	1	78.4	1

POWER RESISTORS - WIRE WOUND - CERAMIC CORES

VITREOUS ENAMEL INSULATION

Power resistors in code series fitting this description are tabulated below. Individual codes in these series have specific resistance values which fall within the resistance ranges shown. For example, the 44W resistor has a resistance value of 300 ±5% ohms. The resistance ranges are not continuous between the minimum and maximum values shown. The minimum and maximum values do not necessarily represent extremes beyond which new designs could not be furnished.

CODE TYPE	APPROXIMATE NORMAL RATING (Note 1) WATTS	APPROXIMATE RESISTANCE RANGE OHMS	SECTION II PAGE
44	30	6 to 20000	41
59	15	24 to 3500	43
60	15	230 to 385	45
67	22	10 to 3000	47
71	32	40 and 60	49
82	7.5	2 to 700	51
84	6	15 to 1500	53
85	20	220 and 13000	55
91	15	400 to 1600	57
96	25	0.25 to 15.75	59
100	5	10 to 3200	61
119	25	100 to 1500	65

NOTE 1: The heat dissipating characteristics of these resistors are as follows:

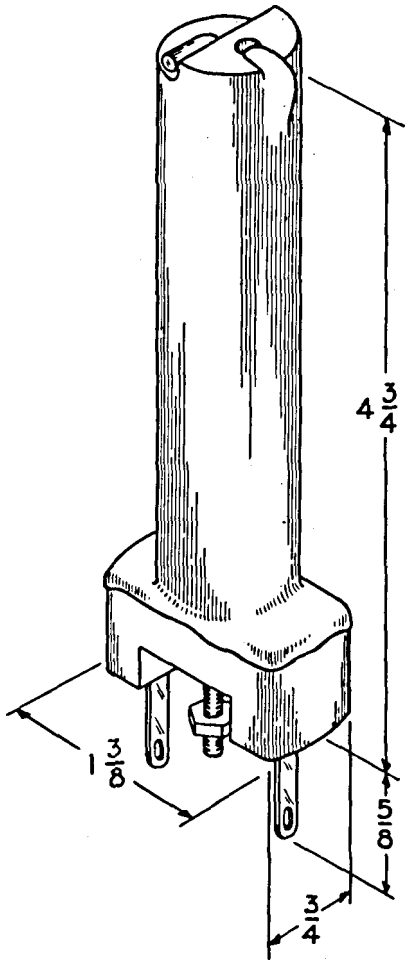
Power Dissipation Condition	Wattage Rating of Resistor	Temperature Rise	Ambient Temperature
Normal Condition	Normal Rating	250° F	77° F
Trouble Condition	2 x Normal Rating	450° F	77° F

DESCRIPTION

Power rating is 30 watts for continuous operation at 77° F ambient temperature.

Provided with a stud and nuts for mounting. Closest recommended mounting centers are 1 inch by 1-1/2 inches.

Single winding resistors.



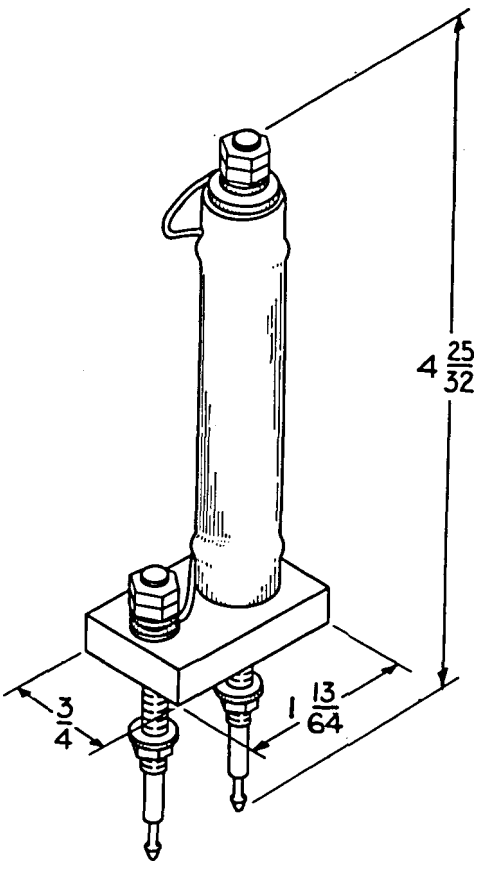
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	44AN	6.32	5
2	44AM	6.8	5
3	44AB	8.7	5
4	44M	14.0	5
5	44AA	16.0	2
6	44C	18.1	5
7	44AL	21.6	1
8	44AC	26.8	5
9	44S	30.0	5
10	44L	36.6	5
11	44B	45.0	5
12	44A	52.5	5
13	44K	54.2	5
14	44E	58.0	5
15	44AD	61.8	1
16	44R	90.0	5
17	44J	115.0	5
18	44G	150.0	5
19	44P	167.0	5
20	44D	200.0	5
21	44N	220.0	5
22	44W	300.0	5
23	44Y	450.0	5
24	44AE	625.0	2
25	44AF	1250.0	2
26	44U	1500.0	5
27	44AG	2500.0	2
28	44AH	5000.0	2
29	44AJ	10000.0	2
30	44AK	20000.0	2

DESCRIPTION

Power rating is 15 watts for continuous operation at 77° F ambient temperature.

Arranged for mounting on mounting plates. Will mount on 7/8 inch horizontal centers and 1-5/16 inch vertical centers. Except for horizontal centers, will mount on panels drilled for 19-type resistors.

Single winding resistors.



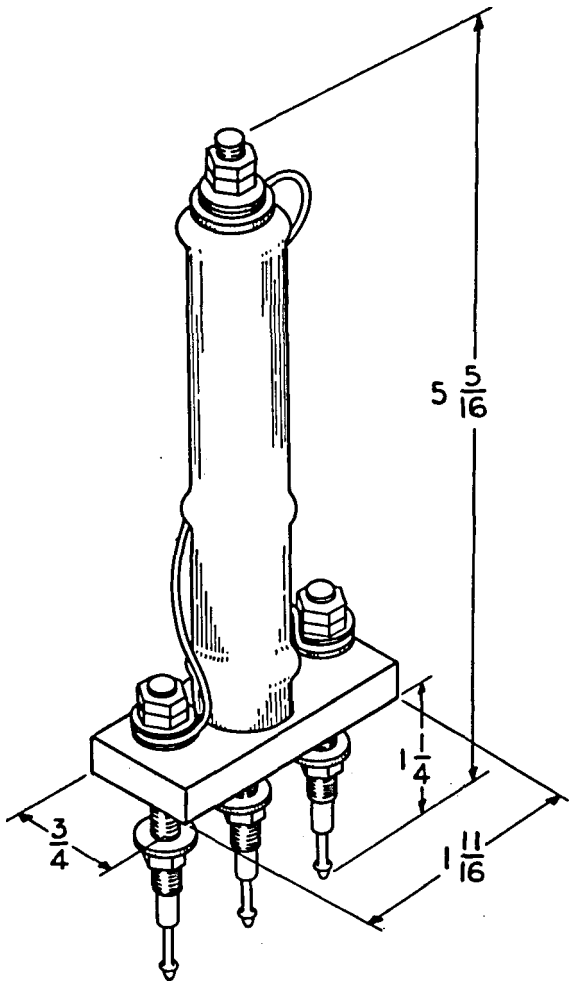
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	59U	24.0	1
2	59S	28.0	1
3	59G	60.0	5
4	59P	90.0	5
5	59W	98.0	1
6	59T	103.5	1
7	59R	107.5	5
8	59Y	110.5	1
9	59K	112.0	5
10	59D	115.0	5
11	59E	150.0	5
12	59H	190.0	5
13	59C	200.0	5
14	59F	240.0	5
15	59L	600.0	5
16	59M	850.0	5
17	59N	1000.0	5
18	59A	3000.0	5
19	59B	3500.0	5

DESCRIPTION

Has two windings and three terminals, one terminal being common to both windings. Terminals for Windings A and B are arranged as shown in Fig. 1.

Arranged for mounting on mounting plates. Will mount on 7/8 inch horizontal centers and 1-3/4 inch vertical centers. Except for horizontal centers, will mount interchangeably with 19-type resistors.

Power ratings indicated in the table are for continuous operation at 77° F ambient temperature.



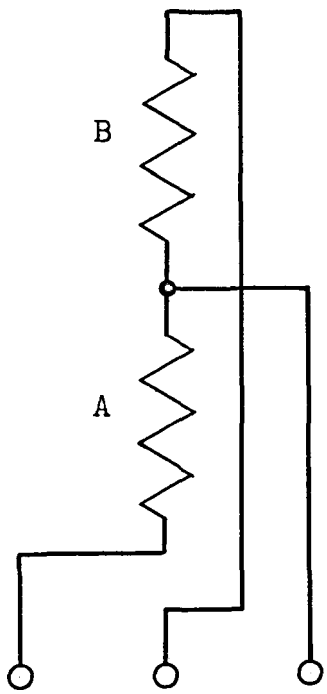


FIG. 1

60-TYPE RESISTOR - Ceramic Core, Enamel Insulation

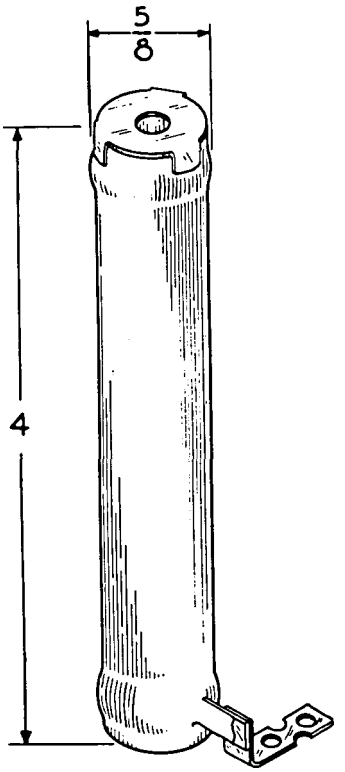
Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	WINDING A MAX. WATTS	WINDING A TOL. %	WINDING B NOMINAL RESISTANCE OHMS	WINDING B MAX. WATTS	WINDING B TOL. %
1	60J	90.0	5.9	1	140.0	9.1	1
2	60E	110.5	5.0	1	220.0	10.0	5
3	60F	110.5	4.4	1	270.0	10.7	1
4	60H	115.0	7.5	5	115.0	7.5	5
5	60C	115.0	6.5	5	150.0	8.5	5
6	60B	115.0	5.2	5	220.0	9.9	5
7	60D	115.0	4.5	5	270.0	10.5	1
8	60K	150.0	7.5	5	150.0	7.5	5

DESCRIPTION

-Power rating is 22 watts for continuous operation at 77° F ambient temperature.

Will mount on 3/4 inch horizontal centers and 1 inch vertical centers. Intended to be mounted on 4-type resistor mounting. Has one soldering terminal, the other connection being made through the 4-type resistor mounting.

Single winding resistor.



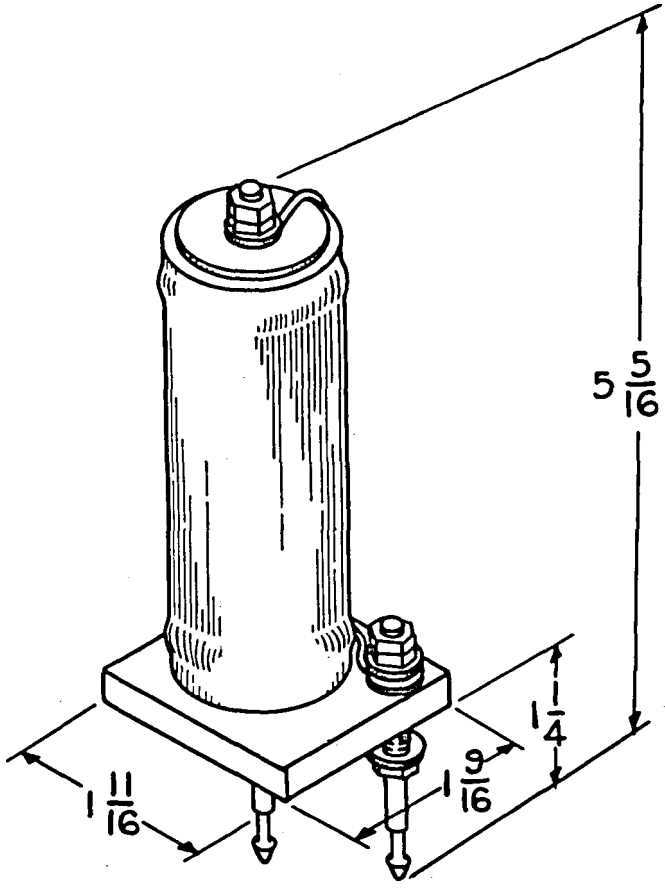
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	67M	10	5
2	67B	120	5
3	67F	300	5
4	67C	600	5
5	67J	800	5
6	67N	856	1
7	67G	1000	1
8	67D	1100	5
9	67K	1300	5
10	67E	1500	5
11	67L	1750	5
12	67A	2000	5
13	67H	3000	5

DESCRIPTION

Power rating is 32 watts for continuous operation at 77° F ambient temperature.

Will mount on 1-3/4 inch horizontal and vertical centers.

Single winding resistor.



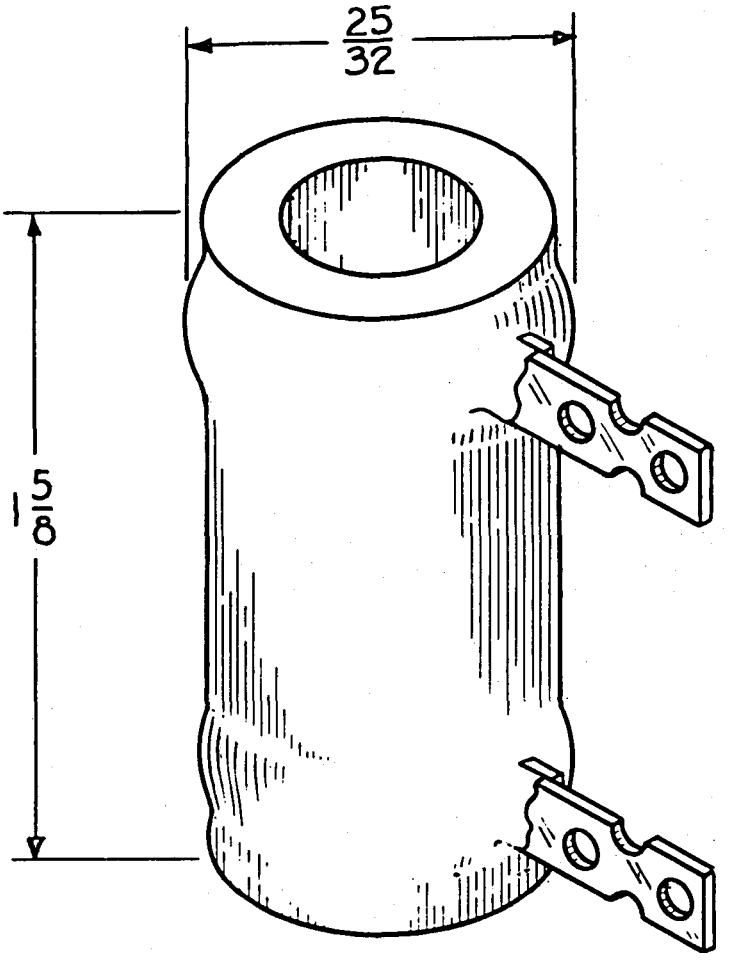
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	71A	40	5
2	71B	60	5

DESCRIPTION

Power rating is 7.5 watts for continuous operation at 77° F ambient temperature. For each degree F that the ambient exceeds 77° F, the power rating decreases 0.4%.

Closest recommended mounting centers are 1-3/8 inches by 1-1/8 inches.

Single winding resistor.



Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	82F	2	5
2	82B	30	1
3	82A	150	5
4	82D	225	1
5	82G	400	5
6	82C	500	1
7	82E	700	5

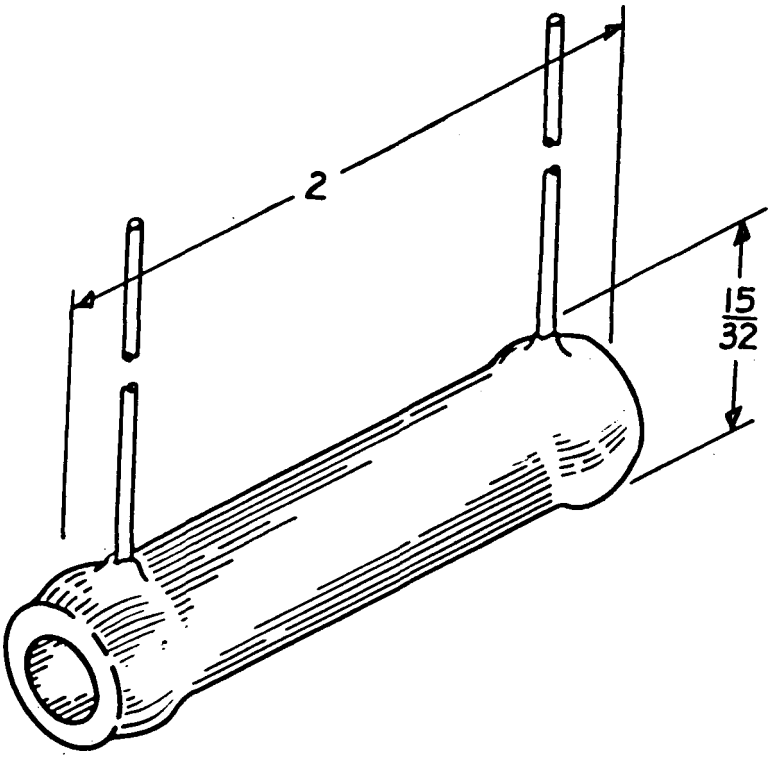
DESCRIPTION

Power rating is 6.0 watts for continuous operation at 77° F ambient temperature.

Equipped with two flexible leads. May be mounted on a threaded stud through the center of the resistor.

Closest recommended mounting centers are 7/8 inch by 7/8 inch.

Single winding resistor.



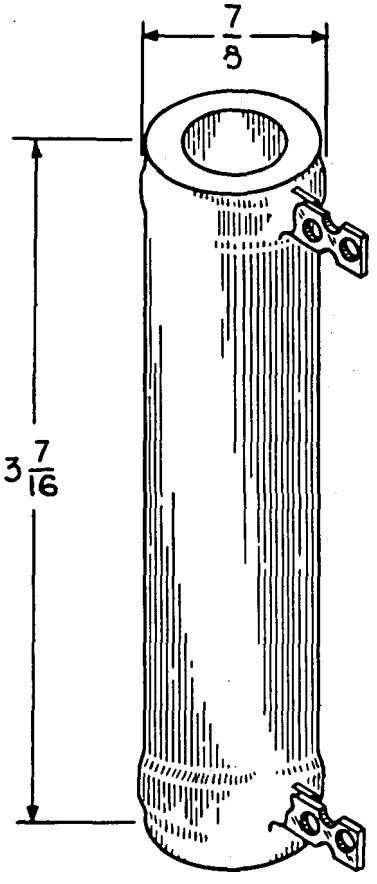
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	84E	15.6	1
2	84F	20.0	1
3	84D	31.2	1
4	84A	400.0	5
5	84B	600.0	5
6	84C	800.0	5
7	84H	900.0	5
8	84G	1500.0	5

DESCRIPTION

Power rating is 20 watts for continuous operation at 77° F ambient temperature.

Closest recommended mounting centers are 1-3/8 inches by 1-7/8 inches.

Single winding resistor.



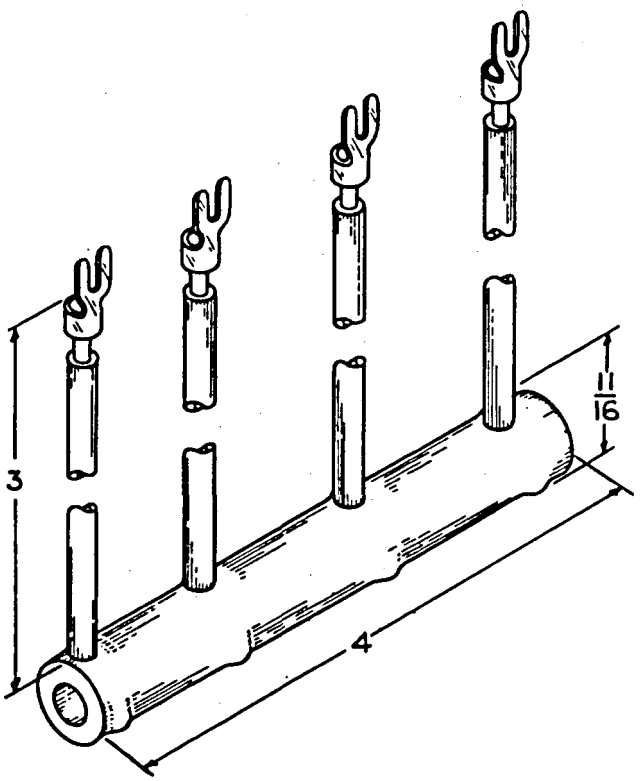
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	85D	220	5
2	85C	13000	5

DESCRIPTION

Has three windings connected in series. Equipped with four flexible leads, one at each end and one at each winding junction. Power rating is 15 watts for continuous operation at 77° F ambient temperature. Resistance values do not vary more than ±5%.

May be mounted on a threaded stud through the center of the resistor.

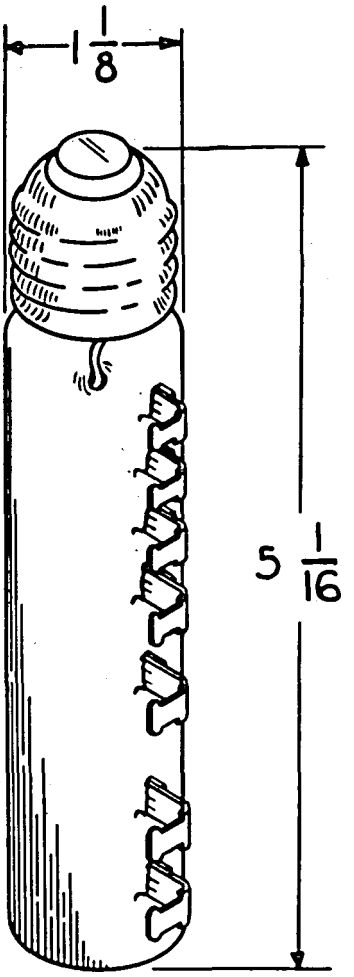
Closest recommended mounting centers are 1-1/8 inch by 1-1/8 inch.



CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	WINDING B NOMINAL RESISTANCE OHMS	WINDING C NOMINAL RESISTANCE OHMS
91A	400	600	600

DESCRIPTION

Has six windings consecutively connected in series and is provided with a tap at each winding junction. Equipped with a medium lamp base. Intended for use interchangeably with ballast lamps where voltage regulation permits. Power rating is 25 watts for continuous operation at 77° F ambient temperature.



CODE NO.	WINDING STARTING NEXT TO EDISON BASE	NOMINAL RESISTANCE OHMS	TOLERANCE %
96A	1st	0.25	10
	2nd	0.50	10
	3rd	1.00	5
	4th	2.00	5
	5th	4.00	5
	6th	8.00	5

DESCRIPTION

Have one or more windings, as indicated. Windings are connected in series and taps are provided at the winding junctions. Power rating is 5 watts for continuous operation at 77° F ambient temperature.

Can be mounted by means of a 9A or 9B resistor mounting. Closest recommended mounting centers are 1-3/8 inch by 1 inch.

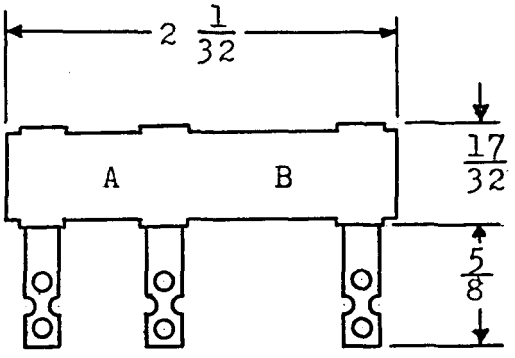


FIG. 1

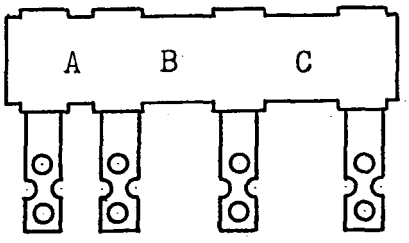


FIG. 2

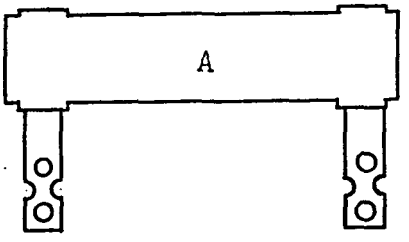
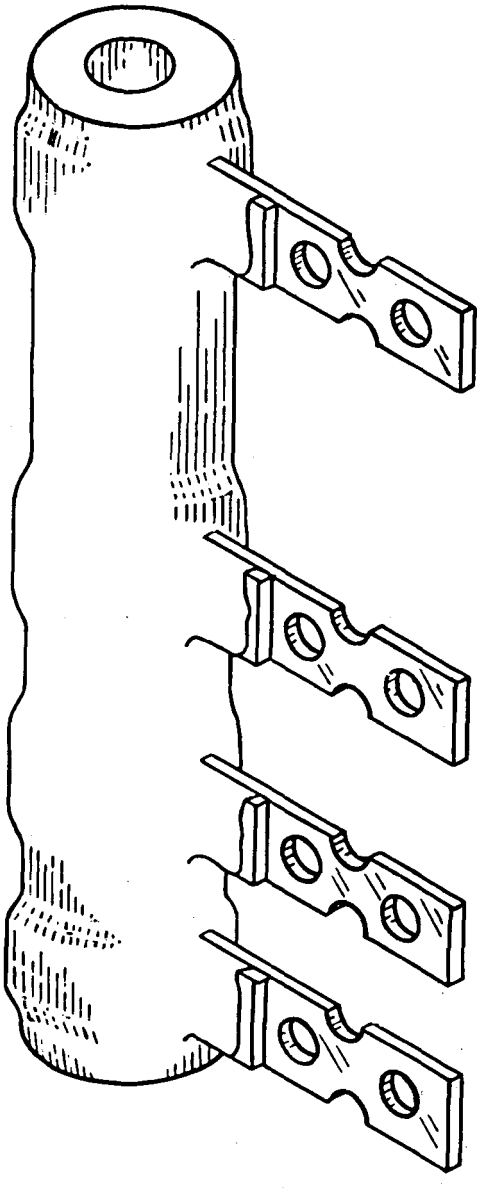


FIG. 3



100-TYPE RESISTOR - Ceramic Core, Enamel Insulation

SINGLE WINDING RESISTOR WITH TWO LUGS
FIGURE 3

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %	RATING WATTS MAX.
1	100G	300	5	6

TWO WINDING RESISTOR WITH THREE LUGS
FIGURE 1

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %	RATING WATTS MAX.
11	100F	100	800	5	5
12	100C	500	200	5	5
13	100B	1075(a)	220	5	5
14	100A	1600	1600	5	5

(a) Plus 5%; minus 10%

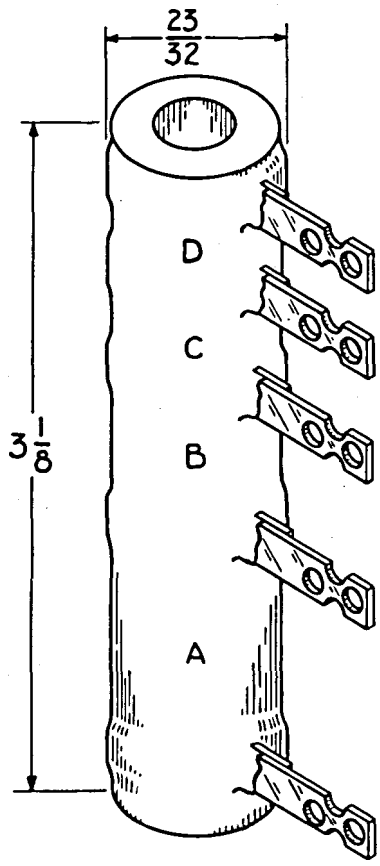
THREE WINDING RESISTOR WITH FOUR LUGS
FIGURE 2

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	WINDING B NOMINAL RESISTANCE OHMS	WINDING C NOMINAL RESISTANCE OHMS	TOLERANCE %	RATING WATTS MAX.
1	100D	10	20	40	5	4
2	100H	60	60	60	5	4
3	100E	80	160	320	5	4

DESCRIPTION

Has four windings connected in series. Resistance values are held with limits of ±5%. Power rating is 25 watts for continuous operation at 77° F ambient temperature.

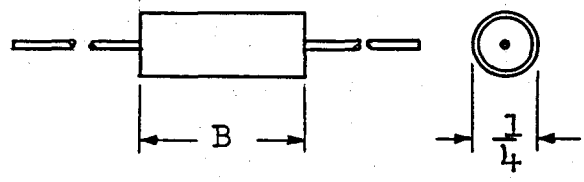
Closest recommended mounting centers are 1-3/4 inch by 1-1/4 inch.



CODE NO.	STAMPED AT	NOMINAL RESISTANCE OHMS
119A	A	800
	B	400
	C	200
	D	100

DESCRIPTION

These resistors consist of a winding of resistance wire over a core of insulating material enveloped in a protective sleeve of colored polyethylene. The color identifies each particular combination of nominal resistance and tolerance. They are provided with tinned axial leads.



Power rating is 0.5 watt for 234 type and 1.0 watt for 235 type at 60°C (140°F) ambient temperature. For each degree centigrade that the ambient exceeds 60°C, the power rating decreases approximately 2-1/4 per cent.

Line No.	CODE	RESISTANCE - OHMS Nom.	Max.	Min.	COLOR	DIM. B
1	234A	4.64	4.70	4.58	Brown	.656
2	234B	14	14.15	13.85	White	.625
3	234C	18	18.19	17.81	Gray	.656
4	234D	28	28.29	27.71	Red	.625
5	234E	47.5	47.99	47.01	Orange	.656
6	234K	56.2	56.49	55.91	Pink	.625
7	234F	68.1	68.8	67.4	Light Blue	.656
8	234P*	220	231	209	Black	.656
9	234N	301	316	286	Light Green	.656
10	234G	750	758	742	Green	.656
11	234H	795	804	788	Blue	.625
12	234L	856	860	852	Tan	.625
13	234M	976	981	971	Purple	.656
14	234J	1270	1283	1257	Yellow	.625
15	235A	1370	1384	1356	Yellow	1.032
16	235B	1600	1616	1584	Gray	1.000
17	235C	1960	1980	1940	Purple	1.000
18	235D	2490	2515	2465	Brown	1.000
19	235E	2550	2576	2524	Orange	1.000
20	235F	3200	3232	3168	Light Blue	1.000
21	235G	5110	5161	5059	Green	1.000

* Has a nominal temperature coefficient of 6000ppm/°C.

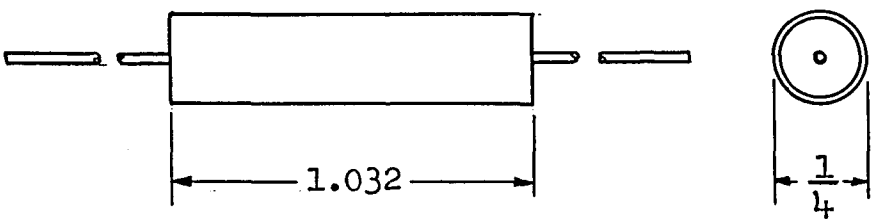
DESCRIPTION

Wire-wound resistor consisting of an inductive winding on a core of insulating material and covered with plastic tubing. Equipped with axial tinned leads.

Has a special temperature coefficient of +500 ±50 ppm/°C.

Power rating is 1.0 watt at 60°C (140°F) ambient temperature. For each degree C that the ambient exceeds 60°C, the power rating decreases approximately 2-1/4 per cent.

Resistance value is 562 ±1% ohms.



WIRE WOUND RESISTORS - FAMILY CODES

Line No.	CODE NO.	RESISTANCE RANGE OHMS	TOLERANCE ±%	CHARACTERISTICS
1	64A	1 to 13000	5	Note 1
2	64B	2.5 to 13000	2	
3	64C	5 to 5800	1	
4	64D	10 to 5800	0.5	
5	64E	50 to 5800	0.1	
6	64F	20 to 5800	0.25	
7				
8	65B	200 to 12000	2	Note 1
9	65C	200 to 5400	1	
10				
11	106A	0.4 to 30000	1	
12	106B	3 to 30000	0.25	Note 3
13	106C	10 to 12000	0.1	
14	106D	0.1 to 3.0	2 + 0.02 ohm	
15				
16	107A	0.4 to 250000	1	Note 4
17	107B	7 to 250000	0.25	
18				
19	136A	4.5 to 1299	1	Note 7
20	136B	4.5 to 1299	2	
21	136C	8.0 to 1299	0.5	
22				
23	137A	1300 to 400000	1	Note 7
24	137B	1300 to 400000	2	
25	137C	1300 to 400000	0.5	
26				
27	138A	2.5 to 183500	1	Note 7
28	138C	2.5 to 183500	0.5	
29				
30	143A	10 to 400	1	Notes 9 & 10
31	143B	10 to 400	0.25	
32				
33	216A	10 to 10500	1	
34				
35	217A	4990 to 80600	1	
36	217C	4990 to 80600	0.1	
37				
38	227A	1 to 1270	1 + 0.01 ohm	Note 7
39	227C	0.1 to 1270	5 + 0.01 ohm	
40	227D	2.0 to 1270	0.5 + 0.01 ohm	
41	227E	900 to 1270	0.25 + 0.01 Ohm	
42				
43	228A	1290 to 5110	1	Note 7
44	228D	1290 to 5110	0.5	
45				
46	241D	4990 to 250000	0.5	Notes 18 & 19
47				
48	242C	100 to 4020	5	Note 20
49				
50				

WIRE WOUND RESISTORS - FAMILY CODES

RATING WATTS	AMBIENT TEMP.	DERATING	BODY MATERIAL	ILLUS-TRATION	Line No.
Notes 2 & 12	104° F		Ceramic	III-7	1
					2
					3
					4
					5
					6
					7
Notes 2 & 12	104° F		Ceramic	III-7	8
					9
					10
0.25	150° F	Note 6	Phenolic	III-8	11
0.25					12
0.25					13
0.10					14
					15
Notes 5 & 12	150° F	Note 6	Phenolic	III-8	16
					17
					18
0.25	77° F		Note 13	III-8	19
					20
					21
					22
0.25	77° F		Note 14	III-8	23
					24
					25
					26
1.0	77° F		Note 15	III-8	27
					28
					29
0.1	104° F		Phenolic	III-8	30
					31
					32
0.25	150° F	Note 8	Ceramic	III-8	33
					34
Note 11	150° F	Note 8	Ceramic	III-8	35
					36
					37
0.5	140° F	Note 16	Phenolic Note 17	III-8	38
					39
					40
					41
					42
1.0	140° F	Note 16	Phenolic Note 17	III-8	43
					44
					45
Note 18	140° F	Note 6	Phenolic	III-8	46
					47
0.25	150° F	Note 6	Phenolic	III-8	48
					49
					50

WIRE WOUND RESISTORS - FAMILY CODES

Line No.	CODE NO.	RESISTANCE RANGE OHMS	TOLERANCE ±%	CHARACTERISTICS
1	244A	100 to 4020	1	Note 21
2	244B	100 to 4020	2	
3				
4	245B	340 to 16200	2	Note 21
5				
6	248C	1 to 1290	5 ± 0.01 ohm	Notes 12 & 23

WIRE WOUND RESISTORS - FAMILY CODES

RATING WATTS	AMBIENT TEMP.	DERATING	BODY MATERIAL	ILLUS-TRATION	Line No.
0.25	150° F	Note 6	Phenolic	III-8	1
					2
					3
Note 22	150° F	Note 6	Phenolic	III-8	4
					5
0.5	170° F	Note 24	Phenolic	III-8	6

WIRE WOUND RESISTORS - FAMILY CODES

1. 64- and 65-type resistors differ in method of winding. For minimum phase angle in the resistance range of 1 to 200 ohms use 64-type and for resistance ranges above 200 ohms use 65-type.
2. Ratings in Watts:

1 to 2 ohms	0.1 watt
2 to 10 ohms	0.25 watt
10 to 13000 ohms	1.0 watt

3. 106B resistor not recommended for general use above 12000 ohms because of high temperature coefficient of resistance.
4. Not recommended for general use above 90000 ohms because of high temperature coefficient of resistance.
5. Ratings in Watts:

0 to 60 ohms	0.25 watt
60 to 14990 ohms	0.375 watt
15000 to 29990 ohms	0.50 watt
30000 to 59990 ohms	0.75 watt
60000 to 89990 ohms	1.0 watt
90000 to 149900 ohms	0.75 watt
150000 to 250000 ohms	1.0 watt

6. Wattage rating decreases 1% for each degree F that the ambient temperature exceeds 150° F.
7. Resistor is inductively wound.
8. Wattage rating decreases approximately 1.8% for each degree F that the ambient temperature exceeds 150° F.
9. Bifilar winding.
10. Low time constant.
11. Ratings in Watts:

4990 to 14900 ohms	0.375 watt
15000 to 29800 ohms	0.50 watt
30100 to 59700 ohms	0.75 watt
60400 to 80600 ohms	1.0 watt

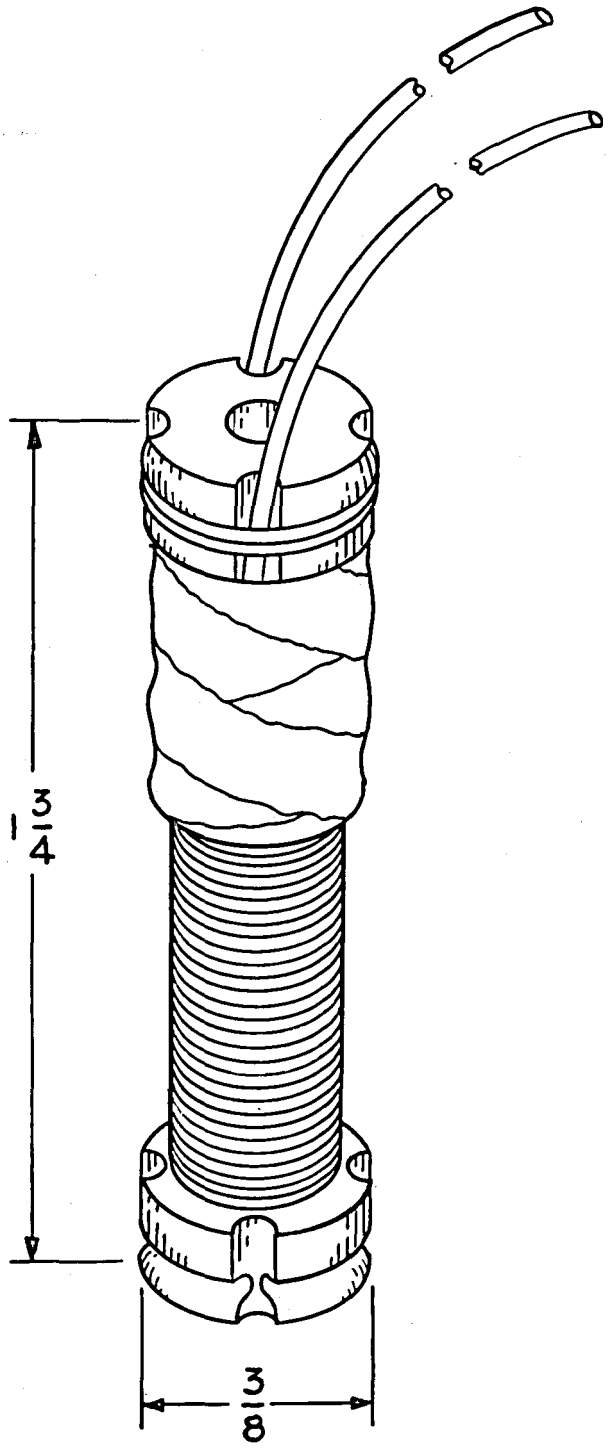
12. Rating in watts for trouble condition is two times normal rating.
13. Single layer unidirectional winding on a phenolic fiber tube covered with Vincellatate muslin. Winding terminates in two flexible axial insulated leads.
14. Multilayer unidirectional winding covered with Vincellatate muslin. Winding terminates in two flexible axial insulated leads.
15. Inductive single layer winding on spool having brass core and phenolic spool heads. Covered with Vincellatate muslin.
16. Wattage rating decreases approximately 2-1/4% for each degree C that the ambient temperature exceeds 60°C (140° F).
17. Conformal coating of plastic.
18. Ratings in Watts:

4990 to 12490 ohms	0.25 watt
12500 to 24990 ohms	0.50 watt
25000 to 49900 ohms	0.75 watt
50000 to 89900 ohms	1.0 watt
90000 to 149000 ohms	0.75 watt
150000 to 250000 ohms	1.0 watt

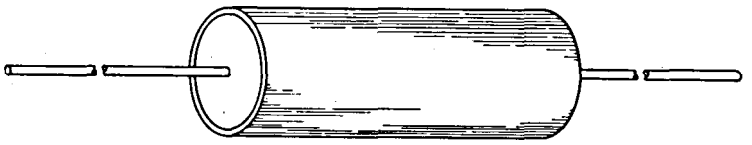
19. Has positive temperature coefficient of 140±30 ppm/°C and low reactance, making the resistor suitable for use at high frequencies.
20. Has a positive temperature coefficient of resistance of 5190±270 ppm/°C.
21. Has a positive temperature coefficient of resistance of 5200±300 ppm/°C.
22. Ratings in Watts:

340 to 2670 ohms	0.375 watt
2740 to 5360 ohms	0.50 watt
5490 to 10700 ohms	0.75 watt
11000 to 16200 ohms	1.00 watt

23. Has a positive temperature coefficient of resistance of 3500 ppm/°C.
24. Wattage rating decreases 1-1/4% for each degree F that the ambient temperature exceeds 170° F. Trouble wattage rating decreases 0.8% for each degree F that the ambient temperature exceeds 150° F.



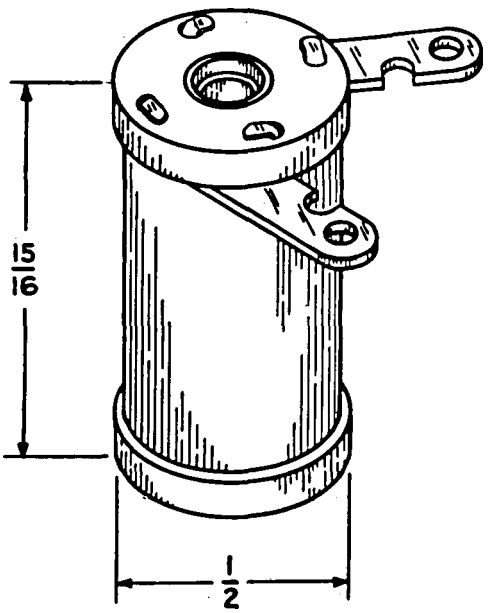
64- and 65-Type Resistors



CODE TYPE	DIMENSIONS - INCHES BODY LENGTH	BODY DIAMETER	LEADS LENGTH	LEADS DIAMETER
106	1	.328	1-1/2	.026
107	1-17/32	.518	1-1/2	.037
*136	1-5/16	13/32	1-13/32	22 Ga H Wire
*137	1-5/16	13/32	1-13/32	22 Ga H Wire
143	9/16	7/32	1-7/16	.026
216	1	3/8	2	.026
217	1-1/2	19/32	2	.037
227	5/8	.250 or .283(a)	1-7/16	.033
228	1	.250	1-7/16	.033
241	1-17/32	.518	1-1/2	.032
242	1-17/32	.518	1-1/2	.032
244	1-17/32	.518	1-1/2	.032
245	1-17/32	.518	1-1/2	.032
248	1	.328	1-1/2	.032

* Refer to this figure for general outline only. For construction, See Notes 13 and 14, Page III-6, for 136- and 137-types respectively.

(a) Resistors within range of 0.1 to 3.83 ohms have max. diameter of 0.283 inches. All others have max. diameter of 0.250 inch.



138-Type Resistors

DESCRIPTION

These resistors consist essentially of a ceramic core having a coating of deposited carbon. See the figures on the following pages identified by code designations for dimensions, leads, terminals, and mounting information.

RESISTANCE VALUE

See data table on following page for resistance range and TABLE 1, Page vii in the Introduction for standard resistance values.

RESISTANCE TOLERANCES

In general, the tolerances expressed are ± values as tabulated. The 222A and 223B resistors, in addition to overall tolerances of ±1%, have distribution requirements and when ordered in quantity are packaged in groups of five. The resistors in each group of five have resistance values substantially evenly distributed above and below the nominal resistance value ordered and are within the ±1% tolerance limits. When less than five resistors are ordered, the resistors furnished have values within the ±1% tolerance limits. The groups of five resistors are divided into three cells as specified in the table and Note 13, Page III-14.

CHARACTERISTICS

The column headed "Characteristics" is used where special qualities, limitations, or requirements apply.

DEPOSITED CARBON RESISTORS - FAMILY CODES

Line No.	CODE NO.	RESISTANCE RANGE	TOLERANCE
1	144A	50 ohms to 5 Meg.	±1%
2			
3	144B		±2%
4	144C		±5%
5	144E		±1%
6			
7	144F		±2%
8	144G		±5%
9			
10			
11	145A	1 ohm to 5 Meg.	±(1% +0.01 ohm)
12			
13	145B		±2%
14	145C		±5%
15	145E	0.288 ohm to 7000 ohms	±(1/2% +0.002 ohm)
16			
17			
18	146A	1 ohm to 5 Meg.	±(1% +0.01 ohm)
19			
20	146B		±2%
21	146C		±5%
22	146E	0.4 ohm to 3.999 ohms	±0.02 ohm
23		4.0 ohms to 20000 ohms	±(1/2% +0.002 ohm)
24			
25			
26	147A	50 ohms to 30 Meg.	±1%
27			
28	147B	50 ohms to 50 Meg.	±2%
29	147C	50 ohms to 50 Meg.	±5%
30	147D	50 ohms to 30 Meg.	±1%
31			
32	147E	50 ohms to 50 Meg.	±2%
33	147F	50 ohms to 50 Meg.	±5%
34			
35			
36	149A	0.300 ohm to 1000 ohms	Note 20
37			
38	149B		Note 20
39			
40			
41	150A	1.0 ohm to 100 ohms	Note 22
42			
43			
44	151A	5 ohms to 5000 ohms	±1%
45			
46			
47	152A	20 ohms to 10 Meg.	±5%
48			
49			
50			

DEPOSITED CARBON RESISTORS - FAMILY CODES

RATING WATTS	AMBIENT TEMP.	DERATING	CHARACTER-ISTICS	FINISH OR COVER	ILLUS-TRATION	Line No.
1	30° C	Notes 1 & 2	Note 27	Note 3	III-17	1
						2
1					III-17	3
1					III-17	4
1				Notes 3 & 4	III-17	5
						6
1					III-17	7
1					III-17	8
						9
						10
0.5	30° C	Notes 1 & 5	Note 28	Note 4	III-17	11
						12
0.5					III-17	13
0.5					III-17	14
0.5					III-17	15
						16
						17
1	30° C	Notes 1 & 6	Notes 15 & 28	Note 7	III-18	18
						19
1					III-18	20
1					III-18	21
1					III-18	22
1						23
						24
						25
2	40° C	Notes 2 & 8	Note 32	Note 3	III-17	26
						27
2					III-17	28
2					III-17	29
2				Notes 3 & 4	III-17	30
						31
2					III-17	32
2					III-17	33
						34
						35
0.1	40° C	Note 8	Notes 19 & 29	none	III-18	36
						37
0.1					III-18	38
						39
						40
0.1	40° C	Note 8	Notes 21 & 29	none	III-18	41
						42
						43
0.25	30° C	Notes 1 & 9	Note 29	Note 10	III-18	44
						45
						46
60	Note 17			Note 11	III-19	47
						48
						49
						50

DEPOSITED CARBON RESISTORS - FAMILY CODES

Line No.	CODE NO.	RESISTANCE RANGE	TOLERANCE
1	153A	10 ohms to 1 meg.	±5%
4	154A	40 ohms to 10 meg.	±5%
7	206A	200 ohms to 5.11 meg.	±5%
10	207A	0.015 meg. to 5.11 meg.	±0%, -2%
13	208A	5 ohms to 12000 ohms Note 23	±0.5% Note 24
17	209A	20.0 ohms to 1300 ohms Note 25	±(0.5 +0.001R)% Note 26
21	221A	1.0 ohm to 2.1 meg.	±(1% +0.01 ohm)
23	221B	511 ohms and 20000 ohms	±2%
25	222A	5.11 ohms to 10000 ohms	Note 13
29	223A	4.99 ohms to 25200 ohms	±1%
31	223B		Note 13
34	237A	1.0 ohms to 261000 ohms	±(1% +0.01 ohm)
37	238A	1.0 ohms to 261000 ohms	±(1% +0.01 ohm)
40	6145C	1.0 ohm to 5.0 meg.	±5%

DEPOSITED CARBON RESISTORS - FAMILY CODES

RATING WATTS	AMBIENT TEMP.	DERATING	CHARACTER-ISTICS	FINISH OR COVER	ILLUS-TRATION	Line No.
300	Note 17			Note 11	III-19	1
						2
						3
600	Note 17			Note 11	III-19	4
						5
						6
3.5	Notes 17 & 18		Notes 14 & 30	Note 11	III-19	7
						8
						9
2.0	30° C	Note 12	Note 33	Note 11	III-20	10
						11
						12
0.01	40° C	Note 8	Note 29	none	III-20	13
						14
						15
						16
0.01	40° C	Note 8	Note 29	none	III-20	17
						18
						19
						20
0.5	40° C	Notes 6 & 8	Notes 15 & 28	Note 4	III-17	21
						22
0.5	40° C	Notes 6 & 8	Notes 15 & 28	Note 4	III-17	23
						24
0.25	40° C	Notes 5 & 8	Notes 16 & 31	Note 11	III-21	25
						26
						27
						28
0.5	40° C	Notes 6 & 8	Notes 15 & 28	Lacquer	III-17	29
						30
0.5					III-17	31
						32
						33
0.125 Note 37	70° C	Note 34	Notes 35 & 36	Note 4	III-17	34
						35
						36
0.25 Note 37	70° C	Note 38	Notes 36 & 39	Note 39	III-17	37
						38
						39
0.5	30° C	Notes 1 & 5	Note 41	Note 4	III-15	40
						41
						42
						43
						44
						45
						46
						47
						48
						49
						50

NOTES:

1. For each degree that the ambient exceeds 30° C the power rating decreases about 1%.

2. While under rated power load, the resistor decreases about 2-1/2 per cent in resistance value.

3. Baked enamel.

4. Insulating sleeve.

5. While under rated power load, the resistor decreases about 2% in resistance value.

6. While under rated power load, the resistor decreases about 3% in resistance value.

7. Ceramic shell - hermetically sealed.

8. For each degree that the ambient exceeds 40° C the power rating decreases 1-1/4%.

9. While under rated power load, the resistor decreases about 1-1/4 per cent in resistance value.

10. Varnish finish - requires special packing for shipment.

11. Enclosed in a glass envelope containing an inert gas at approximately 1/3 atmospheric pressure.

12. For each degree that the ambient exceeds 30° C the power rating decreases about 0.5%.

13. When less than 5 resistors are ordered, the tolerance is ±1%. When ordered in quantity, the resistors are furnished in groups of 5, the ±1% tolerance range is divided into 3 cells as follows:

	Upper Limit	Lower Limit	Resistors* Per Cell
Upper Cell	1.0%	0.30%	1
Center Cell	0.35%	- 0.35%	3
Lower Cell	- 0.30%	- 1.00%	1

*At manufacturers discretion, all 5 may be in the center cell.

NOTE: Resistors in the range of +0.35% to +0.30% are considered to be either in the upper or center cell. Resistors in the range of -0.30% to - 0.35% are considered to be either in the lower or center cell.

14. Max. voltage 700 volts DC or RMS 60 cycle.

15. Max. voltage 350 volts DC or RMS 60 cycle.

NOTES:

16. Max. voltage 300 volts DC or RMS 60 cycles.

17. Free air convection at 40° C.

18. For each degree that the ambient exceeds 40° C the power rating decreases about 0.6%.

19. The 149A and 149B resistors differ in that the resistance values and tolerance requirements apply when the 149A is measured in a No. 9A Attenuator, or equivalent, and the 149B is measured in a KS-9534L2 Attenuator, or equivalent.

20. Resistance values available and corresponding tolerances are shown in the following table:

Resistance-Ohms Range	Steps	Tolerance
0.300 to 19.999	0.001	+(0.75% +0.002 ohm) -(1.00% +0.002 ohm)
20.000 to 99.990	0.01	+0.75% -1.00%
100.000 to 300.000	0.1	+0.75% -1.00%
300.100 to 1000.000	0.1	+0.0025 R% * -0.0033 R% *

* R is the nominal resistance value of the resistor in ohms.

21. The 150A resistor is intended to be assembled with a 149A resistor at its center point.

22. Resistance values available and corresponding tolerances are shown in the following table:

Resistance-Ohms Range	Steps	Tolerance
Zero (metal core)	---	+0.002 ohm max.
1.000 to 19.999	0.001	+(0.5% +0.002 ohm)
20.000 to 100.000	0.01	+(0.5% +0.002 ohm)

23. Zero nominal resistance value is provided by use of a metal rod in place of the resistor unit. The resistance in this case is specified as 0.002 ohm max.

24. The nominal resistance values are provided to any desired tolerance but not smaller than ±0.5%.

25. Infinite resistance value is provided by omitting the carbon coating and the electrodes from the ceramic disc. The resistance in this case is specified as "Infinite".

26. The nominal resistance values are provided to any desired tolerance but not smaller than +(0.5% +0.001R)%. R is the nominal resistance value of the resistor in ohms.

27. -520 (Max. Temperature Coefficient of Resistance PPM/°C).

28. -500 (Max. Temperature Coefficient of Resistance PPM/°C).

29. -450 (Max. Temperature Coefficient of Resistance PPM/°C).

30. -390 (Max. Temperature Coefficient of Resistance PPM/°C).

31. -300 (Max. Temperature Coefficient of Resistance PPM/°C).

32. Maximum temperature coefficient of resistance versus resistance range is as follows:

Resistance Range	Temperature Coefficient PPM/°C
50.0 ohms to 1.0 meg.	-450
1.01 meg. to 10.0 meg.	-495
10.10 meg. to 30.0 meg.	-540
30.10 meg. to 50.0 meg.	-800

33. Temperature coefficient of resistance is maximum -370 PPM/°C, minimum -270 PPM/°C.

34. For each degree that the ambient temperature exceeds 70°C, the power decreases approximately 1-1/4%.

35. Intended for general use where they will not be subjected to relative humidity in excess of 60% for prolonged periods.

36. Has a negative temperature coefficient of resistance of 0.03% per °C.

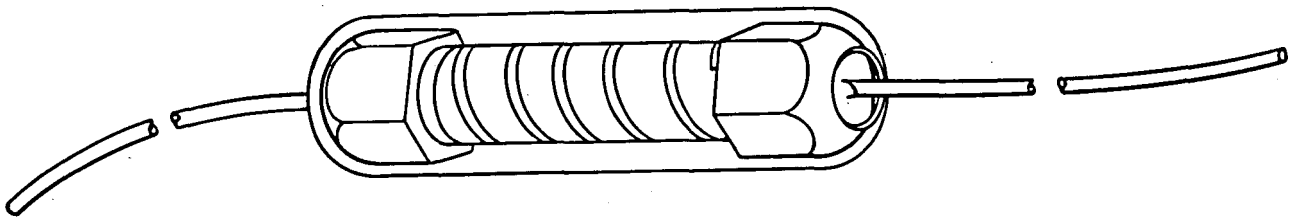
37. When operated within this wattage and temperature rating, these resistors are not expected to change downward by more than 2% nor upward by more than 4% in resistance value.

38. When operated in ambient temperatures above 70°C, the power rating is derated linearly to 0.125 watt at 125°C and to zero power at 150°C.

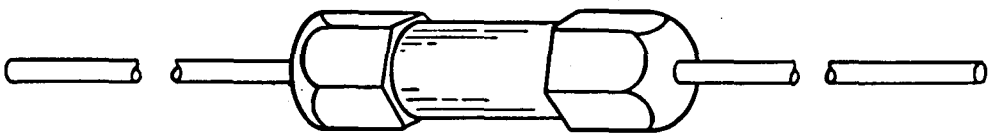
39. Intended for general use where humid conditions may be encountered. Encased in a moisture resistant epoxy shell.

40. When operated in ambient temperatures above 70°C, the power rating is reduced linearly to zero at 150°C.

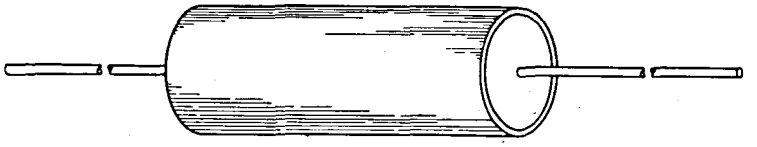
41. This resistor consists of a pair of 145C resistors, each having the same nominal resistance value and matched to that resistance value to within 1 per cent at 75°±5° F.



CODE NO.	DIMENSIONS - INCHES			
	BODY		LEADS	
	LENGTH	DIAMETER	LENGTH	DIAMETER
144E, F, G	1-1/32	23/64	2	.032
145	7/8	13/64	1-1/2	.032
147D, E, F	2-1/8	23/64	2	.032
221	5/8	7/32	1-1/2	.032
237A	.390	1/8	1-1/2	.025
238A	.406	.145	1-1/2	.025

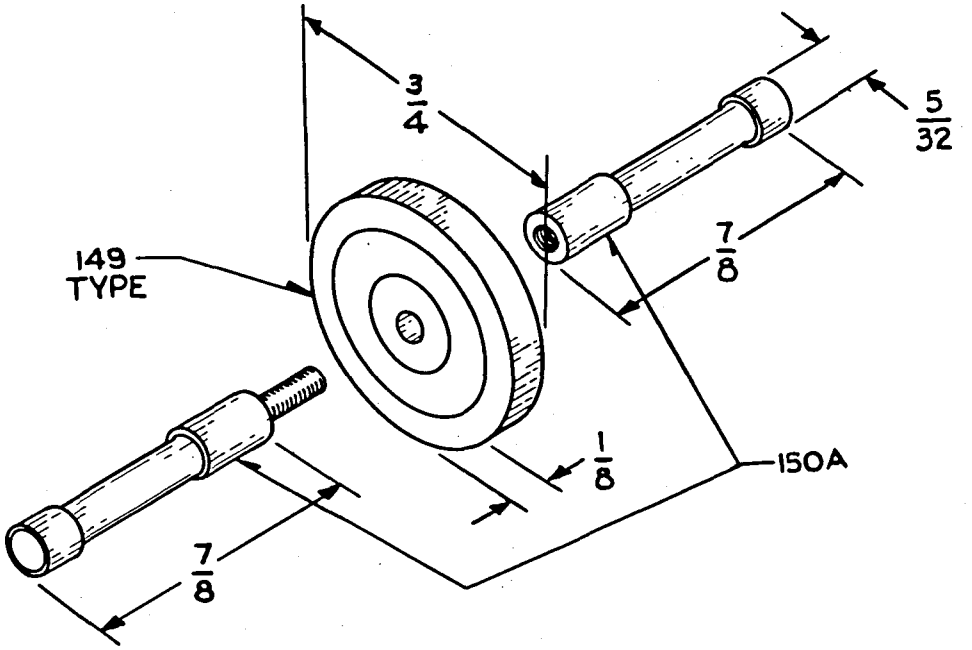


CODE NO.	DIMENSIONS - INCHES			
	BODY		LEADS	
	LENGTH	DIAMETER	LENGTH	DIAMETER
144A, B, C	1	9/32	2	.032
147A, B, C	2-1/16	9/32	2	.032
223	37/64	11/64	1-1/2	.032
239A	.342	.094	1-1/2	.025

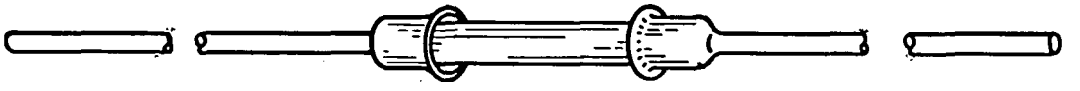


Body Length 1 inch; Body Diameter 9/32 inch; Lead Length 1-25/64 inch; Lead Diameter 0.020 inch

146-Type Resistors

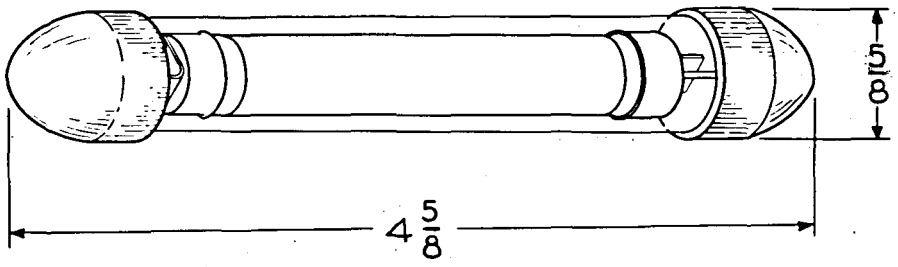


149- & 150-Type Resistors

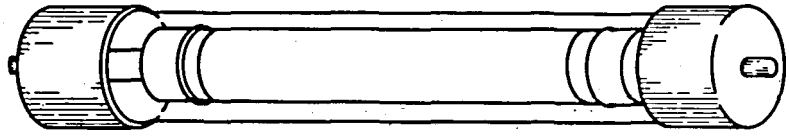


Body Length 17/32 inch; Body Diameter 5/64 inch; Lead Length 1-7/16 inch; Lead Diameter 0.0159 inch

151-Type Resistors

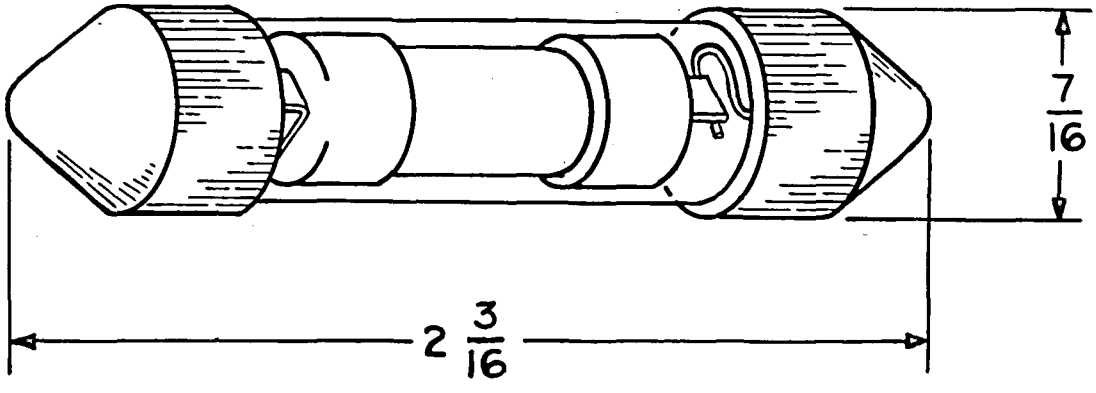


152-Type Resistors

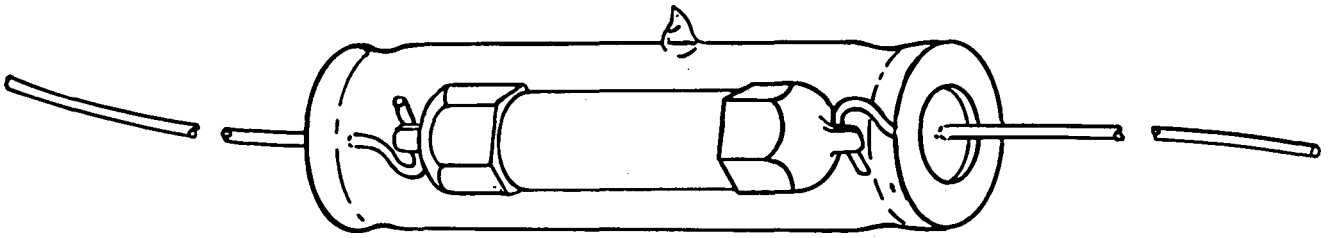


153- & 154-Type Resistors

CODE NO.	BODY LENGTH	BODY DIAMETER
153A	8-7/8	1-1/4
154A	14-7/8	1-1/4

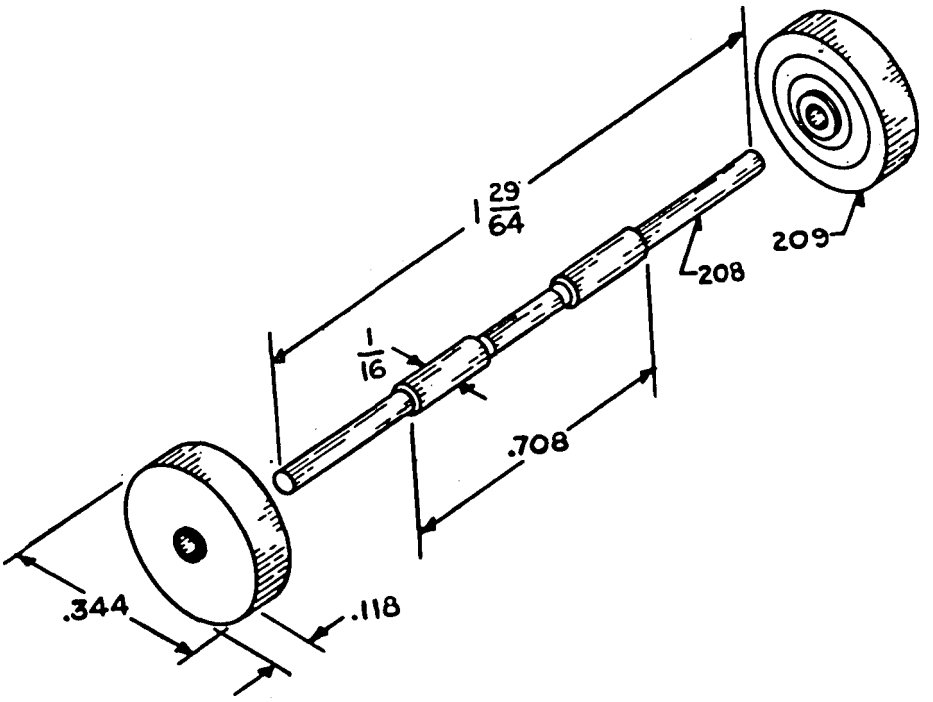


206-Type Resistors
Suitable Mounting: Littlefuse 125004
Fuse Clip

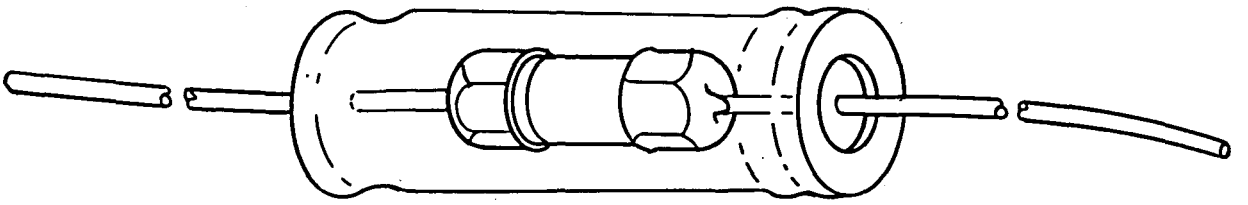


Body Length 1-7/8 inch; Body Diameter 25/64 inch; Lead Length 1-1/2 inch; Lead Diameter 0.032 inch

207-Type Resistors



208- & 209-Type Resistors



Body Length 7/8 inch; Body Diameter 9/32 inch; Lead Length 1-1/2 inch; Lead Diameter 0.020 inch

222-Type Resistors

DEPOSITED CARBON RESISTORS - 218-TYPE RESISTOR

DESCRIPTION

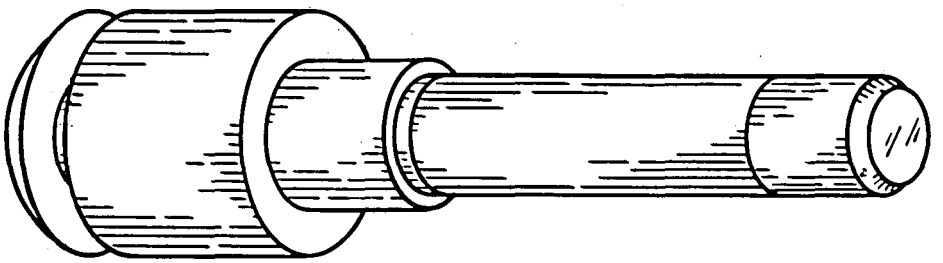
The 218-type resistor consists of a ceramic core having a coating of deposited carbon, and an electrode at each end. One end of the resistor unit is assembled in a ferrule arranged for mounting in the wall of a wave guide.

The resistor is capable of dissipating 0.5 watt. Where the resistor tolerance is less than 3%, allowance should be made for change in resistance due to application of load to the resistor, due to the temperature coefficient of maximum -450 PPM/°C, average -300 PPM/°C.

Overall dimensions are 1-1/8" long by 1/4" diameter. The diameter of the portion of the ferrule which enters the mounting hole is 0.145" +.000 -.002".

They are used in the TH Radio System, and in these applications the power dissipation is approximately 0.1 watt.

CODE NO.	RESISTANCE OHMS	TOLERANCE %
218A	100	1
218B	157	2
218C	100	3



DESCRIPTION

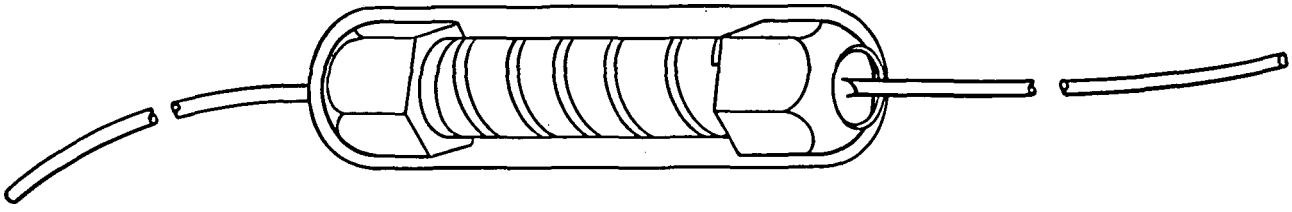
The 226A resistor consists of a pair of 221A resistors, 75 ohms each matched so that the final resistance values do not differ from each other by more than 0.5% (or 0.37 ohm) when measured at 25° C. The maximum differences in temperature coefficients of resistance is 100 PPM/°C, and the maximum temperature coefficient of resistance is -500 PPM/°C.

Each component resistor has body dimensions (including insulating tube) of 5/8 inch long by 7/32 inch diameter and has two axial leads each 1-1/2 inch long and 0.026 inch in diameter.

Each 226A resistor is packaged as a single pair of resistors when furnished to the customer. Each component of the pair is stamped with the code marking "226A", instead of 221A, and the resistance marking is 75.

The maximum power rating is 0.10 watt, or 0.05 watt for each component of the pair.

It is used in the 489A network in the TA Radio System.



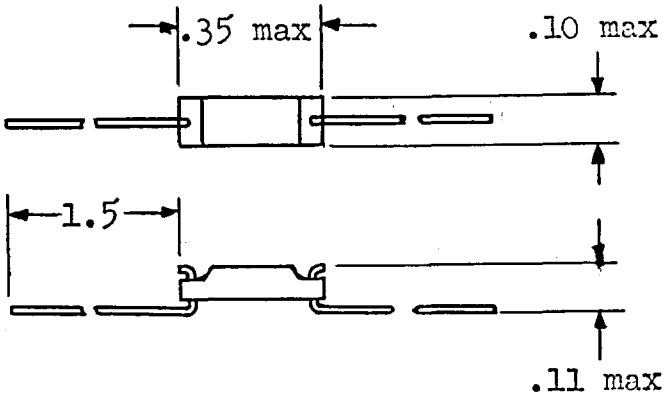
DESCRIPTION

These resistors consist of a tantalum film on a ceramic substrate with co-planar leads of 0.025 inch diameter tinned copper wire.

They are capable of dissapating 0.125 watt at 70° C and are derated to zero power at 125° C. The temperature coefficient of resistance is -100±50 PPM/°C.

The resistors are available in a resistance range of 100 ohms to 0.1 meg.

Code	Tolerance	Available in standard resistance values listed in these columns of STANDARD RESISTANCE VALUES, Table 1
254A	±1%	±2%
254C	±5%	±10%
254J	±3%	±5%

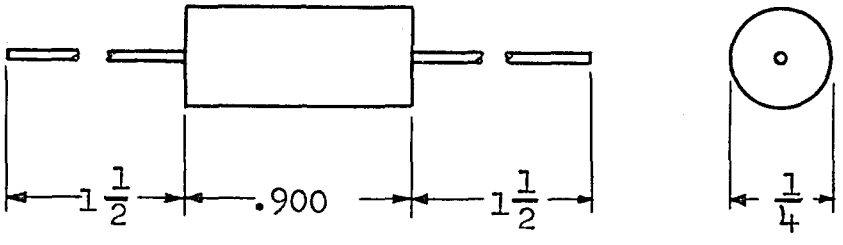


DESCRIPTION

These resistors are precision wire wound resistors having extremely low parasitics of inductance.

They consist of a bifilar loop of resistance wire of appropriate length, wound on a glass bonded mica winding form with axial leads at each end.

Code No.	DC Resistance - Ohms			Inductance - UH	
	Max	Nom	Min	Max	Min
246B	1.917	1.870	1.823	0.055	0.045
246C	2.501	2.440	2.379	0.060	0.050
246A	3.207	3.191	3.175	0.065	0.055
246D	4.649	4.580	4.511	0.060	0.050



GENERAL

The KS- specification resistors listed are those having the most general use. Other KS- specification resistors are not included because of their very special use or because they are approaching obsolescence.

For some resistors, the maximum voltage which may be applied across the terminals of the resistor is specified. A term associated with this requirement is "Critical Resistance Value". This is defined as the value of resistance for which the voltage required to produce rated power dissipation in the resistor is equal to the maximum voltage rating. Below the critical resistance value the wattage rating limits the applied voltage and above the critical resistance value the maximum voltage rating limits the power dissipation. Where the critical resistance value is beyond the range of available resistance values, the maximum voltage the resistor could withstand is not specified.

Temperature coefficient of resistance information is furnished in notes to which reference is made in the tables under the heading of "Characteristics". In adjustable resistors, good contact must be made between the adjusting device and the winding for the temperature coefficient of the resistor to be dependable. The notes indicate whether the requirement is contained in the specification for the resistor or the specification used for the material used in its construction by calling the requirement "resistor requirement" or "material requirement", respectively.

KS- SPECIFICATION RESISTORS - WIRE WOUND

Line No.	KS- NUMBER	RESISTANCE RANGE OHMS	TOLERANCE	RATING WATTS	AMBIENT TEMP.	DERATED TO ZERO WATTS AT TEMP.
1	~~* 8441~~	~~1 - 620~~	~~±5%,10%~~	~~1/2~~	~~104° F~~	~~230° F~~ *
2	~~* 8451~~	~~1 - 3000~~	~~±5%,10%~~	~~1~~	~~104° F~~	~~230° F~~ *
3	~~* 8452~~	~~1 - 4700~~	~~±5%,10%~~	~~2~~	~~104° F~~	~~230° F~~ *
4						
5	8512	1 - 150000	A ±5%	4-215	120° F	670° F
6		Note 3	B ±2%	Notes 1		
7			C ±1%	2 & 3		
8			D ±10%			
9			E ±3%			
10			F ±.5%			
11			G ±.25%			
12						
13	9913	1.4 - 2160	±10%	28	120° F	670° F
14				Notes 1		
15				& 4		
16						
17	9914	4.5 - 7140	±10%	75	120° F	670° F
18				Notes 1		
19				& 4		
20						
21	13192L1	1 - 150000	A ±1%	0.5	150° F	220° F
22	13192L2	1 - 150000	B ±.25%	0.5		
23	13192L3	1 - 400000	D ±.5%	0.75		
24	13192L4	1 - 400000		0.75		
25	13192L5	1 - 1,000,000		1.0		
26	13192L6	1 - 1,000,000		1.0		
27						
28	13609L1	2.0 - 71000	Below 1	140	120° F	670° F
29	13609L2	0.1 - 63000	ohm ±10%	116		
30	13609L3	0.1 - 50000	&	86		
31	13609L4	0.1 - 25000	1 ohm &	50		
32	13609L5	0.1 - 16000	above ±5%	40		
33	13609L6	0.1 - 6300		20		
34	13609L7	0.1 - 4000		14		
35				Note 1		
36						
37	13653	1 - 1100	±10%	15	120° F	670° F
38				Notes 1		
39				& 4		
40						
41	13657L1	1 - 1200	A ±5%	10	120° F	670° F
42	13657L2	1 - 1600	B ±2%	11		
43	13657L3	2 - 4000	C ±1%	40		
44	13657L4	1 - 750	D ±10%	8		
45			E ±3%	Note 1		
46						
47	13809L1	3.5 - 6.0 meg.	±.5%	3.5-6.0	185° F	--
48	13809L2	1.0 - 3.5 meg.		1.0-3.5		
49	13809L3	0.5 - 1.0 meg.		0.5-1.0		
50		Note 5		Note 5		

* MANUFACTURE DISCONTINUED

BODY DIMENSIONS-INCHES DIAMETER	LENGTH	CHARACTERISTICS	BODY MATERIAL	ILLUSTRATION	Line No.
~~* 7/32~~	~~11/16~~	~~Not recommended for high stability applications Notes 12 & 15~~	~~Fiber core and molded in Plastic compound~~	~~IV-25~~	~~1 *~~
~~* 9/32~~	~~1-5/16~~			~~IV-25~~	~~2 *~~
~~* 11/32~~	~~1-13/16~~			~~IV-25~~	~~3 *~~
					4
15/32	1 min.	Note 9	Ceramic core and vitreous enamel insulation	IV-25	5
1-5/16	11-3/4 max.				6
					7
					8
					9
					10
					11
					12
29/32	2-5/16	Adjustable Note 9	Ceramic core and vitreous enamel insulation	IV-27	13
					14
					15
					16
1-5/16	4-1/4	Adjustable Note 9	Ceramic core and vitreous enamel insulation	IV-27	17
					18
					19
					20
19/32	19/32	Non-inductive winding, low time constant requirement Note 13	Ceramic core, Acetate film or cloth-backed Scotch Tape insulation and varnish or lacquer impregnation	IV-27	21
19/32	19/32			IV-27	22
19/32	1-1/32			IV-27	23
19/32	1-1/32			IV-27	24
25/32	1-9/32			IV-27	25
25/32	1-9/32			IV-27	26
					27
1-5/16	11-7/16	Notes 14 & 16	Ceramic core, Vitreous enamel insulation and ferrule terminals	IV-28	28
1-5/16	9-5/8			IV-28	29
1-5/16	7-7/16			IV-28	30
1-1/16	5-1/8			IV-28	31
1-1/16	4-7/16			IV-28	32
3/4	2-15/16			IV-28	33
3/4	2-3/8			IV-28	34
					35
					36
19/32	2	Adjustable Note 9	Ceramic core and vitreous enamel insulation	IV-27	37
					38
					39
					40
1/2	1-3/4	Non-inductive winding(Ayrton Perry) Note 10	Ceramic core and vitreous enamel insulation	IV-28	41
1/2	2			IV-28	42
7/8	3-1/2			IV-28	43
1/2	1-3/8			IV-28	44
					45
					46
1-13/32	9-25/32	High Voltage Notes 6 & 8	Glazed ceramic and ferrule terminals	IV-28	47
1-13/32	5-9/32			IV-28	48
1-5/64	2-15/16			IV-28	49
					50

* MANUFACTURE DISCONTINUED

KS-8512 RESISTORS

Line No.	LIST NO.	RATING WATTS	BODY DIMENSIONS-INCHES DIAMETER	LENGTH	RESISTANCE RANGE OHMS
1	1	4	15/32	1	1.7 - 1500
2	2	8	15/32	1-1/2	1.7 - 3500
3	3	10	15/32	1-3/4	1.7 - 4400
4	4	8	19/32	1	1.7 - 2100
5	5	10	19/32	1-1/2	1.7 - 4900
6	6	15	19/32	2	1.7 - 7600
7	50	20	19/32	3	2.5 - 13100
8	7	12	23/32	1-3/8	1.7 - 5300
9	8	20	23/32	2	1.7 - 9800
10	9	24	23/32	2-1/2	2.1 - 13400
11	10	30	23/32	3-1/8	2.6 - 17800
12	11	32	23/32	3-1/2	3.0 - 20500
13	51	35	23/32	4	3.5 - 24100
14	12	35	23/32	4-1/8	3.6 - 25000
15	13	40	23/32	4-1/2	3.9 - 27800
16	14	45	23/32	5	4.6 - 31200
17	15	50	23/32	5-1/2	5.1 - 34800
18	16	55	23/32	6	6.4 - 38400
19	17	23	25/32	2	1.7 - 10000
20	18	15	29/32	1-9/16	1.7 - 7100
21	19	25	29/32	2	1.8 - 11300
22	20	28	29/32	2-5/16	2.3 - 14300
23	21	35	29/32	3	3.3 - 20800
24	22	40	29/32	3-1/2	3.9 - 25600
25	23	45	29/32	4	4.8 - 30300
26	24	50	29/32	4-1/2	5.4 - 35100
27	25	55	29/32	4-3/4	5.7 - 36650
28	26	60	29/32	5	6.0 - 39300
29	27	65	29/32	5-5/8	7.0 - 45700
30	28	70	29/32	6	7.5 - 49000
31	29	80	29/32	6-1/2	8.2 - 54100
32	30	90	29/32	7-1/4	9.9 - 61200
33	31	40	1-1/8	3	4.1 - 24000
34	32	60	1-1/8	4	5.9 - 35000
35	33	75	1-1/8	5	7.5 - 47000
36	34	90	1-1/8	6	9.3 - 60000
37	35	112	1-1/8	7-1/2	11.9 - 77000
38	36	120	1-1/8	8	12.9 - 83000
39	37	150	1-1/8	10	16.3 - 107000
40	38	33	1-5/16	2	2.6 - 14000
41	39	75	1-5/16	4-1/4	7.3 - 42000
42	40	110	1-5/16	6-1/8	11.3 - 73000
43	41	115	1-5/16	6-1/2	12.2 - 79000
44	42	160	1-5/16	8-1/2	16.3 - 107000
45	43	200	1-5/16	10-1/2	20.7 - 136000

Line No.	LIST NO.	RATING WATTS	BODY DIMENSIONS-INCHES DIAMETER	LENGTH	RESISTANCE RANGE OHMS
1	44	215	1-5/16	11-3/4	23.4 - 153000
2	45	30	1-1/8	4	2.5 - 16200
3	46	60	1-1/8	5-1/4	4.9 - 32400
4	47	125	1-3/16	8	11.6 - 78000
5	48	160	1-1/4	10-5/32	17.3 - 111000
6	49	100	1-11/16	5-11/16	8.0 - 68600
7	50	(Shown in table between Lists 6 and 7)			
8	51	(Shown in table between Lists 11 and 12)			
9	52	40	1-3/16	3	4.1 - 24000
10	53	60	1-3/16	4	5.9 - 35000
11	54	75	1-3/16	5	7.5 - 47000
12	55	90	1-3/16	6	9:3 - 60000
13	56	112	1-3/16	7-1/2	11.9 - 77000
14	57	120	1-3/16	8	12.9 - 83000
15	58	150	1-3/16	10	16.3 - 107000
16	59	33	1-5/16	2	2.6 - 14000
17	60	75	1-5/16	4-1/4	7.3 - 42000
18	61	110	1-5/16	6-1/8	11.3 - 73000
19	62	115	1-5/16	6-1/2	12.2 - 79000
20	63	160	1-5/16	8-1/2	16.3 - 107000
21	64	200	1-5/16	10-1/2	20.7 - 136000
22	65	215	1-5/16	11-3/4	23.4 - 153000

LISTS 52 to 65 are replacements for Lists 31 to 44.
DO NOT USE in new applications.

KS- SPECIFICATION RESISTORS - WIRE WOUND

Line No.	KS- NUMBER	RESISTANCE RANGE OHMS	TOLERANCE	RATING WATTS	AMBIENT TEMP.	DERATED TO ZERO WATTS AT TEMP.
1	14175L1	0.21 - 6300	A ±5%	20	120° F	670° F
2	14175L2	0.23 - 14000	B ±2%	27		
3	14175L3	0.37 - 30000	C ±1%	39		
4	14175L4	0.52 - 43000	D ±10%	50		
5	14175L5	0.71 - 56000		70		
6	14175L6	0.10 - 5900		16		
7				Note 1		
8						
9	14272L1	1 - 1330	±10%	25	120° F	670° F
10	14272L2	1 - 615		10		
11				Notes 1		
12				& 4		
13						
14	14603L1	1 - 2430	A ±5%	5	120° F	670° F
15	14603L2	1 - 7960	B ±2%	10		
16	14603L3	1 - 909	C ±1%	3		
17	14603L4	1 - 2430	D ±10%	5		
18	14603L5	1 - 7960	E ±3%	10		
19	14603L6	1 - 909	F ±.5%	3		
20			G ±.25	Note 1		
21						
22	16703L1	250	±5%	125	120° F	670° F
23	16703L2	169	±5%	Note 1		
24	16703L3	25	±5%			
25	16703L4	50	±5%			
26						
27	16122	3500	±5%	125	120° F	670° F
28				Note 1		
29						
30						
31	16125	6.81	±10%	550	120° F	670° F
32				Note 1		
33						
34	16266L1	2460 - 3970	A ±5%	5	120° F	670° F
35	16266L2	8060 - 13000	B ±2%	10		
36	16266L3	909 - 1540	C ±1%	3		
37			D ±10%	Note 1		
38			E ±3%			
39			F ±.5%			
40			G ±.25%			
41						
42	16340L1	1.96 - 750	±10%	16	120° F	670° F
43	16340L2	4.64 - 1780		27		
44	16340L3	9.09 - 3480		39		
45	16340L4	13.30 - 5110		50		
46	16340L5	17.80 - 6810		70		
47				Notes 1		
48				& 4		
49	16543	1.0 - 2430	±1% or	5	120° F	270° F
50			.05 ohm whichever is greater			

BODY DIMENSIONS-INCHES DIAMETER	LENGTH	CHARACTER-ISTICS	BODY MATERIAL	ILLUS-TRATION	Line No.
1-1/8	1-1/4	Note 9	Ceramic core and	IV-29	1
1-1/8	2		Vitreous enamel	IV-29	2
1-1/8	3-1/2		insulation	IV-29	3
1-1/8	4-3/4			IV-29	4
1-1/8	6			IV-29	5
1/2	2			IV-29	6
					7
					8
25/32	2	Adjustable	Ceramic core and	IV-27	9
		Note 9	Vitreous enamel	IV-27	10
			insulation		11
					12
					13
13/32	1	Note 9	Ceramic core and	IV-29	14
15/32	1-3/4		Vitreous enamel	IV-29	15
1/4	1/2		insulation	IV-29	16
13/32	1		Ceramic core and	IV-32	17
15/32	1-3/4		molded Vitreous	IV-32	18
1/4	1/2		enamel insulation	IV-32	19
					20
					21
19/32 x 3	5-3/4	Note 10	Ceramic core and	IV-30	22
19/32 x 3	5-3/4		Vitreous enamel	IV-30	23
Note 7			insulation		24
					25
					26
19/32 x 3	5-3/4	Note 10	Ceramic core and	IV-30	27
Note 7			Vitreous enamel		28
			insulation		29
					30
1-7/8	11-3/4	Note 11	Ceramic core and	IV-30	31
			Vitreous enamel		32
			insulation		33
13/32	1-1/16	Note 10	Ceramic core and	IV-29	34
15/32	1-13/16		Vitreous enamel	IV-29	35
1/4	9/16		insulation	IV-29	36
					37
					38
					39
					40
					41
1/2	2	Adjustable	Ceramic core and	IV-31	42
1-1/8	2	Note 9	Vitreous enamel	IV-31	43
1-1/8	3-1/2		insulation	IV-31	44
1-1/8	4-3/4			IV-31	45
1-1/8	6			IV-31	46
					47
					48
9/16	1-3/16	Electro-statically shielded Note 9	Ceramic core and Vitreous enamel insulation	IV-31	49 50

KS- SPECIFICATION RESISTORS - WIRE WOUND

Line No.	KS- NUMBER	RESISTANCE RANGE OHMS	TOLERANCE	RATING WATTS	AMBIENT TEMP.	DERATED TO ZERO WATTS AT TEMP.
1	16764L1A	2 to 165000	±(1.0%+.02)	0.60	150°F	
2	16764L1D	4 to 165000	±(0.5%+.02)	0.60		
3	16764L1F	20 to 165000	±(0.1%+.02)	0.60		
4	16764L2A	2 to 132000	±(1.0%+.02)	0.75		
5	16764L3A	2 to 330000	±(1.0%+.02)	1.00		
6	16764L3D	4 to 330000	±(0.5%+.02)	1.00		
7	16764L4A	2 to 1.10 meg	±(1.0%+.02)	2.00		
8	16764L4D	4 to 1.10 meg	±(0.5%+.02)	2.00		
9	16764L5A	2 to 1.10 meg	±(1.0%+.02)	2.00		
10	16764L6A	2 to 3520	±(1.0%+.02)	0.05		
11						
12	16814L1	890	±3.4%			
13	16814L2	73.2	±1.5%			
14						
15	16822L1A	2 to 165000	±(1.0%+.02)	0.60	150°F	
16						
17						
18						
19	16907L1	1.15	±20%	139	120°F	
20	16907L2	3.0	±20%	91		
21						
22	19238L1	3.0	±10%	18	38°C	300°C
23	19238L2	5.0	±2%			
24	19238L3	10.0	±10%			
25	19238L4	25.0	±10%			
26	19238L5	4.7	±2%			
27	19238L6	250.0	±2%			
28	19238L7	1.0	±5%			
29	19238L8	15.0	±10%			
30						
31						
32	19548L1	.24 to 750	C ±5%	0.5	70°C	150°C
33			G ±10%			
34			H +0-10%			
35						
36						
37	19769L1	1 to 2430	A ±5%	12.5	25°C	275°C
38	19769L2	1 to 1540	B ±2%	8.0		
39	19769L3	1 to 920	C ±1%	5.0		
40			D ±10%			
41			E ±3%			
42						
43						
44	19863L1	10	±3%	7.0	25°C	350°C
45	19863L2	9.15	±3%	7.0		
46						
47						
48	19949L1	7.68	±2%	5.0	25°C	350°C
49						
50						

BODY DIMENSIONS-INCHES DIAMETER	LENGTH	CHARACTERISTICS	BODY MATERIAL	ILLUSTRATION	Line No.
3/8	3/4	Notes 17 & 18	Ceramic or plastic core encapsulated in epoxy resin	IV-32	1
3/8	3/4				2
3/8	3/4				3
1/4	1				4
3/8	1				5
3/8	1				6
1/2	2				7
1/2	2				8
1/2	2				9
1/8	5/16				10
					11
.675	1.585		Porcelain and Vitreous enamel	IV-25	12
					13
					14
3/8	3/4	Notes 17 & 20	Ceramic or plastic core encapsulated in epoxy resin	IV-25	15
					16
					17
					18
1-5/8	6-1/2	Note 21	Vitreous enamel	IV-30	19
					20
					21
1-3/8	3/8 thick	Note 22	Ceramic covered with Vitreous enamel	IV-32	22
					23
					24
					25
					26
					27
					28
					29
					30
					31
.148	.400		Molded	IV-25	32
					33
					34
					35
					36
3/8	1-3/4	Note 20	Ceramic and Vitreous enamel	IV-32	37
3/8	1-5/16				38
3/8	1				39
					40
					41
					42
					43
5/16	1	Note 23	Ceramic and Vitreous enamel	IV-29	44
5/16	1				45
					46
					47
13/32	1	Note 24	Ceramic and Vitreous enamel	IV-29	48
					49
					50

NOTES:

1. For applications in which the high surface temperature of these resistors may introduce a personnel hazard in the telephone plant when used at rated wattages, it is recommended that resistors be used such that the power load does not exceed 50% of the rating shown in the table.

2. For multi-winding or tapped winding resistors, the total allowable wattage dissipation shall be reduced by the amount equivalent to the reduction in winding space effected by the additional terminals.

3. See the special table for KS-8512 resistors on page IV-4 showing list numbers and their individual resistance ranges, ratings in watts, and dimensions.

4. The wattage rating in the table applies for the entire winding. The watts dissipated in any section resulting from the location of adjusting bands shall not exceed the proportion determined from the following formula:

$$\text{Watts (section)} = \frac{\text{Resistance of section}}{\text{Res. of entire winding}} \times \text{Resistor Rating in Watts}$$

5. Only the following nominal values of resistance are available under specification KS-13809:

List No.	Resistance - Megohms
1	3.5, 4.0, 5.0, 6.0
2	1.0, 1.5, 2.0, 2.5, 3.0, 3.5
3	0.5, 0.8, 1.0

The resistance value in megohms, the power rating in watts, and the maximum rating in kilovolts are numerically equal, that is, a resistor per KS-13809L1 having a nominal resistance value of 3.5 megohms has a power rating of 3.5 watts and a maximum voltage rating of 3.5 KV.

6. The maximum voltages to be applied across the resistors are numerically equal in KV to the resistance in megohms, that is, the maximum voltage of the 3.5 megohm resistor is 3.5 KV.

7. This resistor is rectangular is shape.

	Temp. Coefficient of Res.	Material or Resistor Requirement
8.	Max. +200 ppm/°C	Resistor Requirement
9.	+ 300 ppm/°C - 50 ppm/°C	Material Requirement
10.	Max. +150 ppm/°C	Material Requirement
11.	Max. +300 ppm/°C	Material Requirement
12.	(1 to 10 ohms) ±650 ppm/°C (More than 10 ohms) ±300 ppm/°C	Resistor Requirement
13.	Max. +130 ppm/°F or ± 20 ppm/°F as specified in order	Resistor Requirement

NOTES: (Contd.)

	Temp. Coefficient of Res.	Material or Resistor Requirement
14.	+260 ppm/°C to +400 ppm/°C at high and low resistance ranges respectively.	Resistor Requirement

15. Resistor is marked with EIA color code as illustrated on page IV-22 to indicate nominal resistance in ohms and tolerance. See Table 2, page IV-22 for nominal resistance values and tolerances in which the resistance values are available (EIA Preferred Number System), and Table 3, page IV-22 for color code.

16. See Table 5, page IV-24 for nominal resistance values available.

17. NOT RECOMMENDED for general use. Components Laboratory, Resistor Development Group should be consulted for new applications.

18. Temperature coefficient of resistance is as follows:

L1, L2, L3, L4	±30 ppm/°C
L5	±15 ppm/°C
L6	±20 ppm/°C

19. Temperature coefficient of resistance is ±30 ppm/°C.

20. Low inductance.

21. L1 has taps provided at 0.05, 0.15, 0.35, and 0.75 ohms. It is designed for a maximum current of 11 amperes. L2 has taps provided at 0.2, 0.6, and 1.4 ohms. It is designed for maximum current of 5.5 amperes. Wattage rating is based on maximum resistance.

22. Temperature coefficient of resistance for L2 and L5 is ±50 ppm/°C. All other lists are ±150 ppm/°C.

23. Inductance for L1 is 1.80 max., 1.40 min.; for L2 is 1.85 max., 1.45 min.

24. Has maximu series inductance of 0.7 uh.

KS- SPECIFICATION RESISTORS - FIXED COMPOSITION

Line No.	KS- NUMBER	RESISTANCE RANGE OHMS	TOLERANCE	RATING WATTS	AMBIENT TEMP.	DERATED TO ZERO WATTS AT TEMP.
1	13490L1	10 ohms to 22 meg	±5%	1/2	104°F	212°F
2	13490L2	10 ohms to 22 meg	±10%	Note 1		
3	13490L3	10 ohms to 22 meg	±20%			
4						
5						
6	13491L1	2.7 ohms to 22 meg	±5%	1	104°F	212°F
7	13491L2	2.7 ohms to 22 meg	±10%	Note 2		
8	13491L3	2.7 ohms to 22 meg	±20%			
9						
10						
11	13492L1	10 ohms to 22 meg	±5%	2	104°F	212°F
12	13492L2	10 ohms to 22 meg	±10%	Note 3		
13	13492L3	10 ohms to 22 meg	±20%			
14						
15						
16	16645L1	2.7 ohms to 22 meg	±5%	1/4	104°F	212°F
17	16645L2	2.7 ohms to 22 meg	±10%	Note 4		
18	16645L3	2.7 ohms to 22 meg	±20%			
19						
20						
21	19077L1	10 to 10000	±10%	1/4	100°C	
22	19077L2	10 to 10000	±5%			
23						
24						
25	19150L1	2.7 ohms to 22 meg	±5%	0.5	70°C	
26	19150L2	2.7 ohms to 22 meg	±10%			
27	19150L3	2.7 ohms to 22 meg	±20%			
28						
29						
30	19151L1	2.7 ohms to 22 meg	±5%	1	70°C	
31	19151L2	2.7 ohms to 22 meg	±10%			
32	19151L3	2.7 ohms to 22 meg	±20%			
33						
34						
35	19152L1	10 ohms to 22 meg	±5%	2	70°C	
36	19152L2	10 ohms to 22 meg	±10%			
37	19152L3	10 ohms to 22 meg	±20%			

BODY DIMENSIONS- INCHES DIAMETER	LENGTH	CHARACTERISTICS & SHELF AGING	BODY MATERIAL	ILLUS-TRATION	Line No.
.148	.406	-8% to +11% -13% to +16% -23% to +26% Notes 5,6,& 7	Fixed carbon composition resistive element encased in plastic compound. Axial leads.	IV-25	1 2 3 4 5
.233	.593	-8% to +11% -13% to +16% -23% to +26% Notes 5,6,& 7	Fixed carbon composition resistive element encased in plastic compound. Axial leads.	IV-25	6 7 8 9 10
.336	.728	-8% to +11% -13% to +16% -23% to +26% Notes 5,6,& 7	Fixed carbon composition resistive element encased in plastic compound. Axial leads	IV-25	11 12 13 14 15
.090	.250	-8% to +11% -13% to +16% -23% to +26% Notes 5,6,7, & 8	Fixed carbon composition resistive element encased in plastic compound. Axial leads	IV-25	16 17 18 19 20
.200	.585	See Note 9	Fixed composition. Plastic encased.	IV-32	21 22 23 24
.148	.406	See Note 8	Fixed carbon composition resistive element encased in plastic compound. Axial leads.	IV-25	25 26 27 28 29
.233	.593	See Note 8	Fixed carbon composition resistive element encased in plastic compound. Axial leads.	IV-25	30 31 32 33 34
.320	.719	See Note 8	Fixed carbon composition resistive element encased in plastic compound. Axial leads.	IV-25	35 36 37

NOTES:

	RMS or DC Max. Voltage Rating	Critical Resistance Value
1.	350 Volts	245000 ohms
2.	500 Volts	250000 ohms
3.	500 Volts	125000 ohms
4.	250 Volts	250000 ohms

5. Resistance - Temperature characteristics:
When ambient is changed from 25°C to the following temperatures, the changes in resistance fall within the following ranges. This is a resistor requirement.

	10000 ohms or lower	Above 10000 ohms
-55°C +105°C	-0%, +10% ±8%	-0%, +20% ±10%

6. Typical limiting frequencies above which a decrease of more than 10% from DC resistance value can be expected.

Nominal Resistance Value	Approx. Max. Frequency for -10% Change
10000 ohms	10 MC
0.1 meg	1 MC
1 meg	100 KC
10 meg	10 KC

7. Resistor is marked with EIA color code as illustrated on page IV-23 to indicate nominal resistance in ohms, and tolerances. See Table 4, page IV-23 for nominal resistance values and tolerances in which the resistance values are available (EIA Preferred Numbers System), and Table 3, page IV-22 for the color code.
8. High reliability. It is intended that the failure rate will be less than 15 failure units per 1000 hours when operated at 50% of the rated power at 25°C.
9. Temperature coefficient of resistance is +7000 ppm/°C.

KS- SPECIFICATION RESISTORS - DEPOSITED CARBON, METAL, OR METAL OXIDE

Line No.	KS- NUMBER	RESISTANCE RANGE OHMS	TOLERANCE	RATING WATTS	AMBIENT TEMP.	DERATED TO ZERO WATTS AT TEMP.
1	16311L1	10 to 511000	Note 9	1/8	158°F	300°F
2	16311L2	50 to 511000	±5%			
3	16311L3	30 to 261000	Note 9			
4	16311L4	20 to 200000	Note 9			
5	16311L5	20 to 200000	Note 9			
6	16311L6	20 to 200000	Note 9			
7						
8						
9	16312L1	15 to 866000	Note 9	1/4	158°F	300°F
10	16312L2	20 to 511000	±5%			
11	16312L3	10 to 402000	Note 9			
12	16312L4	24.9 to 402000	Note 9			
13	16312L5	49.9 to 402000	Note 9			
14	16312L6	10 to 402000	Note 9			
15						
16						
17	16313L1	10 to 1.91 meg	Note 9	1/2	158°F	300°F
18	16313L2	10 to 1.10 meg	±5%			
19	16313L3	10 to 866000	Note 9			
20	16313L4	20 to 866000	Note 9			
21	16313L5	49.9 to 866000	Note 9			
22	16313L6	10 to 866000	Note 9			
23						
24						
25	16314L1	10 to 1.91 meg	Note 9	1.0	158°F	300°F
26	16314L2	10 to 5.11 meg	±5%			
27	16314L3	24.9 to 1.91 meg	Note 9			
28	16314L4	24.9 to 1.91 meg	Note 9			
29	16314L5	24.9 to 1.91 meg	Note 9			
30	16314L6	24.9 to 1.91 meg	Note 9			
31						
32						
33	16315L1	20 to 10 meg	Note 9	2.0	158°F	300°F
34	16315L2	30 to 10 meg	±5%			
35	16315L3	50 to 2 meg	Note 9			
36	16315L4	50 to 2 meg	Note 9			
37	16315L5	50 to 2 meg	Note 9			
38	16315L6	50 to 2 meg	Note 9			

KS- SPECIFICATION RESISTORS - DEPOSITED CARBON, METAL, OR METAL OXIDE

BODY DIMENSIONS-INCHES DIAMETER	LENGTH	CHARACTERISTICS	BODY MATERIAL	ILLUSTRATION	Line No.
.165	.437	Notes 2 & 8	Ceramic core with	IV-32	1
.125	.375	Notes 2 & 8	moisture resistant		2
.100	.282	Notes 1 & 8	enclosure. Axial leads.		3
.100	.282	Notes 1 & 8	Note 7.		4
.100	.282	Notes 1 & 8			5
.100	.282	Notes 1 & 8			6
					7
					8
.250	.657	Notes 3 & 8	Ceramic core with	IV-32	9
.188	.625	Notes 3 & 8	moisture resistant		10
.155	.421	Notes 2 & 8	enclosure. Axial leads.		11
.155	.421	Notes 2 & 8	Note 7		12
.155	.421	Notes 2 & 8			13
.155	.421	Notes 2 & 8			14
					15
					16
.282	.843	Notes 4 & 8	Ceramic core with	IV-32	17
.250	.750	Notes 4 & 8	moisture resistant		18
.248	.610	Notes 3 & 8	enclosure. Axial leads.		19
.248	.610	Notes 3 & 8	Note 7		20
.248	.610	Notes 3 & 8			21
.248	.610	Notes 3 & 8			22
					23
					24
.437	1.125	Notes 5 & 8	Ceramic core with	IV-32	25
.375	1.062	Notes 5 & 8	moisture resistant		26
.281	.760	Notes 4 & 8	enclosure. Axial leads.		27
.281	.760	Notes 4 & 8	Note 7		28
.281	.760	Notes 4 & 8			29
.281	.760	Notes 4 & 8			30
					31
					32
.437	2.281	Notes 6 & 8	Ceramic core with	IV-32	33
.375	2.188	Notes 6 & 8	moisture resistant		34
.437	2.281	Notes 6 & 8	enclosure. Axial leads.		35
.437	2.281	Notes 6 & 8	Note 7.		36
.437	2.281	Notes 6 & 8			37
.437	2.281	Notes 6 & 8			38

NOTES:

	Max. Voltage Rating	Critical Resistance Value
1.	200 volts	
2.	250 volts	500000 ohms
3.	300 volts	360000 ohms
4.	350 volts	250000 ohms
5.	500 volts	250000 ohms
6.	750 volts	281000 ohms

7. KS-16311 to KS-16314 resistors, inclusive, may be mounted by their lead wires. Mounting straps are recommended for use in mounting the KS-16315 resistors.

8. Temperature coefficient of resistance is as follows:

List 1 and 2	±500 ppm/°C
List 3	±250 ppm/°C
List 4	±50 ppm/°C
List 5	±25 ppm/°C
List 6	±100 ppm/°C

9. Add suffix as follows to the list number for tolerance:

A	±1%	Lists 1, 3, 4, 5, 6
B	±2%	Lists 3, 4, 5, 6
C	±5%	Lists 1, 3, 4, 5, 6
D	±1/2%	Lists 4, 5, 6
E	±1/4%	Lists 3, 4, 5, 6
F	±0.1%	Lists 4, 5, 6

KS- SPECIFICATION RESISTORS - DEPOSITED CARBON, METAL, OR METAL FILM

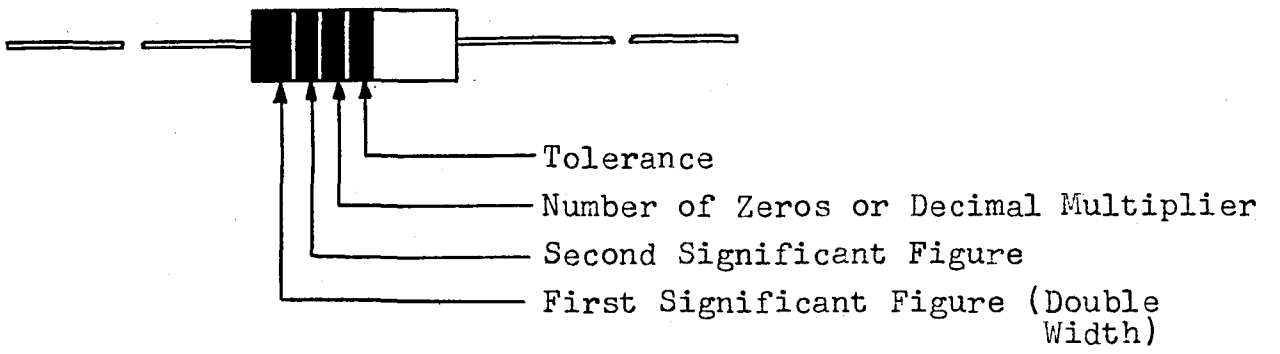
Line No.	KS- NUMBER	RESISTANCE RANGE OHMS	TOLERANCE	RATING WATTS	AMBIENT TEMP.	DERATED TO ZERO WATTS AT TEMP.
1	16896L1	4000 to 2.56 meg Note 2	-	1/4	50°C	-
2						
3						
4						
5	19113L1A	10 to 1.3 meg	±5%	2.0	70°C	150°C
6	19114L1D	10 to 1.3 meg	±10%			Note 5
7	19113L2A	120 to 39000	±5%	3.0	40°C	
8	19113L2D	120 to 39000	±10%			
9	19113L3A	120 to 82000	±5%	4.0	40°C	
10	19113L3D	120 to 82000	±10%			
11	19113L4A	180 to 82000	±5%	5.0	40°C	
12	19113L4D	180 to 82000	±10%			
13	19113L5A	180 to 82000	±5%	7.0	40°C	
14	19113L5D	180 to 82000	±10%			
15						
16						
17	19756L1	50 to 20000	Note 3	0.1	70°C	150°C
18	19756L2	50 to 20000				
19	19756L3	100 to 20000				
20						

NOTES:

1. Temperature coefficient of resistance is as follows:
   List 1 ±100 ppm/°C
   List 2 ±50 ppm/°C
   List 3 ±25 ppm/°C
2. NOT RECOMMENDED for general use. Components Laboratory, Resistor Development Group should be consulted for any new use. Consists of a group of seven resistors closely interrelated with respect to specific ratios of resistance values.
3. Add suffix as follows to the list number for tolerance:
   A ±1% Lists 1, 2, 3
   D ±1/2% Lists 1, 2, 3
   E ±1/4% Lists 2, 3
4. Maximum temperature coefficient of resistance is +375 ppm/°C.
5. Resistor should not be used in an ambient greater than 150°C.

KS- SPECIFICATION RESISTORS - DEPOSITED CARBON, METAL, OR METAL OXIDE

BODY DIMENSIONS-INCHES DIAMETER	LENGTH	CHARACTER-ISTICS	BODY MATERIAL	ILLUS-TRATION	Line No.
.250	.657	Note 2	Metal film encapsulated in plastic	IV-32	1 2 3 4
.336	11/16	Note 4	Metal film, insulated	IV-32	5 6
.375	15/16				7 8
.375	1-9/16				9 10
.375	1-3/4				11 12
.375	2-1/16				13 14 15 16
.065	.152	Note 1	Metal film encapsulated in plastic	IV-32	17 18 19 20



COLOR CODE MARKING

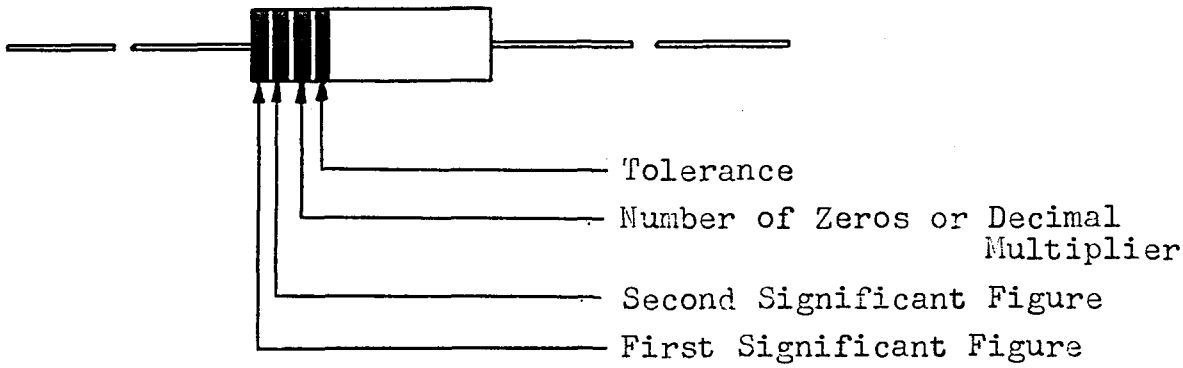
TABLE 2

NOMINAL RESISTANCE VALUES
(EIA PREFERRED NUMBER SYSTEM)

NOMINAL RESISTANCE OHMS				AVAILABLE IN TOLERANCES ± PERCENT
1.0	10	100	1000	5,10
1.1	11	110	1100	5
1.2	12	120	1200	5,10
1.3	13	130	1300	5
1.5	15	150	1500	5,10
1.6	16	160	1600	5
1.8	18	180	1800	5,10
2.0	20	200	2000	5
2.2	22	220	2200	5,10
2.4	24	240	2400	5
2.7	27	270	2700	5,10
3.0	30	300	3000	5
3.3	33	330	3300	5,10
3.6	36	360	3600	5
3.9	39	390	3900	5,10
4.3	43	430	4300	5
4.7	47	470	4700	5,10
5.1	51	510		5
5.6	56	560		5,10
6.2	62	620		5
6.8	68	680		5,10
7.5	75	750		5
8.2	82	820		5,10
9.1	91	910		5

TABLE 3

COLOR	FIGURE OR NO. OF ZEROS	DEC. MULTIPLIER	TOL. %
BLACK	0		
BROWN	1		
RED	2		
ORANGE	3		
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
GOLD		0.10	±5
SILVER		0.01	±10
NO COLOR			±20



COLOR CODE MARKING

TABLE 4

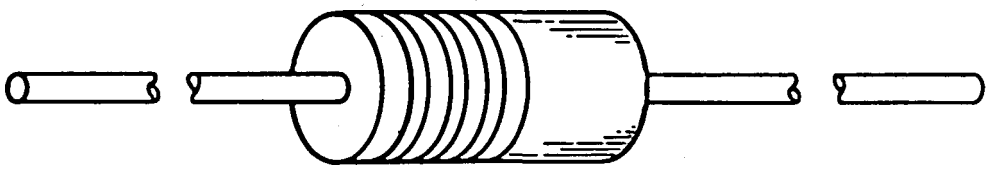
NOMINAL RESISTANCE VALUES
(EIA PREFERRED NUMBER SYSTEM)

NOMINAL RESISTANCE						AVAILABLE IN TOLERANCES
OHMS					MEGOHMS	± PERCENT
	10	100	1000	10000	0.10,1.0,10	5,10,20
	11	110	1100	11000	0.11,1.1,11	5
	12	120	1200	12000	0.12,1.2,12	5,10
	13	130	1300	13000	0.13,1.3,13	5
	15	150	1500	15000	0.15,1.5,15	5,10,20
	16	160	1600	16000	0.16,1.6,16	5
	18	180	1800	18000	0.18,1.8,18	5,10
	20	200	2000	20000	0.20,2.0,20	5
	22	220	2200	22000	0.22,2.2,22	5,10,20
	24	240	2400	24000	0.24,2.4,	5
2.7	27	270	2700	27000	0.27,2.7	5,10
3.0	30	300	3000	30000	0.30,3.0	5
3.3	33	330	3300	33000	0.33,3.3	5,10,20
3.6	36	360	3600	36000	0.36,3.6	5
3.9	39	390	3900	39000	0.39,3.9	5,10
4.3	43	430	4300	43000	0.43,4.3	5
4.7	47	470	4700	47000	0.47,4.7	5,10,20
5.1	51	510	5100	51000	0.51,5.1	5
5.6	56	560	5600	56000	0.56,5.6	5,10
6.2	62	620	6200	62000	0.62,6.2	5
6.8	68	680	6800	68000	0.68,6.8	5,10,20
7.5	75	750	7500	75000	0.75,7.5	5
8.2	82	820	8200	82000	0.82,8.2	5,10
9.1	91	910	9100	91000	0.91,9.1	5

TABLE 5

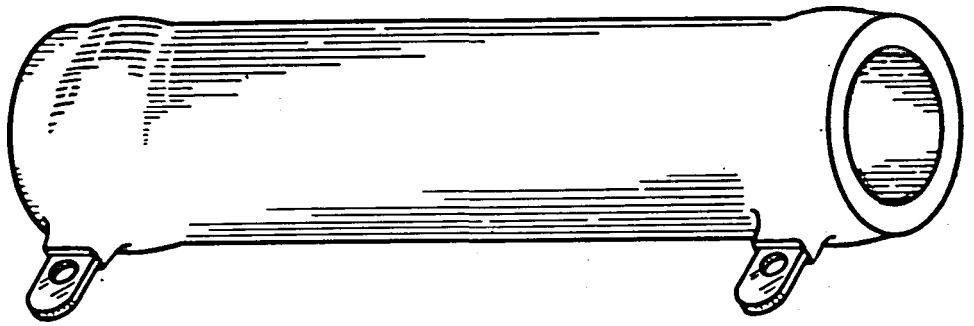
NOMINAL RESISTANCE VALUES - OHMS

0.1	1.0	10	100	1000	10000
0.11	1.1	11	110	1100	11000
0.12	1.2	12	120	1200	12000
0.14	1.4	14	140	1400	14000
0.16	1.6	16	160	1600	16000
0.18	1.8	18	180	1800	18000
0.20	2.0	20	200	2000	20000
0.22	2.2	22	220	2200	22000
0.25	2.5	25	250	2500	25000
0.28	2.8	28	280	2800	28000
0.31	3.1	31	310	3100	31000
0.35	3.5	35	350	3500	35000
0.40	4.0	40	400	4000	40000
0.45	4.5	45	450	4500	45000
0.50	5.0	50	500	5000	50000
0.56	5.6	56	560	5600	56000
0.63	6.3	63	630	6300	63000
0.71	7.1	71	710	7100	71000
0.80	8.0	80	800	8000	
0.90	9.0	90	900	9000	

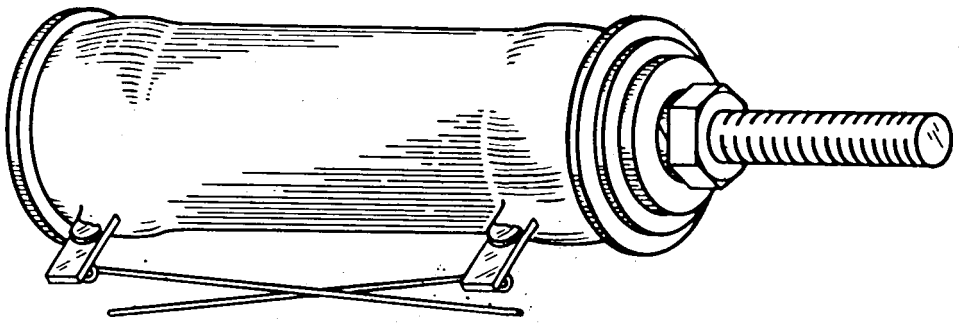


~~*KS-8441, KS-8451, KS-8452*~~ KS-13490, KS-13491, KS-13492, KS-16645, KS-19113, KS-19150, KS-19151, KS-19152, & KS-19548

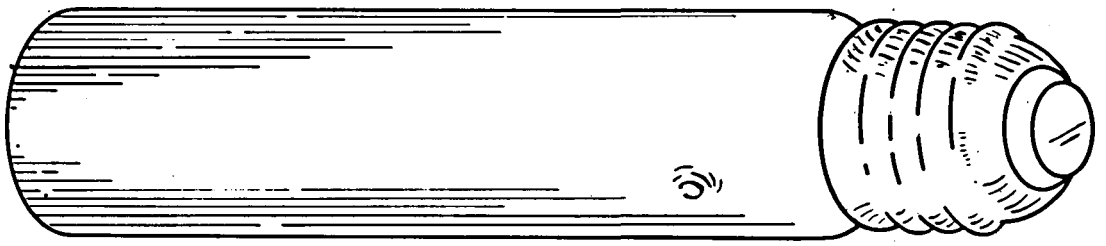
* MANUFACTURE DISCONTINUED



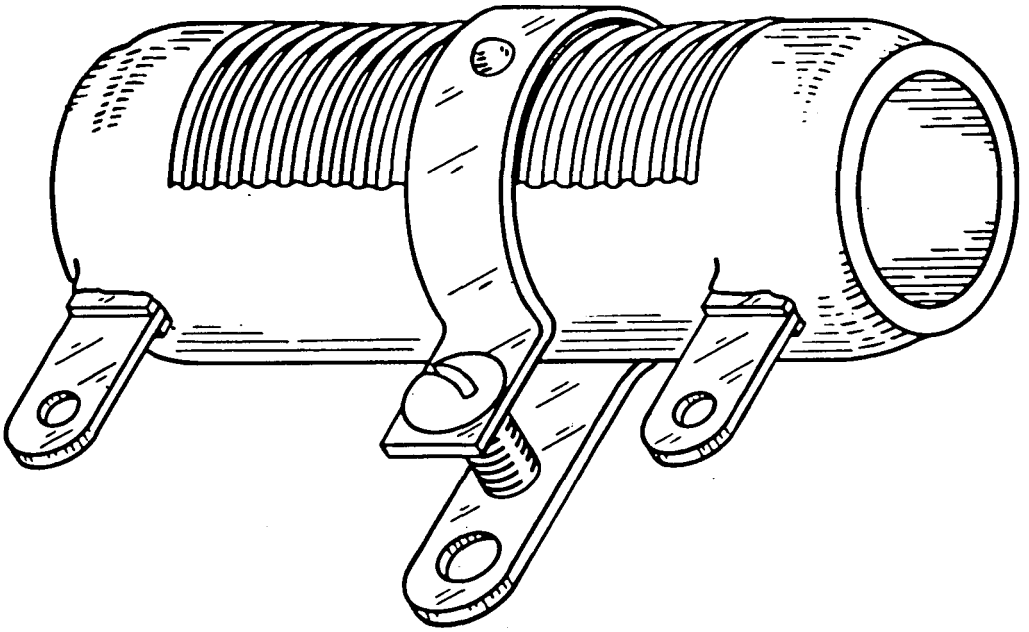
KS-8512L22 (Other KS-8512 Resistors similar in appearance except as shown in illustration on following page)
KS-16814 similar in appearance



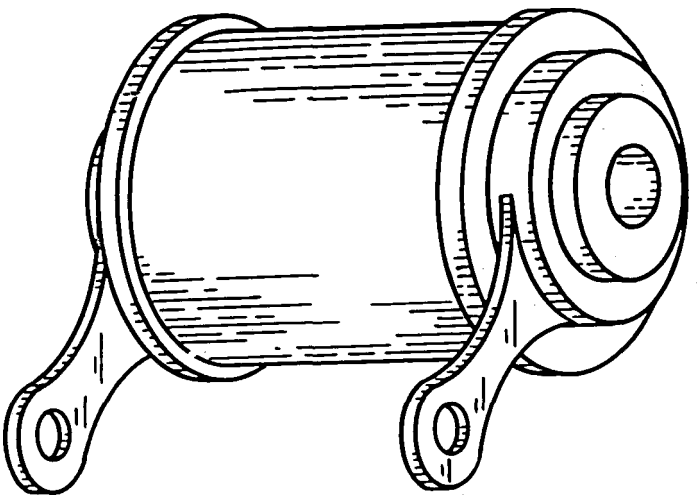
KS-8512,L17 Showing Method of Mounting



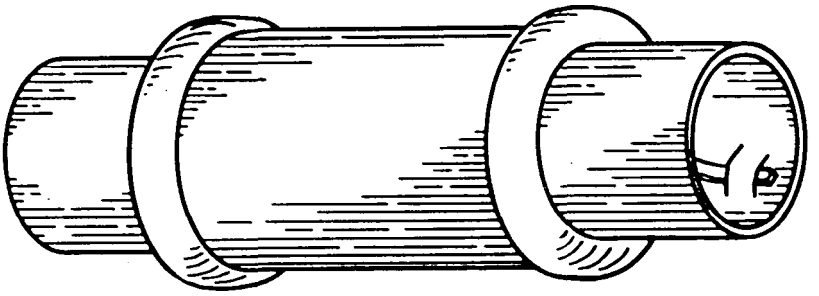
KS-8512,L45,L46,L47,L48, & L49
General Appearance



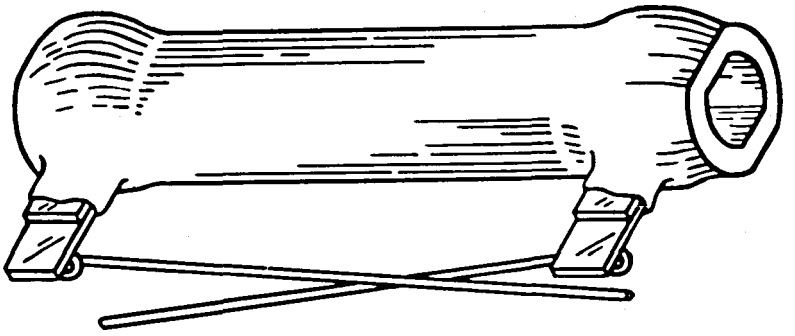
KS-9913, KS-9914, KS-13653, & KS-14272
Resistors



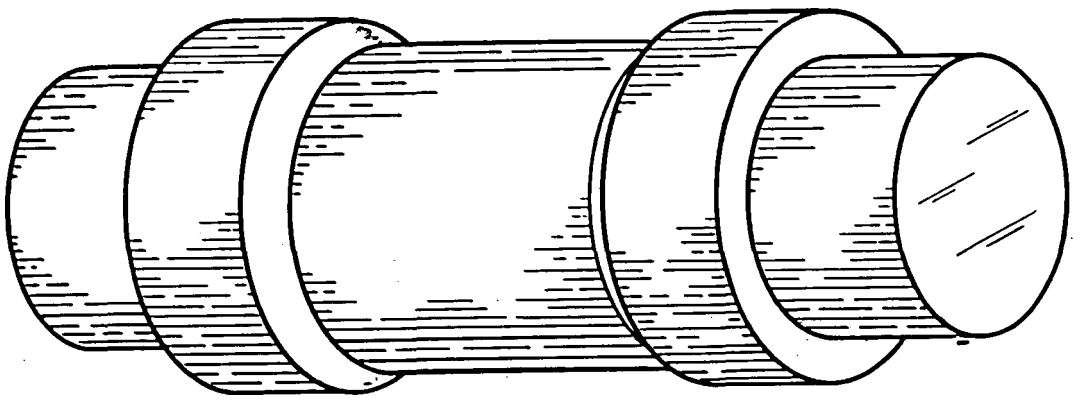
KS-13192, L5 Resistor



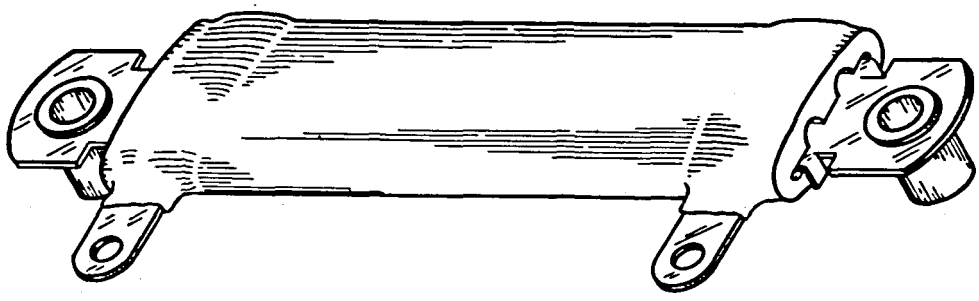
KS-13609, L7 Resistor



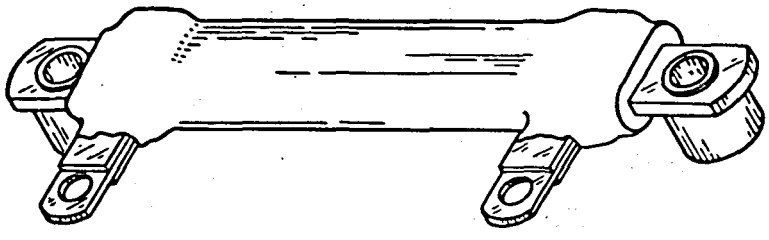
KS-13657, L1 Resistor



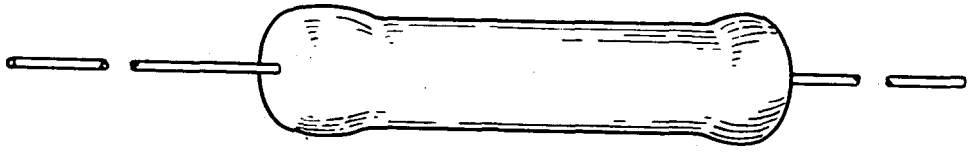
KS-13809, L3 Resistor



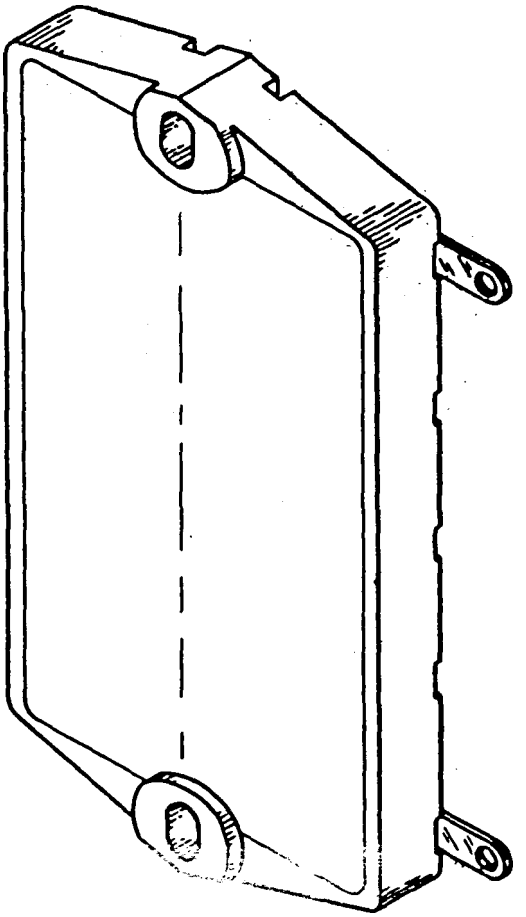
KS-14175, L3 (Representative of L1 - L5)
Resistor



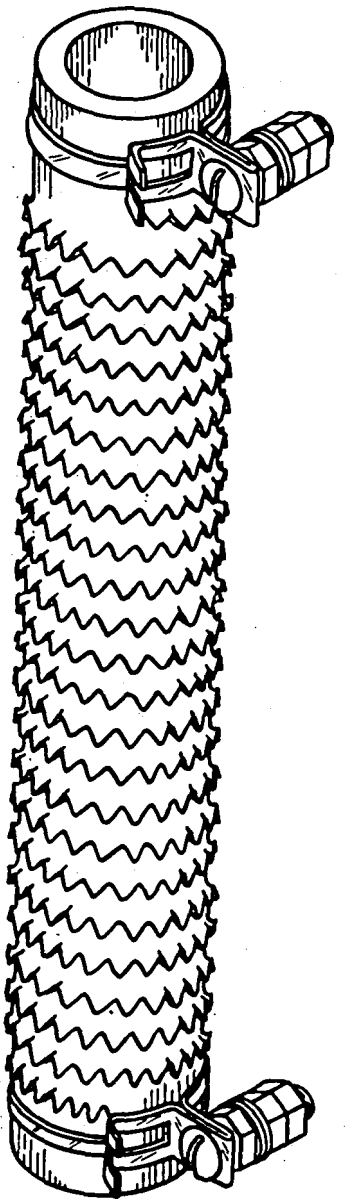
KS-14175, L6 Resistor



KS-14603, KS-16266, KS-19863, &
KS-19949 Resistors

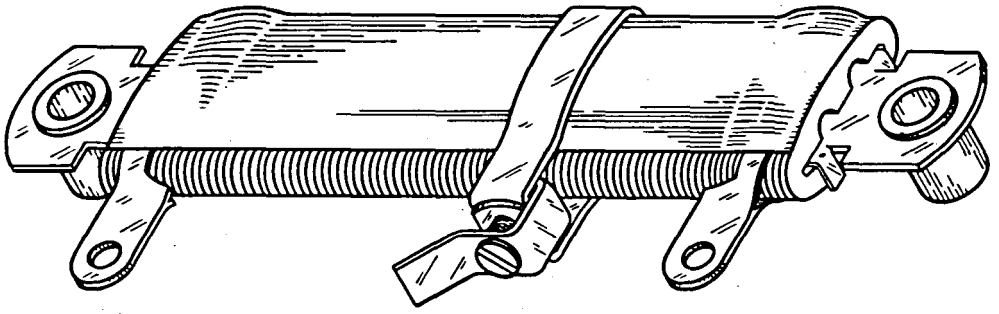


KS-16122 Resistor &
KS-16073 Resistor

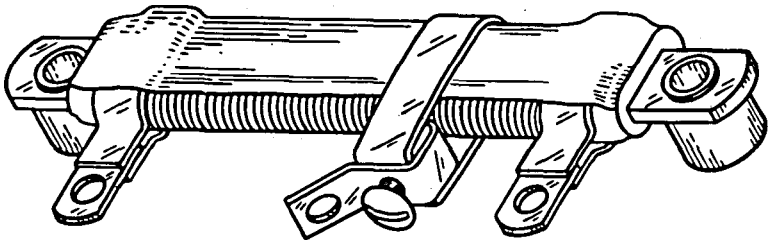


KS-16125 Resistor

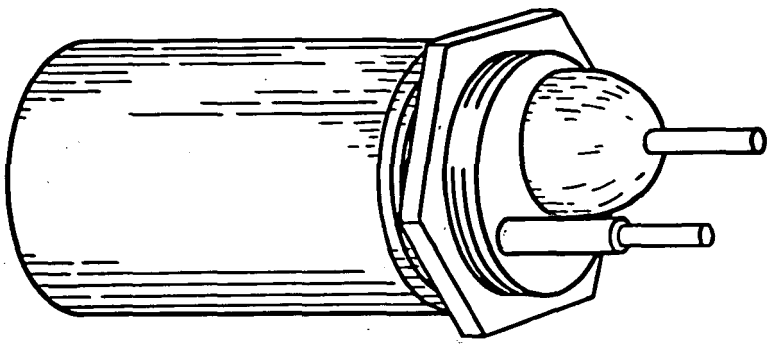
KS-16907 Resistor similar except has four taps and no mounting lugs



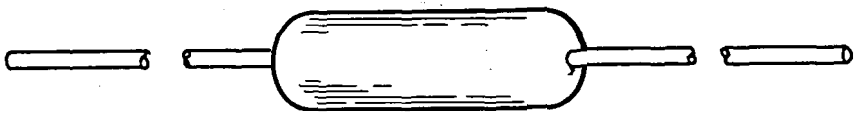
KS-16340, L3 (Representative of L2 - L5)
Resistor



KS-16340, L1 Resistor

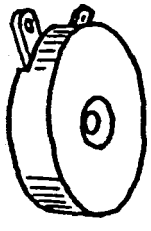


KS-16543 Resistor



KS-16311 through KS-16315 Resistors
(KS-16312 Illustrated)

KS-14603L4, L5, & L6, KS-16311 through 16315, KS-16896, KS-16764, KS-19077, & KS-19769 Resistors



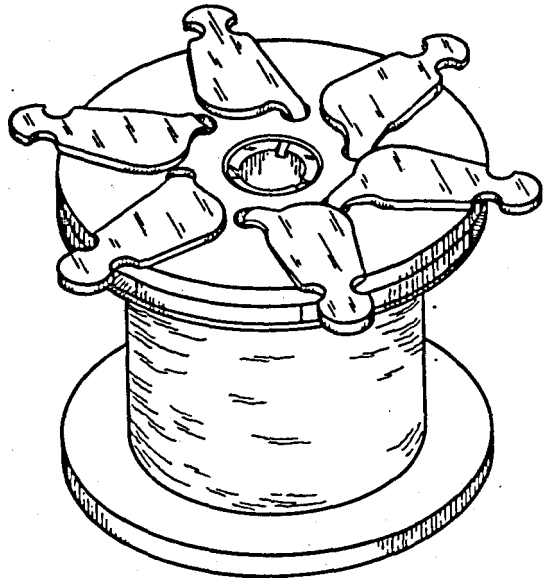
KS-19238 Resistor

DESCRIPTION

The 36-type resistors are precision wire wound on a spool having a brass core and phenol fiber spoolheads. They are mounted by a screw which passes through a 3/16 inch diameter hole in the core. The spool is 7/8 inch high and the diameter including the terminals is 1-3/8 inches. The closest recommended mounting centers are 1-5/8 inches by 1-5/8 inches.

Most of the 36-type resistors are used to provide attenuation and those so used have attenuation and terminal impedances listed in the tables following. The figures listed in the table under "Fig. No." show the relative positions of the resistor windings and the terminal impedances.

The power rating for the entire resistor is 1.5 watts for continuous operation in an ambient of 100° F.



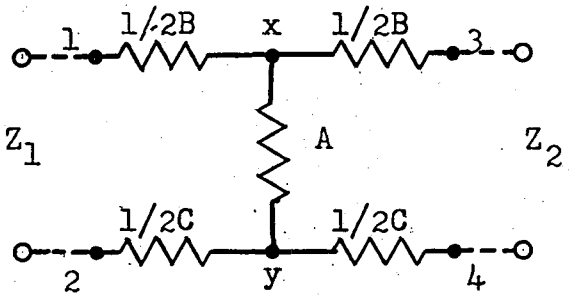
FOR SCHEMATIC FIGURES SEE PAGES V-4 and V-5.

Line No.	CODE NO.	FIG. NO.	TOL. %	NOMINAL RESISTANCE - OHMS WINDINGS A	B	C	D	E
1	36F	4.1	1	91.0	1071.0	91.0	1071.0	
2	36G	4.1	1	213.0	577.0	213.0	577.0	
3	36H	4.1	1	408.0	430.0	408.0	430.0	
4	36J	4.1	1	742.0	367.0	742.0	367.0	
5	36K	4.1	1	1330.0	336.0	1330.0	336.0	
6	36L	4.1	1	70.0	5230.0	70.0	5230.0	
7	36M	4.1	1	143.0	2665.0	143.0	2655.0	
8	36U	1	1	5180.0	34.6	34.6		
9	36W	4.1	1	298.0	487.0	298.0	487.0	
10	36Y	4.1	1	44.0	2099.0	44.0	2099.0	
11	36AA	4.1	1	146.0	738.0	146.0	738.0	
12	36AR	3.1	1	34.5	5200.0	34.5		
13	36AS	3.1	1	68.8	2583.0	68.8		
14	36AT	3.1	1	135.8	1258.0	135.8		
15	36AU	3.1	1	258.3	567.7	258.3		
16	36AW	3.1	1	435.8	195.0	435.8		
17	36BY	5	4	5516.0	36.6	36.6		
18	36CA	5	4	2917.0	77.7	77.7		
19	36CB	6	4	143.0	143.0	2652.0	2652.0	
20	36CC	6	4	317.0	317.0	1394.0	1394.0	
21	36CE	9	2	40000.0				
22	36CG	3.1	1	418.8	220.4	418.8		
23	36CH	4.1	1	553.5	392.4	553.5	392.4	
24	36CJ	7.1	1	10.0	20.0	40.0	80.0	160.0
25	36CK	7.2	1	50.0	100.0	200.0	400.0	800.0
26	36CL	4.2	1	105.8	3506.0	105.8	3506.0	
27	36CM	3.2	Note 1	400.0	249.4	400.0		
28	36CN	3.2	Note 1	466.0	153.4	466.0		
29	36CP	3.2	Note 2	311.7	421.6	311.7		
30	36CR	2.1	Note 3	190.2	190.2	282.9	190.2	190.2
31	36CS	2.2	1	217.1	34.1	298.3	217.1	34.1
32	36CT	2.3	1	241.1	81.5	156.0	241.1	81.5
33	36CU	3.2	1	1372.0	1372.0	1855.0		
34	36CW	3.2	1	739.5	739.5	4342.0		
35	36DA	8	1	500.0	6500.0			
36	36DB	7.3	Note 4	0.15	0.30	0.60	1.20	2.40

NOTES:

1. Tolerance for windings A & C is ±0.5% and for winding B is ±1%.
2. Tolerance for windings A & C is ±1% and for winding B is ±0.5%.
3. Tolerance for windings A, B, D, & E is ±0.5% and for winding C is ±0.25%.
4. Tolerance for winding A is ±20%, winding B ±10%, winding C ±5%, winding D ±2%, and winding E ±1%.

ATTENUATION DB	TERMINAL IMPEDANCE OHMS Z1	Z2	CODE NO.	Line No.
5	300	300	36F	1
10	300	300	36G	2
15	300	300	36H	3
20	300	300	36J	4
25	300	300	36K	5
2	600	600	36L	6
4	600	600	36M	7
1	600	600	36U	8
12.5	300	300	36W	9
2.5	300	300	36Y	10
7.5	300	300	36AA	11
1	600	600	36AR	12
1	600	600	36AS	13
4	600	600	36AT	14
8	600	600	36AU	15
16	600	600	36AW	16
1	600	600	36BY	17
2	600	600	36CA	18
4	600	600	36CB	19
8	600	600	36CC	20
-	-	-	36CE	21
15	600	600	36CG	22
17.5	300	300	36CH	23
-	-	-	36CJ	24
-	-	-	36CK	25
3	600	600	36CL	26
14	600	600	36CM	27
18	600	600	36CN	28
10	600	600	36CP	29
13	600	600	36CR	30
10	600	300	36CS	31
15	600	300	36CT	32
-	-	-	36CU	33
-	-	-	36CW	34
-	-	-	36DA	35
-	-	-	36DB	36



Windings A, B, and C are Bifilar wound. A connected to midpoints of B and C at insulated splices x and y.

FIG. 1

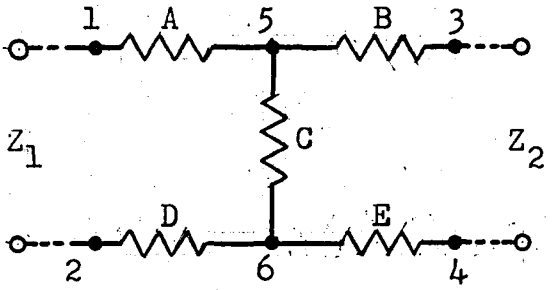


	FIG. 2.1	FIG. 2.2	FIG. 2.3
Wdg. A	RL	RL	RL
Wdg. B	RL	Bif	Bif
Wdg. C	RL	RL	Bif
Wdg. D	RL	RL	RL
Wdg. E	RL	Bif	Bif

FIGS. 2.1, 2.2, 2.3

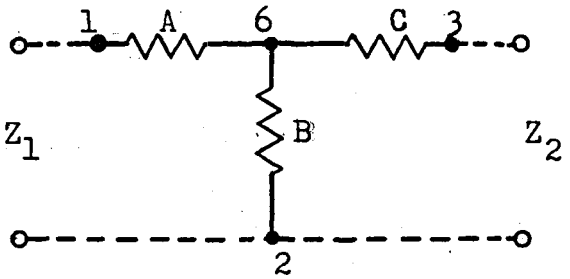


	FIG. 3.1	FIG. 3.2
Wdg. A	Bif	RL
Wdg. B	Bif	RL
Wdg. C	Bif	RL

FIGS. 3.1, 3.2

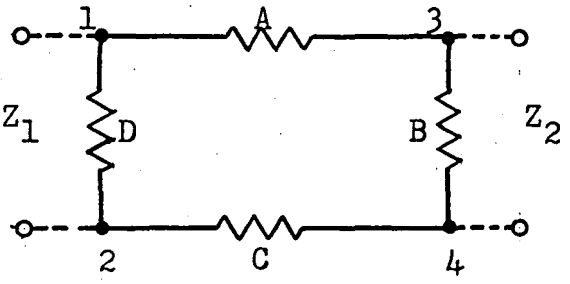
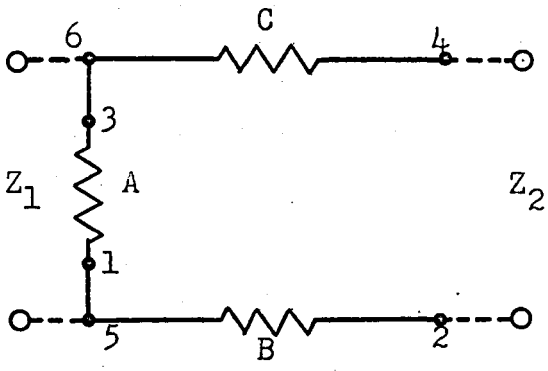


FIG. 4.1
Wdgs. A & C are a parallel pair
Wdgs. B & D are a parallel pair

FIG. 4.2
Wdg. A Bifilar
Wdg. B Reverse Layer
Wdg. C Bifilar
Wdg. D Reverse Layer

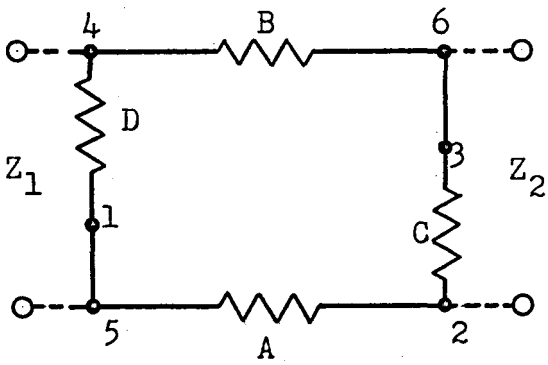
FIGS. 4.1, 4.2

RL=Reverse Layer Bif=Bifilar Ind= Inductive



Wdg. A	Bifilar
Wdg. B	Bifilar
Wdg. C	Bifilar

FIG. 5



Wdg. A	Bifilar
Wdg. B	Bifilar
Wdg. C	Bifilar
Wdg. D	Bifilar

FIG. 6

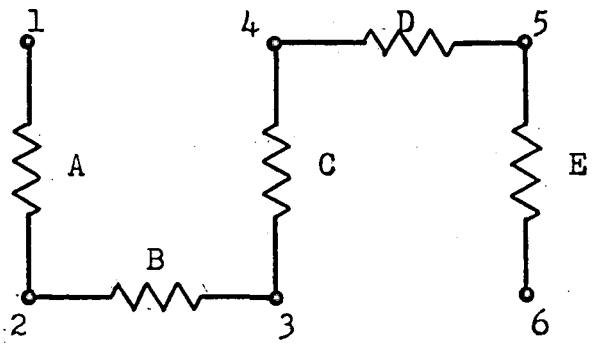
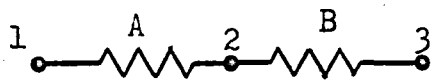


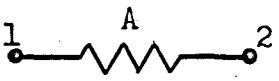
	FIG. 7.1	FIG. 7.2	FIG. 7.3
Wdg. A	Bif	Bif	Ind
Wdg. B	Bif	Bif	Ind
Wdg. C	Bif	Bif	Ind
Wdg. D	Bif	RL	Ind
Wdg. E	Bif	RL	Ind

FIGS. 7.1, 7.2, & 7.3



Wdg. A	Bifilar
Wdg. B	Bifilar

FIG. 8



Wdg. A Bifilar

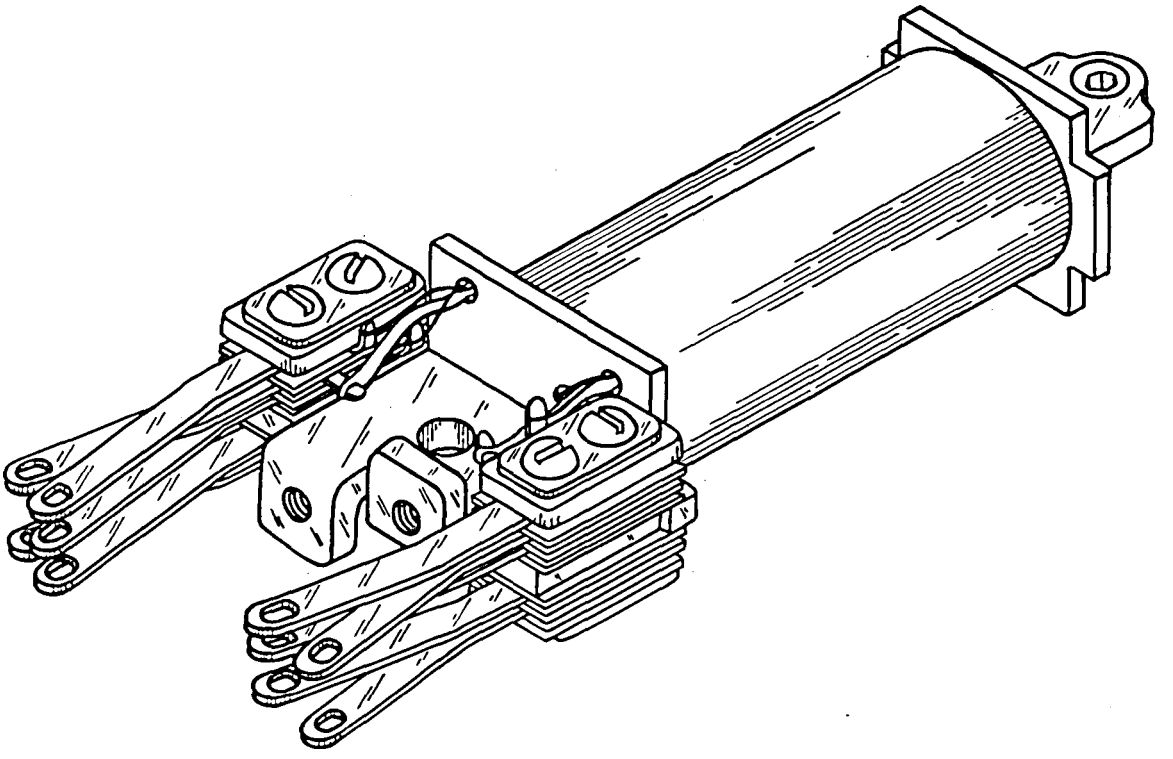
FIG. 9

DESCRIPTION

The 40-type resistors are wound non-inductively on an iron core of the punched flat type similar to that of the "E" type relays. They mount interchangeably with the "E" type relays. These resistors are 1-3/8 inch wide and 11/16 inch thick, 3-15/64 inch high from mounting surface to top. Their terminals extend 3/4 inch beyond the mounting surface. The resistors mount on 1-3/4 inch vertical centers and on horizontal centers as shown in the following tables.

The resistance tolerances are ±5% except as shown otherwise in the tables.

The power rating of the entire resistor is 4.6 watts.



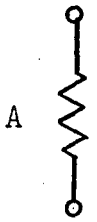


FIG. 1

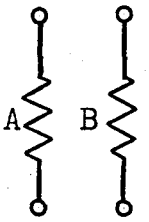


FIG. 2

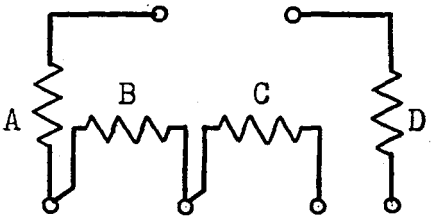


FIG. 3

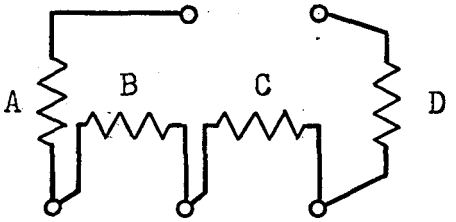


FIG. 4

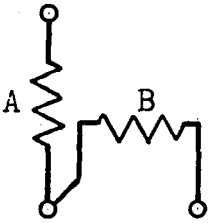


FIG. 6

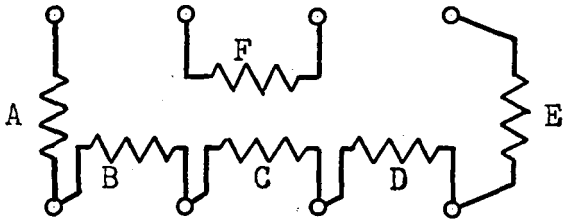


FIG. 7

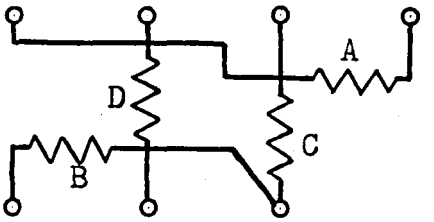


FIG. 8

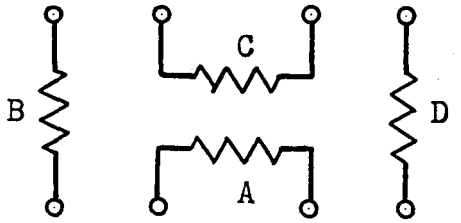


FIG. 9

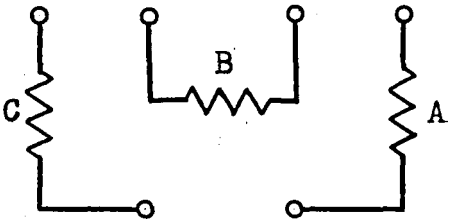


FIG. 10

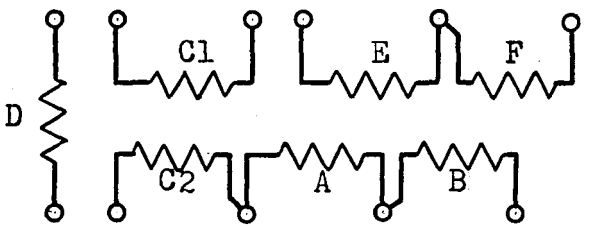


FIG. 11

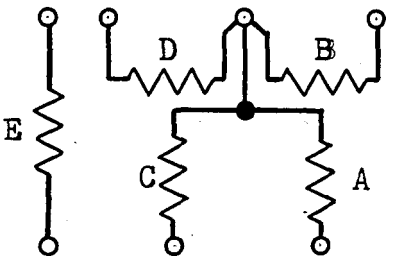


FIG. 12

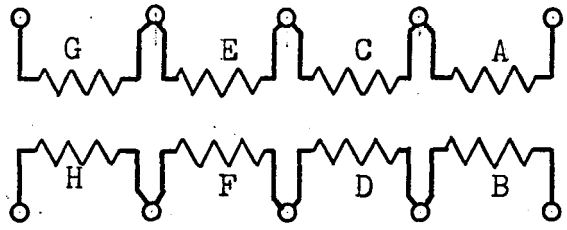


FIG. 14

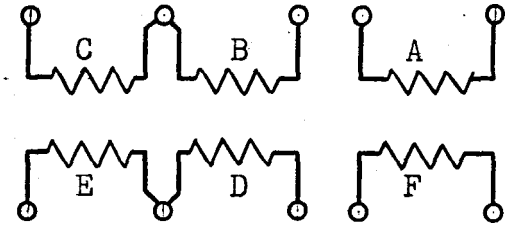


FIG. 15

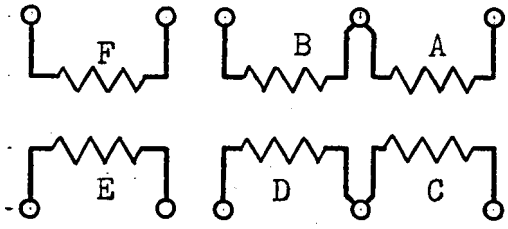


FIG. 16

Line No.	CODE NO.	FIG. NO.	RESISTANCE - OHMS, IN WINDINGS A	B	C	D	E	F	G	H	HORIZ CTRS.
1	40A	1	21000								3/4
2	40B	1	7600								3/4
3	40D	1	17500								3/4
4	40H	1	24000								3/4
5	40J	1	12000								3/4
6	40K	1	*14500								3/4
7	40L	1	6500								3/4
8	40M	1	10000								3/4
9	40N	1	* 7000								3/4
10	40P	1	* 6200								3/4
11	40R	2	3500	3000							3/4
12	40S	1	500								3/4
13	40T	2	100	100							3/4
14	40U	2	10	10							3/4
15	40W	2	* 3000	* 2500							3/4
16	40Y	2	* 4000	* 7000							3/4
17	40AB	1	**22000								3/4
18	40AD	1	* 5000								3/4
19	40AE	2	* 1000	*13500							3/4
20	40AF	1	3500								3/4
21	40AG	2	6000	15000							3/4
22	40AH	1	13000								3/4
23	40AJ	1	8000								3/4
24	40AK	1	1000								3/4
25	40AL	1	*15000								3/4
26	40AM	1	* 8000								3/4
27	40AN	1	*10000								3/4
28	40AP	1	*20000								3/4
29	40AS	2	* 5000	* 5000							3/4
30	40AT	2	2000	11000							3/4
31	40AU	2	* 2060	* 8400							3/4
32	40AW	1	13500								3/4
33	40AY	1	2000								3/4
34	40BA	1	50								3/4
35	40BB	2	* 1654	* 6117							3/4
36	40BC	3	* 4797	* 511	*3562	* 1534					3/4
37	40BD	4	* 173	* 1941	*1087	* 422					3/4
38	40BE	2	* 8674	* 3579							3/4
39	40BG	4	* 1174	* 447	* 64	* 1488					3/4
40	40BH	6	*11000	*11000							3/4
41	40BK	2	*20000	*20000							3/4
42	40BL	7	* 450	* 1300	* 600	* 1150	*150	1200			3/4
43	40BN	2	30	40							3/4
44	40BP	8	6500	* 580	5920	*14500					3/4
45	40BR	6	* 9000	* 9000							3/4

* - Plus or minus 1%
** - Plus 1%, minus 0%

Line No.	CODE NO.	FIG NO.	RESISTANCE - OHMS, IN WINDINGS A	B	C	D	E	F	G	H	HORIZ CTRS.
1	40BS	1	* 3								3/4
2	40BT	1	300								3/4
3	40BU	9	*1000	* 1000	*11000	*11000					3/4
4	40BW	9	9000	9000	600	600					3/4
5	40BY	9	*1000	* 1000	*20000	*20000					3/4
6	40CA	10	* 220	* 1410	*10250						3/4
7	40CB	11	180	180	(C1)50 (C2)50	8600	200	100			7/8
9	40CC	2	*15000	*15000							3/4
10	40CD	2	300	2000							3/4
11	40CE	2	300	500							3/4
12	40CF	12	5000	5000	600	600	425				3/4
13	40CG	8	600	2000	3000	300					3/4
14	40CJ	14	100	100	200	200	400	400	800	800	7/8
15	40CK	15	830	300	30	30	300	500			7/8
16	40CL	16	330	330	330	330	500	500			7/8

* - Plus or minus 1%

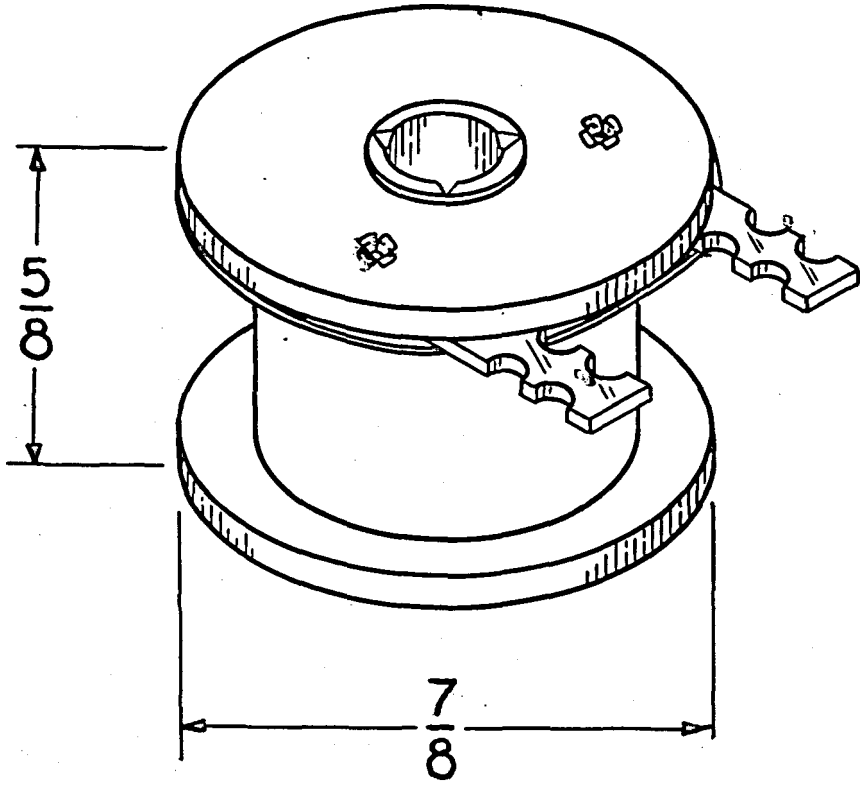
** - Plus 1%, minus 0%

DESCRIPTION

Non-inductive resistors wound on a spool. The power rating is 1 watt in free air and 2 watts when mounted singly on metal plates in an ambient of 150° F. The corresponding ratings for trouble conditions are 2 and 4 watts respectively. The maximum continuous operating temperature of the resistor surface is 250° F.

Can be mounted on No. 930- or similar type mounting plates or in the drillings for No. 221- or similar type relays. Can also be mounted in a separate drilling by means of a screw which passes through the core of the resistor. The screw is furnished with the mounting plate and can be obtained of sufficient length to mount either 1, 2, 3, or 4 resistors, one over the other in the same plate position.

The closest recommended mounting centers are 1-1/8 inch by 1-1/8 inch.



BIFILAR WINDINGS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	63BU	3.0	5
2	63EF	7.36	1
3	63DP	10.0	1
4	63A	15.0	5
5	63B	20.0	5
6	63ES	23.1	2
7	63C	50.0	5
8	63FJ	62.6	2
9	63DU	68.0	1
10	63FK	75.0	±2 ohms
11	63D	100.0	5
12	63E	150.0	5
13	63DW	168.0	1
14	63CR	190.0	1
15	63F	200.0	5
16	63BN	210.0	1
17	63CL	230.0	1
18	63G	250.0	5
19	63AL	265.0	1
20	*63FD	280.0	5
21	63AN	295.0	1
22	63H	300.0	5
23	63J	350.0	5
24	63K	400.0	5
25	63FL	430.0	1
26	63L	500.0	5
27	63AK	600.0	5
28	63CP	700.0	1
29	63CJ	725.0	1
30	63M	750.0	5
31	63N	800.0	5
32	63DE	875.0	1
33	63AG	900.0	1
34	63AM	950.0	5
35	63FH	1000.0 Min	-
36	63DH	1000.0	1
37	63P	1000.0	5
38	63DF	1034.0	1
39	63BT	1080.0	1
40	63AA	1150.0	5
41	63AE	1200.0	1
42	63R	1200.0	5
43	63AF	1230.0	1
44	63DC	1275.0	1
45	63BK	1300.0	1
46	63S	1400.0	1
47	63BH	1420.0	1
48	63CW	1500.0	1
49	63DB	1750.0	1
50	63CM	2000.0	1
51	63T	2000.0	5
52	63DA	2100.0	1
53	63U	2300.0	5
54	63CY	2500.0	1
55	63AP	2500.0	5
56	63CK	2600.0	1
57	63BJ	2660.0	1
58	63AD	3000.0	1
59	63W	3000.0	5
60	63CN	3250.0	1
61	63DL	3300.0	1
62	63DK	3500.0	1
63	63CS	3575.0	1
64	63DJ	3630.0	1
65	63DG	3700.0	1
66	63AC	4000.0	5
67	63DM	4250.0	1
68	63CH	4450.0	1
69	63FG	5000.0	0.5
70	63DN	5000.0	1
71	63Y	5000.0	5
72	63CU	5250.0	1
73	63FF	5610.0	1
74	63AH	8100.0	5
75	63DT	10000.0	1
76	63AB	10000.0	5
77	63CT	13500.0	1

*Equipped with flexible leads 9-1/2 inches long, provided with No. 72 cord tips.

REVERSE LAYER WINDINGS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	63DY	312.0	1
2	*63EP	680.0	5
3	63EN	1000.0	2
4	63EA	1155.0	1
5	63CE	1634.0	2
6	63EB	2140.0	1
7	63BF	2218.0	0.5
8	63BB	2950.0	0.6
9	63EW	5525.0	1
10	63EJ	6700.0	1
11	63EK	8000.0	1
12	63EC	15700.00	1
13	63FE	21300.00	1

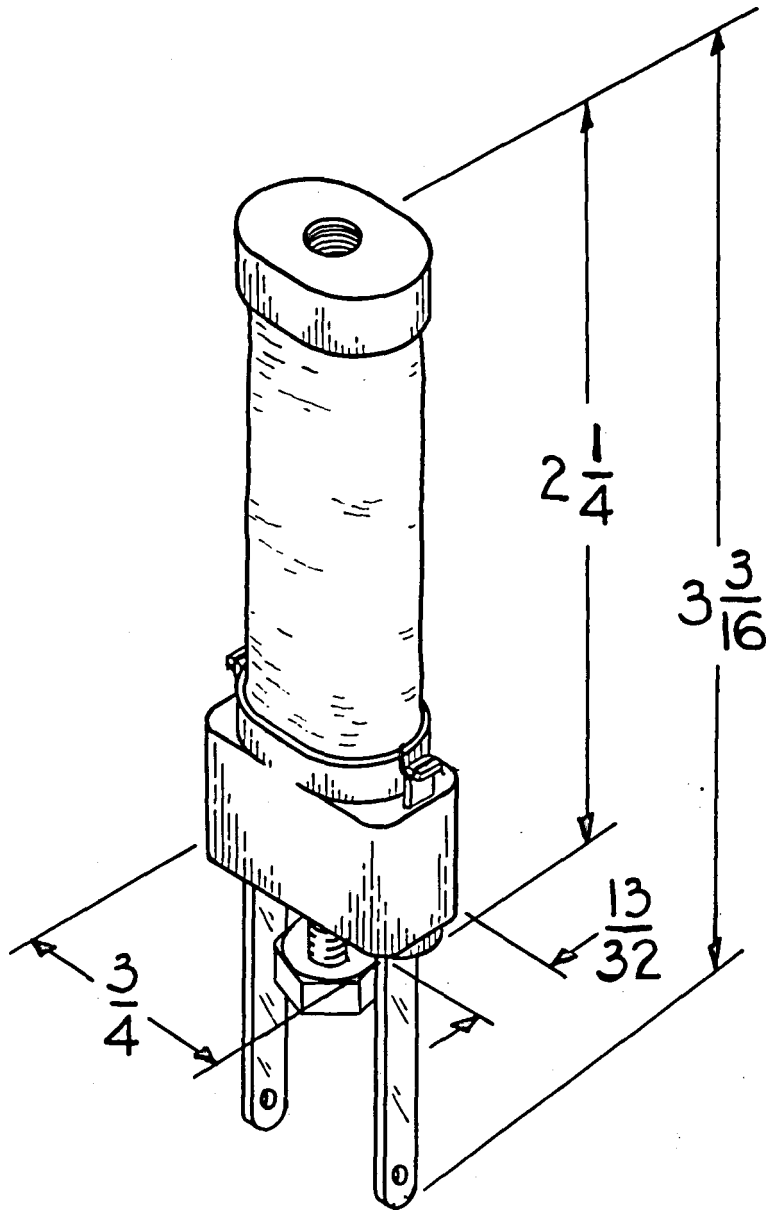
* Has a relatively high temperature coefficient of resistance.

DESCRIPTION

These are spool type resistors, non-inductively wound in the manner indicated in the tables. Where space permits, these resistors are recommended in place of the 64- and 65-type resistors. For minimum phase angle, use bifilar wound resistors between 1 and 200 ohms and reverse layer wound resistors above 200 ohms.

Mount on 7/8 inch vertical centers and 7/16 inch horizontal centers.

The power rating is 1 watt in an ambient of 150° F. For each degree F that the ambient exceeds 150° F, the power rating shall decrease 1%.



BIFILAR WINDINGS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE ±%
1	80CH	0.5	5
2	80CJ	1.0	5
3	80CK	2.0	5
4	80AN	2.5	2
5	80CS	4.0	3
6	80CL	4.0	5
7	80CW	5.0	1
8	80CT	8.0	2
9	80CM	8.0	5
10	80CY	10.0	1
11	80AT	15.0	0.25
12	80DA	20.0	1
13	80CP	24.0	5
14	80DB	40.0	1
15	80DC	80.0	1
16	80D	84.04	0.1
17	80DD	100.0	1
18	80AD	129.2	0.1
19	80E	138.1	0.1
20	80AE	150.0	0.1
21	80AF	153.5	0.1
22	80F	155.8	0.1
23	80BB	213.0	1
24	80BD	225.0	1
25	80BE	239.0	1
26	80BF	253.0	1
27	80BG	267.0	1
28	80BH	283.0	1
29	80BL	317.0	1
30	80BM	335.0	1
31	80BN	354.0	1
32	80BP	371.0	1
33	80BR	394.0	1
34	80BS	419.0	1
35	80BT	444.0	1
36	80BU	471.0	1
37	80BY	529.0	1
38	80BC	550.0	1
39	80CA	560.0	1
40	80CB	592.0	1
41	80CC	625.0	1
42	80BK	805.0	1
43	80AY	3000.0	1
44	80DJ	3000.0	5
45	80BA	3550.0	1

REVERSE LAYER WINDINGS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE ±%
1	80G	209.4	0.1
2	80AG	225.0	0.1
3	80L	300.0	0.1
4	80DG	350.0	1
5	80DH	400.0	1
6	80AJ	567.7	0.1
7	80AK	600.0	0.1
8	80CN	1200.0	5
9	80R	1681.0	0.1
10	80S	2204.0	0.1
11	80A	2580.0	1
12	80T	3117.0	0.1
13	80W	4216.0	0.1
14	80Y	5632.0	0.5
15	80AA	6000.0	0.5
16	80AC	9869.0	0.5

DESCRIPTION

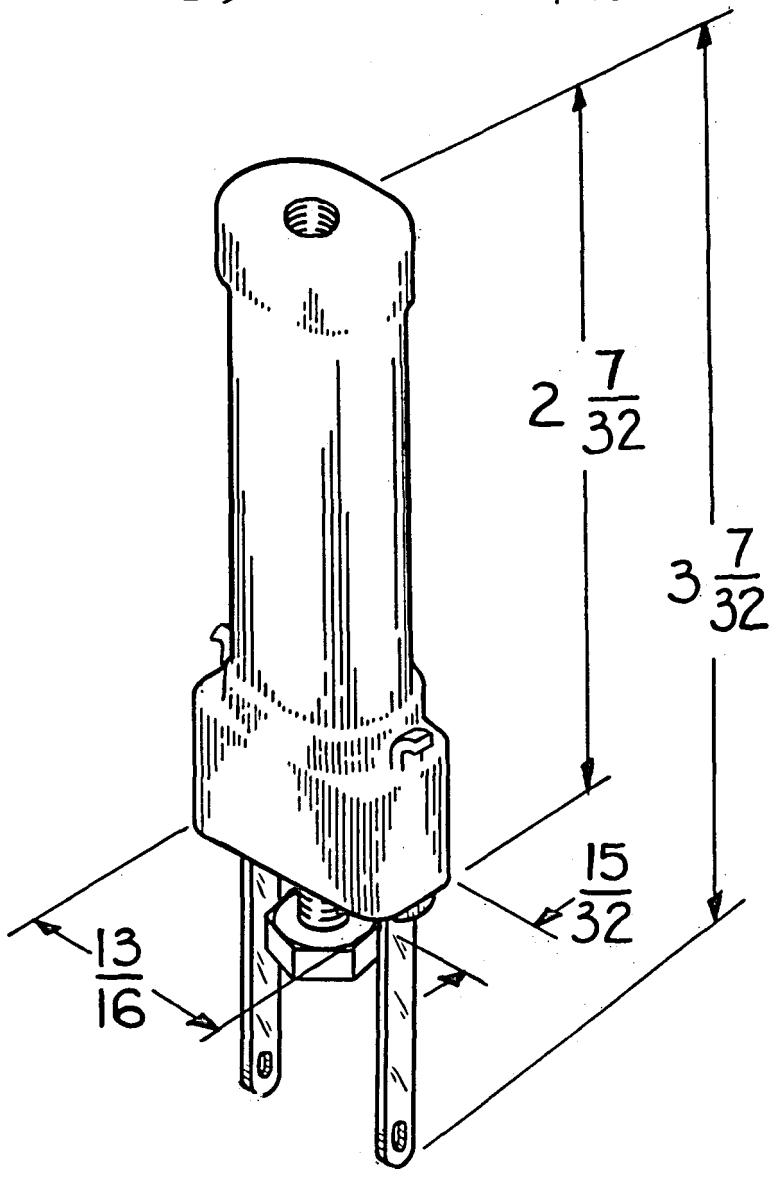
These are spool type resistors, inductively wound.

They mount on 1 inch vertical centers and 5/8 inch horizontal centers.

The power rating is 1 watt in an ambient of 150° F. For each degree F that the ambient exceeds 150° F, the power rating shall decrease 1%.

Resistance values are held within limits of ±1%.

CODE NO.	NOMINAL RESISTANCE OHMS
105A	120000
105B	78000



DESCRIPTION

These resistors are wound on a phenol plastic spool having four terminals. The end terminals are bent to facilitate connection to bus bars to provide voltages as required by individual circuits. Several types of windings are used as indicated in the table headings on the following pages, to minimize inductance and capacitance in the windings to the degree required by circuit applications.

The dimensions vary depending upon the fullness of the windings, as indicated in the tables under the column headings "Fig. No." and "Dimension D".

The power rating of the resistor at an ambient of 77° F is 1 watt total for windings A and B and 1-1/4 watts total for windings A, B, and C. Trouble ratings are double the normal rating.

These resistors are used in supply circuits in Type J, K, and L Carrier Telephone Systems.

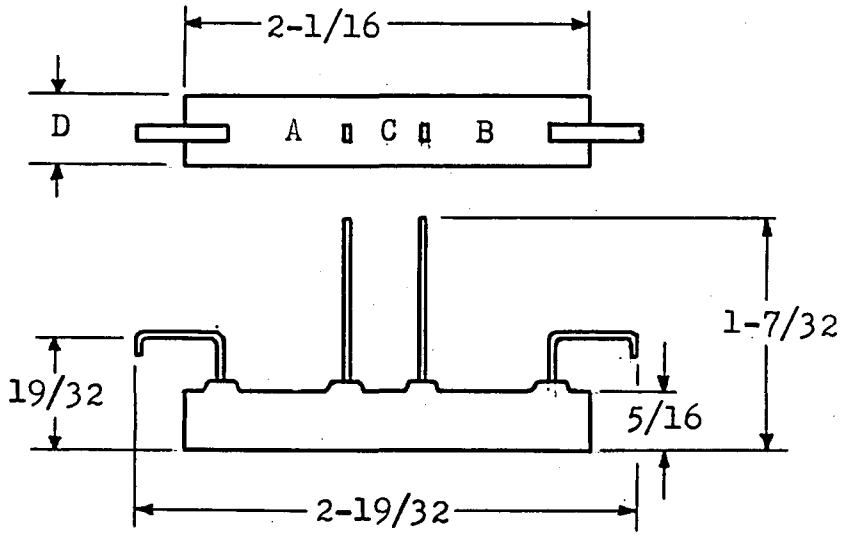


FIG. 1

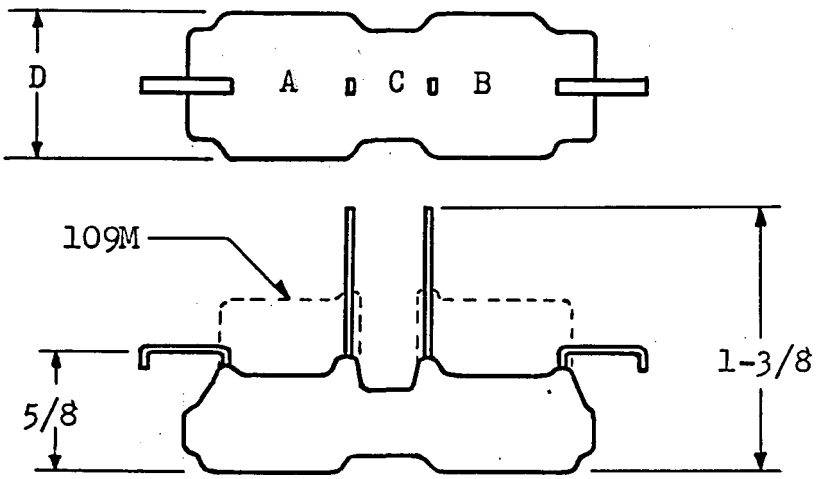


FIG. 2

TWO BIFILAR WINDING RESISTORS TWO TERMINALS PER WINDING

Line No.	CODE NO.	FIG NO.	DIM D	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	109L	1	3/8	30.0	5	30.0	5
2	109S	1	3/8	60.0	5	60.0	5
3	109T	1	3/8	2.0	5	2.0	5
4	109Y	1	3/8	15.0	5	15.0	5

TWO NON-INDUCTIVE (TAPE) WINDING RESISTORS TWO TERMINALS PER WINDING

14	109P	2	3/4	1750	1	1750	1
15	109AA	2	3/4	760	1	760	1
16	109AB	2	3/4	250	5	250	5

TWO INDUCTIVE WINDING RESISTORS TWO TERMINALS PER WINDING

27	109A	1	3/8	2.50	5	2.50	5
28	109B	1	3/8	6.75	5	6.75	5
29	109C	1	3/8	9.25	5	9.25	5
30	109D	1	3/8	12.00	5	12.00	5
31	109E	1	3/8	13.50	5	13.50	5
32	109F	1	3/8	22.00	5	22.00	5
33	109G	1	3/8	27.00	5	27.00	5
34	109H	1	3/8	63.00	5	63.00	5

TWO NON-INDUCTIVE (TAPE) WINDING RESISTORS AND ONE BIFILAR WINDING CONNECTED IN SERIES. INNER TERMINALS COMMON TO ADJACENT WINDINGS.

Line No.	CODE NO.	FIG NO.	DIM D	WINDING A NOMINAL RESISTANCE OHMS	TOL %	WINDING B NOMINAL RESISTANCE OHMS	TOL %	WINDING C NOMINAL RESISTANCE OHMS	TOL %
1	109R	2	5/8	850	1	850	1	135	.75
2	109M	2	1/2	1000	1	1000	1	135	.75
3	109N	2	3/4	1750	1	1750	1	135	.75

NOTE: Windings A and B have Non-Inductive (Tape) windings and Winding C has Bifilar winding. Windings A, B, and C are connected in series.

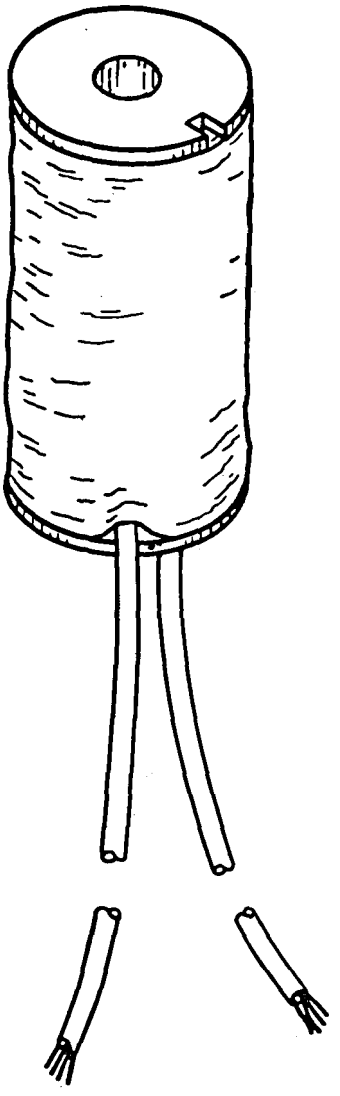
THREE BIFILAR WINDING RESISTORS CONNECTED IN SERIES. INNER TERMINALS COMMON TO ADJACENT WINDINGS

20	109W	1	3/8	162	0.5	162	0.5	225	0.5
21	109U	1	1/2	280	5	280	5	135	0.75

DESCRIPTION

These resistors are wound on steatite cores having four winding sections and are equipped with 6 inch flexible leads. They are used as components of filters, equalizers, and networks. They have inductive or non-inductive windings as indicated in the following tables. The non-inductive resistors have bifilar or reverse layer windings. The winding arrangements are shown in the circuit diagrams in which the letters "A", "B", "C", and "D" are designations of windings most of which have only one external lead connection.

The body dimensions are 1 inch long by 1/2 inch diameter. The resistor has a 1/8 inch diameter hole in the core for mounting.



SINGLE REVERSE SECTION WINDING RESISTOR WITH TWO LEADS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	101AP	400	0.5
2	101ED	1053	0.1
3	101BA	2000	0.5

SINGLE BIFILAR WINDING WITH TWO LEADS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
30	101EJ	90	1
31	101EK	412	1
32	101EL	600	1
33	101EH	766	2

TWO BIFILAR WINDING RESISTORS WITH FOUR LEADS

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	101DP	53	0.5	53	0.5

THREE BIFILAR WINDING RESISTORS WITH THREE LEADS

15	101EC	32.04	0.5	495.52	0.5
16	101DY	42.76	0.5	376.18	0.5
17	101EB	50.00	0.5	325.00	0.5
18	101EA	56.56	0.5	290.38	0.5

THREE BIFILAR WINDING RESISTORS WITH THREE LEADS

Line No.	CODE NO.	ACROSS WHITE & WHITE LEADS WINDING A NOMINAL RESISTANCE OHMS	TOL %	ACROSS RED & WHITE LEADS WINDING B NOMINAL RESISTANCE OHMS	TOL %
40	101EF	35.20	0.5	119.70	0.5
41	101EG	95.24	0.5	968.82	0.5

FOUR WINDING RESISTORS (THREE BIFILAR AND ONE INDUCTIVE) WITH FOUR LEADS

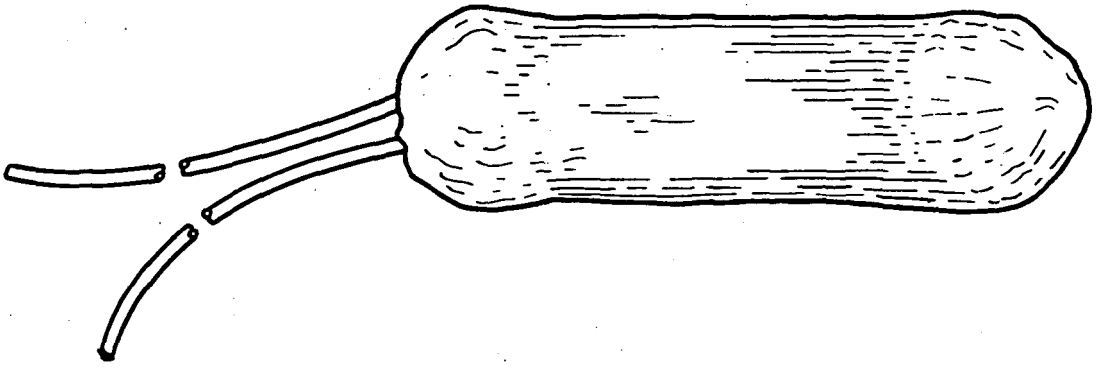
CODE NO.	NOMINAL RESISTANCE-OHMS		TOLERANCE %
101EE	Between		
	Blue and Yellow leads	5156.20	0.5
	Yellow and Red leads	288.85	0.5
	Yellow and White leads	56.90	0.5
	White and Red leads	288.85	0.5

DESCRIPTION

These resistors are wound in multi-section ceramic spools and are covered with textile insulation. The 102-type resistors have flexible lead wires which vary in length from code to code. The 104-type resistors have flexible leads of minimum 6 inches in length. The 115-type resistors have three solid tinned lead wires extending from the "Winding B" end of the spool, located within a 180° arc. With the middle terminal of the 115-type uppermost, Winding A is connected to the right hand and middle terminals and Winding B is connected to the left hand and middle terminals.

These resistors are used as components in potentiometers, filters, equalizers, networks, transformers and repeaters in carrier telephone systems.

The resistors are approximately 1-3/4 inches long by 1/2 inch to 9/16 inch diameter depending on fullness of winding and insulation. The 104- and 115-type resistors have a hole through the center of the spool which will clear a 0.101 inch rod, and the hole has a .138-32 thread 3/16 inch deep at one end for mounting. Other means of mounting must be provided for the 102-type resistors which are completely covered with insulation and asphalt compound.



102L Resistor

INDUCTIVE WINDINGS

Line No.	CODE NO.	TERMINALS	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	102AB	Two terminal leads-no color code	.222	1
3	102AA	White - Red	1.425	3
		White - Red White	7.150	0.3
		White - Blue	7.150	0.3
		White - Blue White	1.425	3
7	102D	Blue White - Blue	700.	1
		Blue - Red White	1560.	1
		Red White - Red	3500.	1
10	102P	Blue White - Green	8000.	0.5
		Green - Green White	6800.	0.5
		Green White - Brown	5200.	0.5
		Brown - Brown White	20000.	0.5
14	102M	Red - Red White	10000.	1
15	102J	Red - Red White	11000.	0.5
16	102K	Red - Red White	15000.	0.5
17	102L	Red - Red White	20000.	1
18	102B	Red - Red White	30000.	0.5
19	102A	Red - Red White	60000.	1
20	102N	Red - Red White	100000.	1

REVERSE HALF-SECTION WINDINGS

Line No.	CODE NO.	TERMINALS	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	102F	Red - Red White	2308	0.3
2	102C	Red - Red White	3500	1
3	102G	Red - Red White	7298	0.2

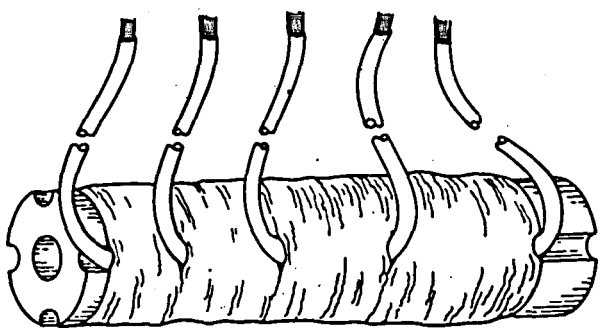
BIFILAR WINDINGS

14	102W	Red & Red White	154.50	0.2
		Red & Blue	125.00	0.2
		Red White & Blue	154.50	0.2
18	102T	Red & Red White	164.40	0.2
		Red & Blue	125.00	0.2
		Red White & Blue	164.40	0.2
22	102U	Red & Red White	313.80	0.2
		Red & Blue	125.00	0.2
		Red White & Blue	313.80	0.2

SERIES BIFILAR WINDINGS

37	102Y	Red & Red White	1095.4	0.4
		Red & Blue	364.4	0.5
		Red White & Blue	1095.4	0.4

Line No.	CODE NO.	FIG NO.	NOMINAL RESISTANCE OF WINDINGS (OHMS) "A"	"B"	"C"	"D"	"E"	TOLERANCE %
1	104CD	6A	10.69	10.69	354.80	10.69	10.69	*
2	104BY	1C	13.40	-	-	-	-	1
3	104CC	1C	14.30	-	-	-	-	1
4	104CA	4C	56.00	56.00	-	-	-	0.5
5	104AC	1A	62.40	-	-	-	-	0.5
6	104BN	5A	74.50	2365.00	74.50	-	-	1
7	104CF	5A	98.36	1781.00	98.36	-	-	0.5
8	104CB	4C	111.20	111.20	-	-	-	0.5
9	104AD	2A	125.00	1450.00	125.00	-	-	0.5
10	104CH	5A	144.00	1200.00	144.00	-	-	0.5
11	104CG	5A	162.30	1048.00	162.30	-	-	0.5
12	104BG	4A	213.00	213.00	-	-	-	0.5
13	104BD	5A	219.50	723.90	219.50	-	-	0.5
14	104BP	4A	245.40	245.40	-	-	-	1
15	104BE	5A	312.50	429.40	312.50	-	-	0.5
16	104CJ	5A	338.60	369.20	338.60	-	-	0.5
17	104BF	4A	401.00	401.00	-	-	-	0.5
18	104BS	4A	467.00	467.00	-	-	-	0.5
19	104BC	5A	516.20	96.42	516.20	-	-	0.5
20	104BM	1C	1059.00	-	-	-	-	1
21	104BT	4A	1162.00	146.40	-	-	-	1
22	104BH	4A	1166.00	255.00	-	-	-	1
23	104BR	4A	2227.00	623.00	-	-	-	1
24	104BJ	4A	2304.00	753.00	-	-	-	1
25	104BU	4B	13140.00	16860.00	-	-	-	0.5
26	104CE	7A	19000.00	1000.00	1000.00	-	-	2



104-Type Resistor

* 104CD has a tolerance of ±1% for windings A-B-D- & E and - ±0.3% for winding C.

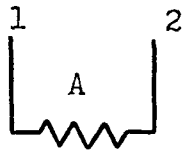


FIG. 1A & 1C

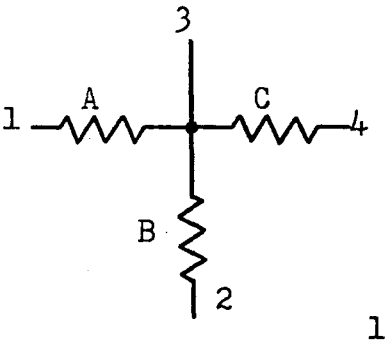


FIG. 2A

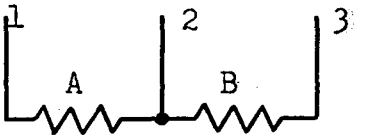


FIG. 4A, 4B & 4C

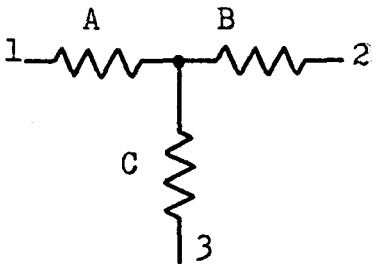


FIG. 5A

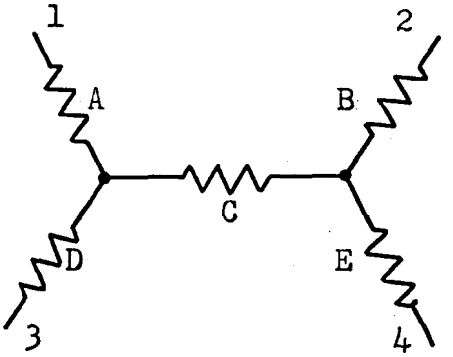


FIG. 6A

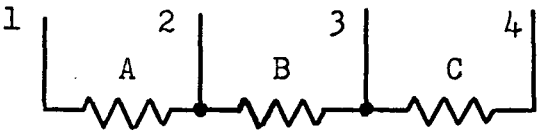


FIG. 7A

FIG.	Color of Leads on: 1	2	3	4	5
1A	White	White			
1C	Blue	Blue			
2A	White	Red	Yellow	White	
4A	Green	Red	Yellow		
4B	Green-White	Brown	Green		
4C	White	Red	White		
5A	White	Red	White		
6A	Red	Red-White	Blue	Blue-White	
7A	Blue-White	Yellow	Green	White	

TWO REVERSE WINDING RESISTORS WITH THREE LEADS

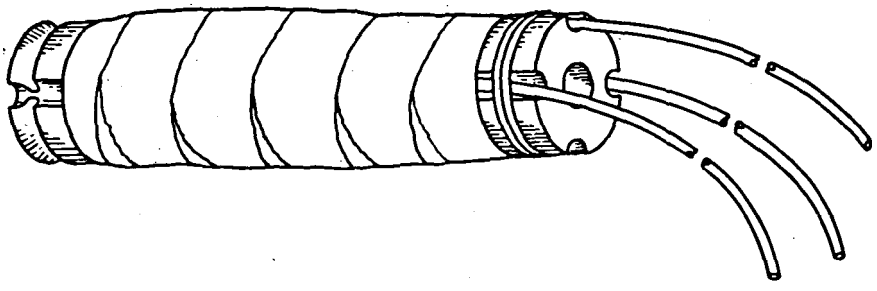
Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	115A	238.10	0.25	732.10	0.25
2	115AH	271.00	0.5	445.00	0.5
3	115N	863.00	1	428.00	1
4	115AG	880.00	0.5	2616.00	0.5

TWO BIFILAR WINDING RESISTORS WITH THREE LEADS

14	115B	1.88	5	6.09	5
15	115D	8.24	2	9.24	2
16	115E	10.37	2	11.63	2
17	115M	11.80	2	15.05	2
18	115F	13.05	1	14.65	1
19	115G	16.43	1	18.44	1
20	115L	19.69	2	26.70	2
21	115H	20.69	1	23.21	1
22	115C	21.18	2	94.90	1
23	115AB	26.00	2	27.40	2
24	115AC	28.80	2	30.10	2
25	115AD	31.30	2	32.30	2
26	115AE	33.20	2	33.80	2
27	115AF	34.30	2	34.50	2
28	115AA	36.60	1	41.10	1
29	115K	37.80	2	57.30	2
30	115Y	46.10	1	51.70	1
31	115U	58.00	1	65.10	1
32	115W	66.90	1	52.50	1
33	115T	73.00	1	82.00	1
34	115AK	80.60	1	102.00	0.5
35	115R	91.90	1	103.20	1
36	115J	96.40	2	194.10	2
37	115S	118.50	1	87.50	1
38	115AJ	133.60	0.5	183.70	0.5

REVERSE AND BIFILAR WINDING RESISTORS WITH THREE LEADS

Line No.	CODE NO.	WINDING A NOMINAL RESISTANCE OHMS	TOLERANCE %	WINDING B NOMINAL RESISTANCE OHMS	TOLERANCE %
1	115AL	65.5	0.5	421.6	0.5
2	115P	255.0	1	168.0	1



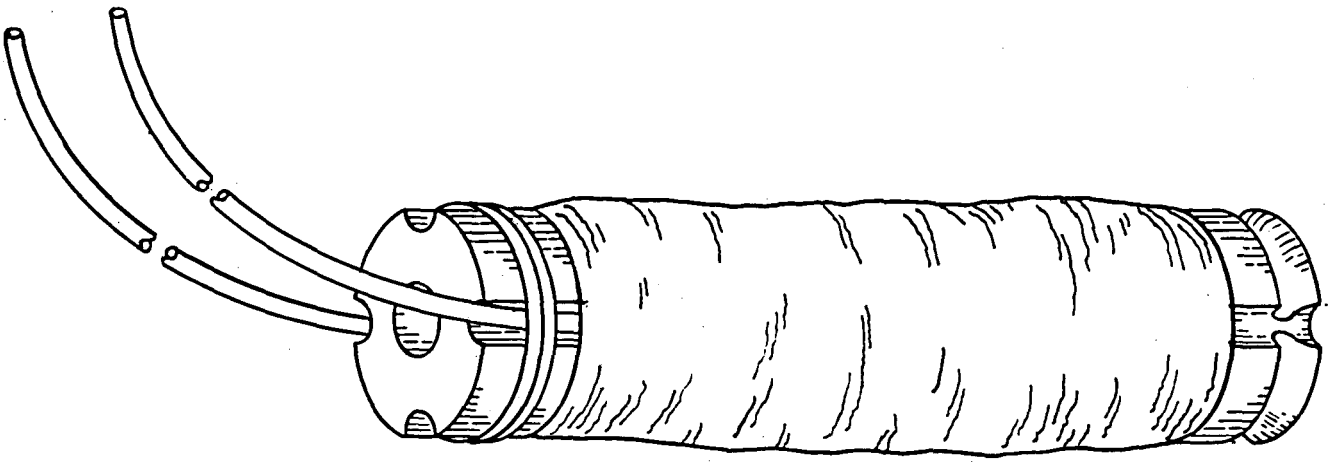
115-Type Resistor

DESCRIPTION

These resistors are non-inductively wound on ceramic spools. They are for use in rheostats in impedance bridges. The outer ends of the 212A resistor are left open for future adjustment. The outer ends of the other 212-, 213-, and 214-type resistors are spliced and soldered.

The overall dimensions of each 212- and 213-type resistors and each component 214-type resistor are approximately 1-3/4 inch long by 3/8 inch diameter. The tinned terminal leads extend approximately 2 inches from one end of the resistor.

Each 214A resistor is packaged as a single pair of resistors when furnished to the customer.



212- and 213-TYPE RESISTORS

Line No.	CODE NO.	TYPE OF WINDING	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	213A	Bifilar	1.0	0.5
2	213B	Bifilar	10.0	0.1
3	212B	Bifilar	30.6	0.5
4	212A	Bifilar	117.3 Min	
5	213C	Reverse Layer	1000.0	0.1

214-TYPE RESISTOR

CODE NO.	Description & NOMINAL RESISTANCE OHMS	TOLERANCE %
214A	Consists of a PAIR OF 213C RESISTORS, 1000 ohms each	Final resistance values should not differ from each other by more than 0.05% (or 0.5 ohm) when measured at 20° C

DESCRIPTION

These resistors are inductively wound, using mandrellated 0.001 inch diameter enameled copper-nickel resistance wire such as Advance wire. They are enclosed and sealed in phenol fabric tubes. The windings are wound on a mandrel which is removed when the windings are inserted in the tubes.

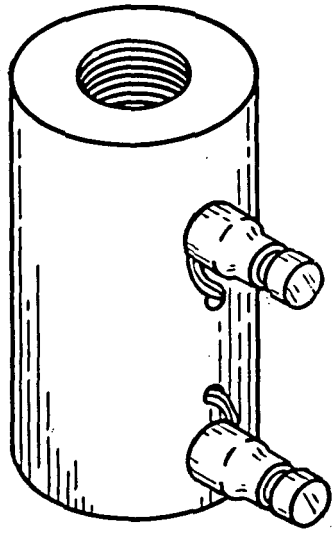
The 128A resistor is 1 inch long by 1/2 inch diameter and is provided with two terminal pins.

The 129A resistor is 1-1/4 inch long by 1/2 inch diameter and is provided with three terminal pins.

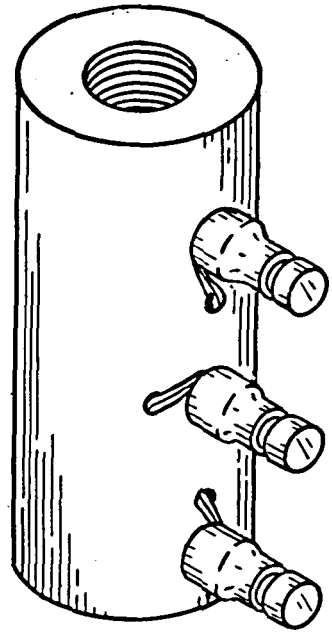
In both resistors, the dimension from the free end of the terminals to the diametrically opposite surface of the resistor is 25/32 inch.

These resistors are end mounted by means of a fiber screw 1/4 inch long by 1/4 inch diameter. The screw is furnished with the resistor.

The resistors are used in line amplifiers in the Type L Carrier Telephone System.



128A



129A

CODE NO.	TERMINAL PINS	NOMINAL RESISTANCE OHMS	TOLERANCE %	EQUIV. SHUNT CAPACITANCE AT 50 KC (mmf)
128A	1 - 2 *	7000	1	0 ±1.0
129A	1 - 2	1750	5	0 to -3.0
	2 - 3	1750	5	0 to -3.0

* Not marked on 128A - for reference only.

DESCRIPTION

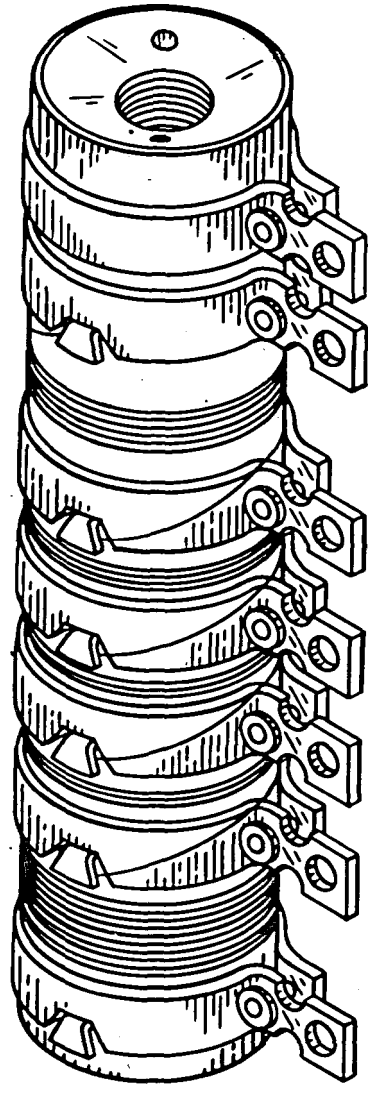
The resistor is wound on an insulated cylindrical aluminum core. It is provided with seven lug-type terminals, one of which is not connected to the windings, but is used for separate wiring connection in the apparatus of which this resistor is a component.

The resistor is inductively wound. Windings A, B, C, D, and E are wound consecutively and are connected in series. The terminal which is not connected to the winding is at the end of the core, and the outer end of winding A is connected to the adjacent terminal.

The resistor is used in the 18A thermistor in the J86213A regulated disc type rectifier. The current through the resistor is approximately 0.030 amperes.

The overall dimensions, not including terminals, are 3-1/4 inches long by 23/32 inch diameter. The terminals are in axial alignment and extend radially 7/16 inch from the resistor surface.

The core is provided with a tapped hole 1/4-28 by 11/32 inch at each end for mounting.



INDUCTIVE FIVE WINDING RESISTOR
CONSECUTIVELY CONNECTED IN SERIES
WITH SEVEN LUG TYPE TERMINALS

CODE NO.	WINDING	BETWEEN TERMINALS	NOMINAL RESISTANCE OHMS	TOLERANCE %
139A	A	5 - 6	80	5
	B	4 - 5	40	10
	C	3 - 4	20	10
	D	2 - 3	10	20
	E	1 - 2	600	2

DESCRIPTION

RESISTORS HAVING SPECIAL RESISTANCE-TEMPERATURE CHARACTERISTICS

124A RESISTOR

This resistor is inductively wound with pure nickel wire on a core of insulating material. A material requirement for temperature coefficient of resistance specified for the wire in ppm/°C is maximum 6500, minimum 5800.

The resistor is designed for maximum current of 0.060 ampere. It is used in the J86212A regulated rectifier.

The dimensions are 3-9/16 inch long by 17/32 diameter by 7/8 inch over diametrically opposite ends of terminals. A 5/8 inch long by 1/4 inch diameter screw of insulating material is furnished for mounting.

224-TYPE RESISTORS

The 224A resistor has a low reactance (bifilar) winding on a phenolic core and is suitable for use at high frequencies. The 224B resistor has an inductive winding on a phenloic core and is not suitable for use at high frequencies. They are enclosed in a phenolic tubular shell. The resistors are equipped with 0.026 inch diameter tinned axial leads which extend approximately 2 inches from each end of the body. They may be supported from these leads. The body dimensions are 1 inch long by 21/64 inch diameter.

These resistors are wound with pure nickel wire. The temperature coefficient of resistance is specified as a requirement on the completed resistor and in ppm/°C is maximum 6500, minimum 5000.

The 224A resistor is used in the J68372D Limiter-Discriminator in TJ Radio. The normal operating voltage in this application is 0.7 volts. The voltage developed across the resistor provides a temperature compensating bias for clipper doides in a limiter circuit. For satisfactory performance in this respect rather than heat dissipating capability, the power rating is limited to 0.01 watt.

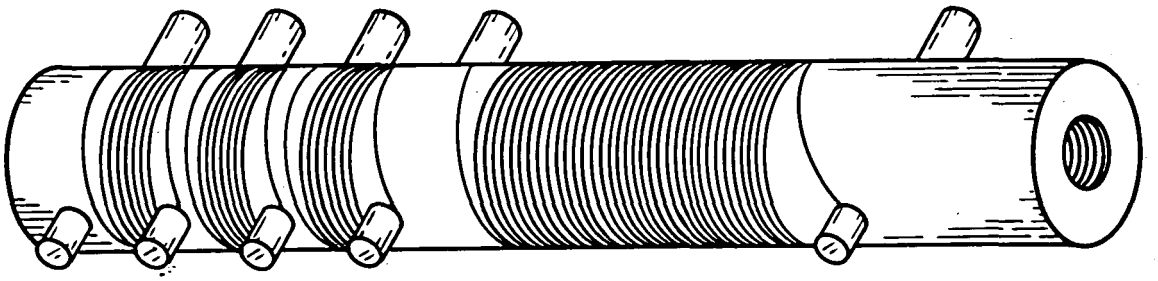
The 224B resistor is intended for use in the TL Radio System.

225A RESISTOR

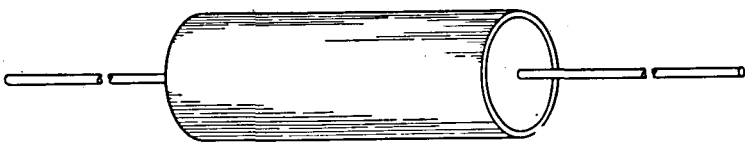
This resistor has a bifilar winding on a phenolic core and is suitable for use at high frequencies. It is covered by Mylar-backed thermosetting pressure sensitive tape. The resistor is equipped with 0.026 inch diameter tinned axial leads which extend approximately 1-7/16 inches from each end of the body. The resistor may be supported by these leads. The body dimensions are 1/2 inch long by 11/64 inch diameter.

The resistor is wound with nickel-iron wire (Ni 46%, Balance Iron). The temperature coefficient of resistance is specified as a requirement on the completed resistor and in ppm/°C is maximum 3400, minimum 2900.

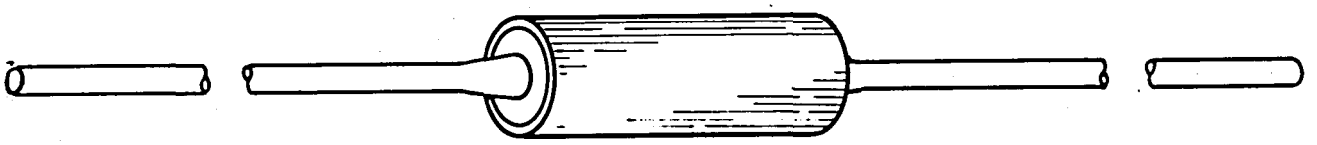
The resistor is used in the J68404B I.F.Limiter-Amplifier of the TH Radio System to compensate for changes in ambient temperature The normal operating current in this application is 80 milliamperes. For satisfactory performance in this respect rather than heat dissipating capability, the power rating should be limited to 0.06 watt.



124A Resistor



224-Type Resistors



225A Resistor

FOUR WINDING RESISTOR CONNECTED IN SERIES

CODE NO.	WINDING BETWEEN TERMINALS	NOMINAL RESISTANCE OHMS
124A	1 - 2	520
	1 - 3	580
	1 - 4	640
	1 - 5	700

NOTE: Resistance values are held to within ±2% of nominal value at 68°F.

224-TYPE RESISTORS

CODE NO.	NOMINAL RESISTANCE AT 25° C ±2% C OHMS	TOLERANCE %
224A	70	± 4 ohms
224B	35	± 5 ohms

225A RESISTOR

CODE NO.	NOMINAL RESISTANCE AT 25° C ±2% OHMS	TOLERANCE %
225A	8.8	± 4 ohms

DESCRIPTION

These resistors are like the 107-type resistor except that the code numbers apply to a specific value of resistance whereas the 107-type covers a range of resistance values. The 126-type differs from the 107- and 131-types in being enclosed in a metal shell instead of a phenol plastic shell. The 131-type resistors are adjusted to tolerances for inductance as well as resistance, as shown in the table below. The 131-type resistors have inductive and non-inductive (bifilar) winding sections connected in series.

These resistors are equipped with tinned axial terminal leads which extend 2 inches from each end of the resistor. The body dimensions are 1-1/2 inches long by 1/2 inch in diameter. They should not be supported by the lead wires. The power rating is 0.25 watt for continuous operation at 77° F ambient.

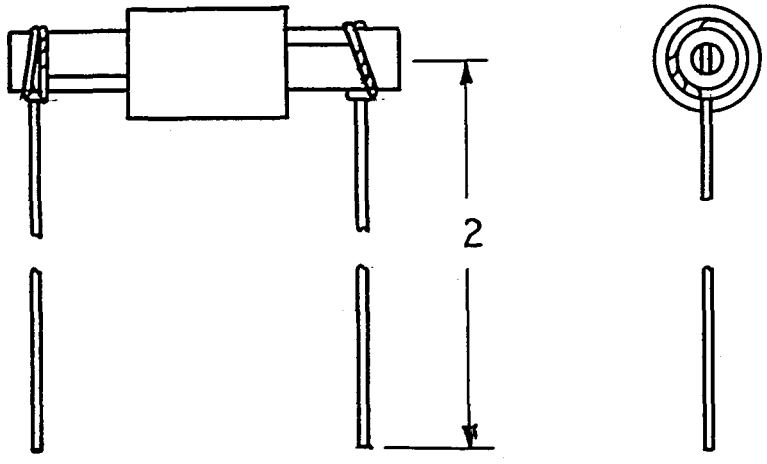
Line No.	CODE NO.	RESISTANCE OHMS	TOLERANCE %	INDUCTANCE MICRO-HEN.	TOLERANCE %
1	126A	15	±2	(Non-Inductive)	
2	126C	135	±1	(Bifilar)	
3	131A	12	±2	25	±8
4	131B	20	±2	55	±8

DESCRIPTION

The 130A resistor consists of a resistance winding on a ceramic tube equipped with two radial tinned lead wires, which extend 2 inches from the longitudinal center line of the resistor core tube. The resistive element consists of several turns of resistance tape wrapped around the core tube, covered and secured in place by electrical tape and a bakelite varnish finish.

The body dimensions are 1 inch long by 9/32 inch diameter.

This resistor is used in the 340A plug.



CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %	WATTAGE RATING
130A	72	0.1	0.5

DESCRIPTION

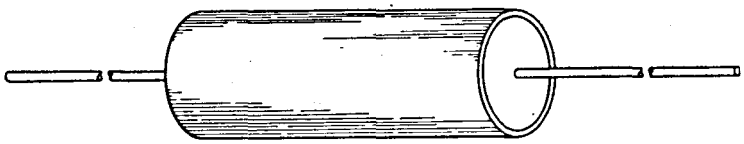
All of these resistors use the 106-type resistor structure, except that the 215-type is provided with No. 47 cord tips at the ends of the two terminal leads. They differ from the 106-type, which covers a range of resistance values, by having a specific value of resistance for each code number.

These resistors differ among themselves in types of windings as follows:

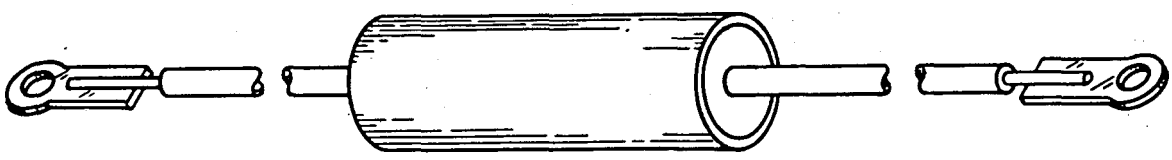
202-type	Mandrellated wire winding
210-type	Inductive winding
211-type	Inductive, copper and resistance wire windings in series
215-type	Bifilar type winding

The body dimensions are 1 inch long by 21/64 inch diameter. The resistors have 0.026 inch diameter tinned axial lead wires which extend 2 inches from each end, except the 215A which has one lead extending 2-3/16 inches and the other 1-9/16 inches from the body of the resistor.

The 210A resistor, in addition to resistance requirement, has an inductance requirement of maximum 0.20 microhenry, minimum 0.10 microhenry.



202, 210, & 211-Type Resistor



215-Type Reistor

202-, 210-, 211-, and 215-TYPE RESISTORS - AXIAL LEADS

202-TYPE RESISTOR

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
1	202A	2205	0.2

210-TYPE RESISTORS

Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %	RATING* WATTS
14	210A	16	3	0.01
15	210B	344	1	0.25

* Power rating applies at 150° F (66°C) ambient temperature. For each degree that the ambient exceeds 150° F, the power rating decreases 1%

211-TYPE RESISTORS

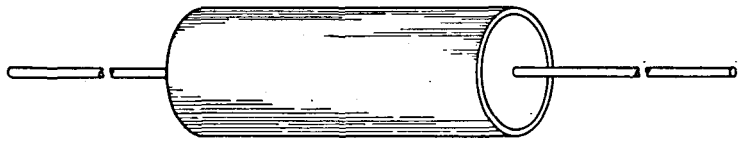
Line No.	CODE NO.	NOMINAL RESISTANCE OHMS	TOL %	NOMINAL INDUCTANCE MICROHENRIES	TOL %
30	211A	95	0.5	8.83	10
31	211B	100	0.5	9.30	10
32	211C	105	0.5	9.77	10
33	211D	110	0.5	10.23	10
34	211E	115	0.5	10.69	10
35	211F	120	0.5	11.16	10
36	211G	125	0.5	11.63	10
37	211H	130	0.5	12.09	10
38	211J	135	0.5	12.56	10
39	211K	140	0.5	13.02	10
40	211L	200	0.5	15.00	33

215-TYPE RESISTOR

CODE NO.	NOMINAL RESISTANCE OHMS	TOLERANCE %
215A	600	0.1

NOTE: The resistor is rated at 0.25 watt at 130° F (54° C) ambient.temperature. For each degree F that the ambient exceeds 130° F the power rating decreases 2-1/2%.

219A and 220A RESISTORS



Jan 1959

CODE NO.	DIMENSIONS - INCHES BODY LENGTH	BODY DIAMETER	LEADS LENGTH	LEADS DIAMETER
219A*	1	5/16	2	0.026
220A	1-1/2	1/2	2	0.037

* Dimensions are those of each unit of the pair

219A RESISTOR

CODE NO.	DESCRIPTION & NOMINAL RESISTANCE OHMS	TOLERANCE %
219A	Consists of a pair of 106A resistors, 5 ohms each.	Final resistance values do not differ from each other by more than 0.01C ohm (or 0.2%) when measured at 25° C.

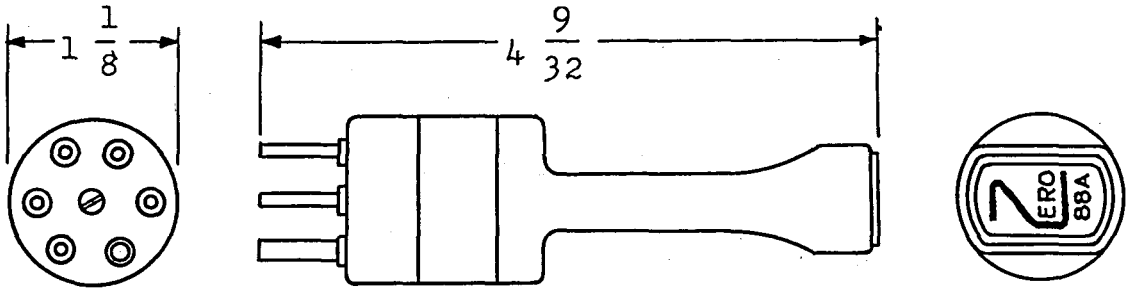
220A RESISTOR
MULTIPLE LAYER BUNCH WINDING RESISTOR

CODE NO.	DESCRIPTION & NOMINAL RESISTANCE OHMS	TOLERANCE %
220A	This is a 107A resistor of 180000 ohms	1

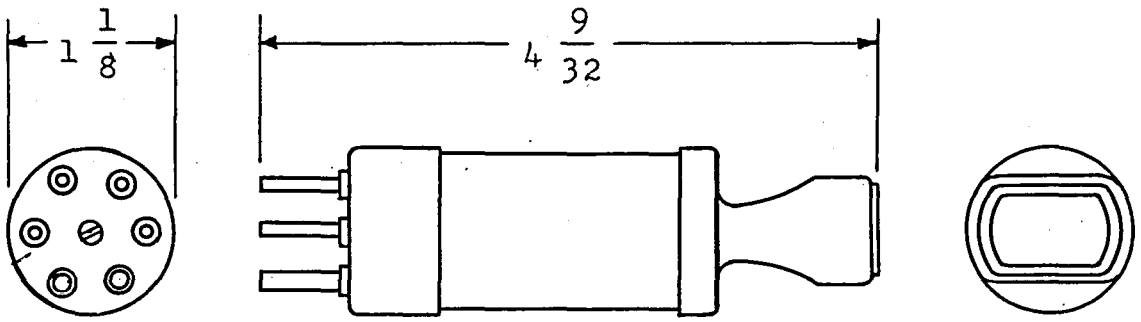
NOTE: Power rating is 1.0 watt at 150° F (66° C) ambient temperature. For each degree F that the ambient exceeds 150° F the power rating decreases 1%.

DESCRIPTION

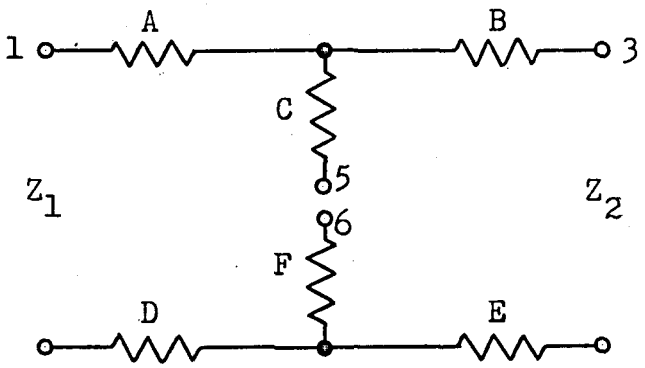
These resistors are mounted on electron tube type bases having six terminal pins. The terminal pins of the 88A are strapped so as to provide zero attenuation when in circuit. The other 88-type resistors have a spool containing six windings mounted on the base. The windings form an "H" section and provide attenuation as shown. They are provided with handles to facilitate plugging into a No. 144B electron tube socket



88A



88B, C, D, E, & F



$Z_1 = Z_2 = 600$ Ohms

Circuit provides strap from 5 to 6

Prong Numbers not marked

A = B = D = E

C = F

Clockwise, large prongs are 3 & 4 respectively.

88-TYPE RESISTORS - ELECTRON TUBE BASE

Line No.	CODE NO.	RESISTANCE - OHMS WDG. A	RESISTANCE - OHMS WDG. C	TOLERANCE %	ATTENUATION DB
1	88A	0	Infinite	---	0
2	88B	17.3	2594	±1	1
3	88C	34.4	1292	±1	2
4	88D	51.4	853	±1	3
5	88E	67.9	629	±1	4
6	88F	84.1	493	±1	5

DESCRIPTION

The 89-type resistors consist of wire wound resistor units potted with microcrystalline wax in electron tube type bases having six terminal pins. They are connected in circuit by inserting in a No. 144-type electron tube socket.

These resistors are used as interchangeable components of pads and equalizers, and the attenuations listed in the following tables are the attenuations introduced by network, or the overall circuit when the 89-type resistors are in circuit.

The resistors are for use in Type A Carrier and Type A2 Video Systems.

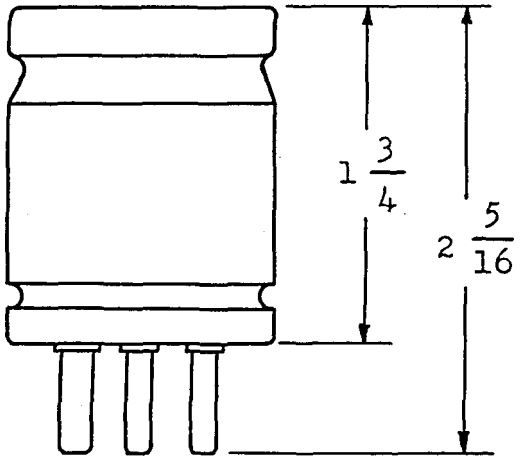


FIG. A

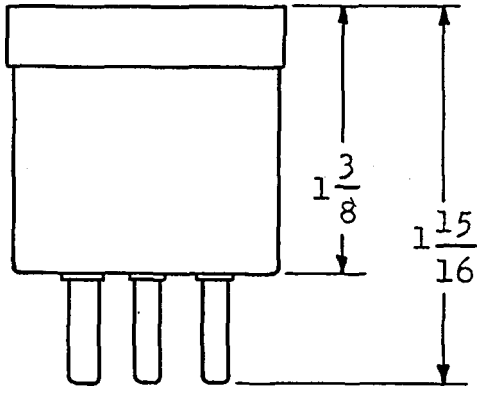
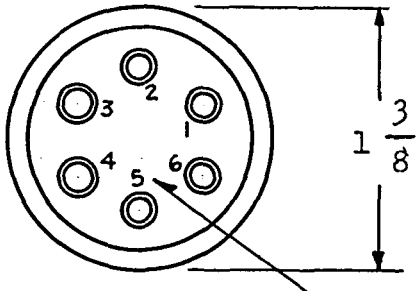
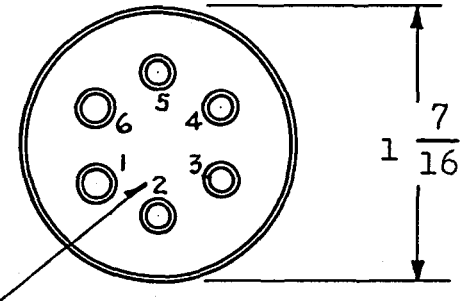


FIG. B





Numbers are for reference only and do not in all cases agree with associated socket terminal designations.

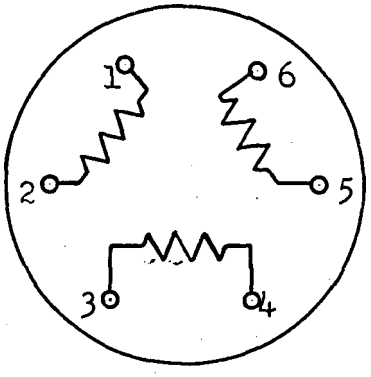


FIG. 1

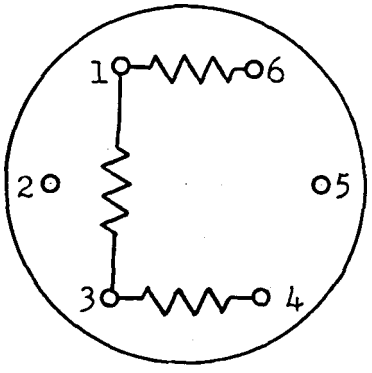


FIG. 2

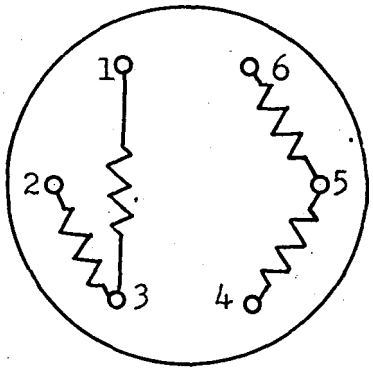


FIG. 3

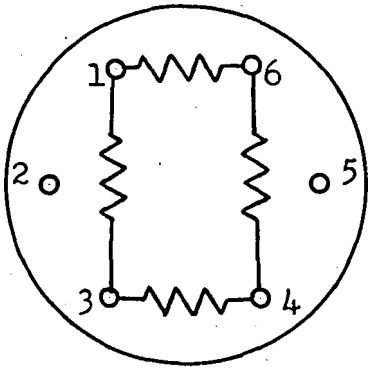


FIG. 4

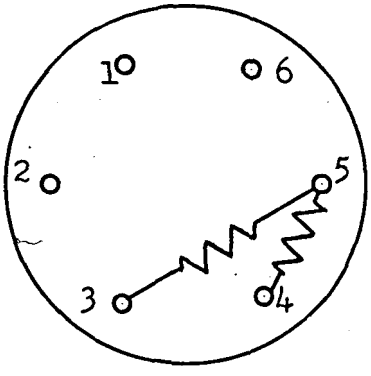


FIG. 5

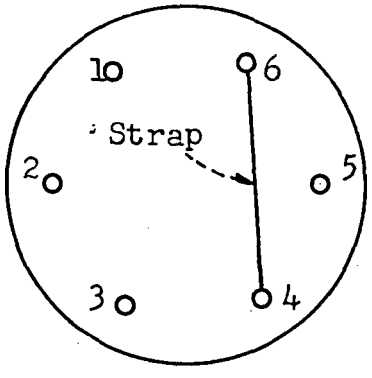


FIG. 6

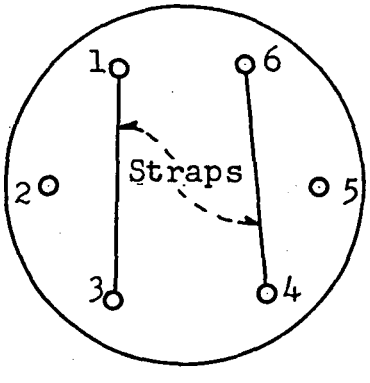


FIG. 7

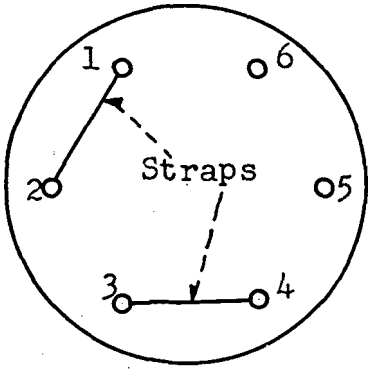


FIG. 8

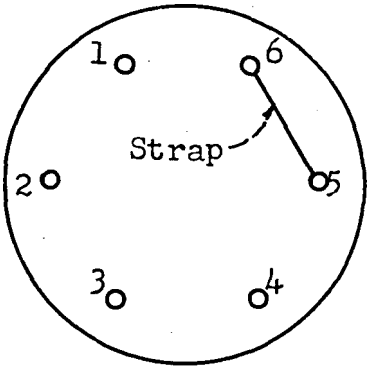


FIG. 9

RESISTORS CONNECTED TO TERMINAL PINS PER FIGURE 1 CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 2	3 - 4	5 - 6	ATTENUATION DB*
1	89C	17.9	17.9	10000 **	0.5
2	89D	27.5	27.5	6545 **	0.75
3	89E	36.5	36.5	4931 **	1.0
4	89F	46.6	46.6	3859 **	1.25
5	89G	56.5	56.5	3186 **	1.5
6	89H	67.2	67.2	2687	1.75
7	89J	77.75	77.75	2315	2.0
8	89K	89.0	89.0	2021	2.25
9	89L	100.3	100.3	1796	2.5
10	89M	111.9	111.9	1609	2.75
11	89N	123.8	123.8	1454	3.0
12	89P	136.5	136.5	1319	3.25
13	89R	149.1	149.1	1207	3.5
14	89S	162.0	162.0	1110	3.75
15	89T	174.8	174.8	1030	4.0
16	89U	189.0	189.0	952.1	4.25
17	89W	203.7	203.7	883.4	4.5
18	89Y	218.4	218.4	823.8	4.75
19	89AA	233.4	233.4	771.2	5.0
20	89AB	248.9	248.9	723.2	5.25
21	89AC	264.9	264.9	679.5	5.5
22	89AD	281.9	281.9	638.6	5.75
23	89AE	298.9	298.9	602.2	6.0
24	89AF	316.3	316.3	569.2	6.25
25	89AG	334.1	334.1	538.8	6.5
26	89AH	352.6	352.6	510.6	6.75
27	89AJ	371.1	371.1	484.3	7.0
28	89AK	391.4	391.4	459.9	7.25
29	89AL	411.4	411.4	437.5	7.5
30	89AM	432.4	432.4	416.3	7.75
31	89AN	453.5	453.5	396.9	8.0
32	89AP	475.7	475.7	378.4	8.25
33	89AR	498.3	498.3	361.2	8.5
34	89AS	521.8	521.8	345.0	8.75
35	89AT	545.5	545.5	330.0	9.0

Resistance values are held within ±2% unless otherwise indicated.

*Obtained only when associated with other resistors in miscellaneous pads and equalizers, in 600 ohm circuits.

** Resistance values are held within ±5%.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 1
CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 2	3 - 4	5 - 6	ATTENUATION DB*
1	89AU	571.0	571.0	315.2	9.25
2	89AW	595.5	595.5	302.3	9.5
3	89AY	622.0	622.0	289.4	9.75
4	89BA	649.0	649.0	277.3	10.0
5	89BB	703.9	703.9	255.7	10.5
6	89BC	764.4	764.4	235.4	11.0
7	89BD	827.5	927.5	217.5	11.5
8	89BE	894.3	894.3	201.2	12.0
9	89BF	965.0	965.0	186.5	12.5
10	89BG	1040.0	1040.0	173.1	13.0
11	89BH	1119.0	1119.0	160.8	13.5
12	89BJ	1203.0	1203.0	149.6	14.0
13	89BK	1292.0	1292.0	139.3	14.5
14	89BL	1387.0	1387.0	129.8	15.0
15	89BM	1487.0	1487.0	121.1	15.5
16	89BN	1593.0	1593.0	113.0	16.0
17	89BP	1705.0	1705.0	105.6	16.5
18	89BR	1824.0	1824.0	98.7	17.0
19	89BS	1950.0	1950.0	92.3	17.5
20	89BT	2083.0	2083.0	86.4	18.0
21	89BU	2224.0	2224.0	80.9	18.5
22	89BW	2374.0	2374.0	75.8	19.0
23	89BY	2532.0	2532.0	71.1	19.5
24	89CA	2700.0	2700.0	66.7	20.0
25	89CB	2878.0	2878.0	62.5	20.5
26	89CC	3066.0	3066.0	58.7	21.0
27	89CD	3266.0	3266.0	55.1	21.5
28	89CE	3477.0	3477.0	51.8	22.0
29	89CF	5030.0	5030.0	35.75	25.0
30	89CG	9190.0	9190.0	19.59	30.0
31	89CH	8.76	8.76	20550.0	.25
32	89CJ	676.6	676.6	266.2	10.25
33	89CK	734.5	734.5	245.0	10.75
34	89CL	795.6	795.6	226.2	11.25
35	89CM	860.5	860.5	209.2	11.75

Resistance values are held within ±2% unless otherwise indicated.

* Obtained only when associated with other resistors in miscellaneous pads and equalizers, in 600 ohm circuits.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 1
CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 2	3 - 4	5 - 6	ATTENUATION DB*
1	89CN	929.1	929.1	193.7	12.25
2	89CP	1002.0	1002.0	179.6	12.75
3	89CR	1079.0	1079.0	166.8	13.25
4	89CS	1161.0	1161.0	155.1	13.75
5	89CT	1248.0	1248.0	144.2	14.25
6	89CU	1339.0	1339.0	134.4	14.75
7	89CW	1436.0	1436.0	125.3	15.25
8	89CY	1539.0	1539.0	116.9	15.75
9	89DA	1647.0	1647.0	109.2	16.25
10	89DB	1764.0	1764.0	102.0	16.75
11	89DC	1885.0	1885.0	95.5	17.25
12	89DD	2015.0	2015.0	89.36	17.75
13	89DE	2152.0	2152.0	83.66	18.25
14	89DF	2298.0	2298.0	78.3	18.75
15	89DG	2452.0	2452.0	73.42	19.25
16	89DH	2614.0	2614.0	68.84	19.75
17	89DJ	3166.0	3166.0	56.86	21.25
18	89DK	3938.0	3938.0	45.7	23.0
19	89FP	7236.0	7236.0	24.9	28.0
20	89FR	8155.0	8155.0	22.1	29.0
21	89FS	16570.0	16570.0	10.9	35.0
22	89FT	2879.0	2879.0	64.5	20.25
23	89FU	2971.0	2971.0	60.6	20.75
24	89FW	3372.0	3372.0	53.4	21.75
25	89FY	3585.0	3585.0	50.2	22.25
26	89GA	3700.0	3700.00	48.6	22.50
27	89GB	3818.0	3818.0	47.2	22.75
28	89GC	5685.0	5685.0	31.7	26.0
29	89GD	4455.0	4455.0	40.4	24.0
30	89GE	6416.0	6416.0	28.05	27.0

Resistance values are held within ±2% unless otherwise indicated.

* Obtained only when associated with other resistors in miscellaneous pads and equalizers, in 600 ohm circuits.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 2
CONSTRUCTION PER FIGURE B

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 3	1 - 6	3 - 4	ATTENUATION DB
1	89DM	8.66	1300	1300	1 Note 1
2	89DN	17.40	657	657	2 Note 1
3	89DP	35.70	332	332	4 Note 1
4	89DR	67.30	196	196	7 Note 1
5	89DS	107.00	145	145	10 Note 1
6	89FD*	1423.00	1925	1925	10 Note 2
7	89FE*	4950.00	1222	1222	20 Note 2
8	89FF*	15796.00	1065	1065	30 Note 2

Resistance values are held to within ±1% unless otherwise indicated.

* Resistance values are held to within ±0.25%.

NOTES:

1. Obtained when used in 75 ohm unbalanced circuit in A2 Video Amplifier equipment.

2. Obtained when used in 1000 ohm unbalanced circuit in A2 Video Amplifier equipment.

RESISTORS CONNECTED TO TERMINAL PINS PER FIGURE 3 CONSTRUCTION PER FIGURE B

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 3	2 - 3	4 - 5	5 - 6	ATTENUATION DB
1	89DU	210	470	4770	2120	1 Note 1
2	89DW	320	400	3125	2500	2 Note 1
3	89DY	400	335	2500	2985	3 Note 1
4	89EA	460	280	2170	3570	4 Note 1
5	89EB	525	228	1905	4385	5 Note 1
6	89EC	590	185	1695	5400	6 Note 1
7	89ED	650	146	1538	6840	7 Note 1
8	89EE	710	110	1412	9090	8 Note 1
9	89EF	765	80	1309	12500	9 Note 1
10	89EG	825	50	1213	20000	10 Note 1
11	89EH	880	23	1140	open	11 Note 1
12	89EJ	926	0*	1080	open	12 Note 1
13	89EL	450	945	2220	1058	1 Note 2
14	89EM	780	880	1283	1135	2 Note 2
15	89EN	1040	750	962	1333	3 Note 2
16	89EP	1290	630	775	1587	4 Note 2
17	89ER	1500	530	667	1886	5 Note 2
18	89ES	1700	430	588	2328	6 Note 2
19	89ET	1910	345	523	2900	7 Note 2
20	89EU	2100	260	476	3845	8 Note 2
21	89EW	2330	190	429	5260	9 Note 2
22	89EY	2550	125	392	8000	10 Note 2
23	89FA	2770	55	361	18180	11 Note 2
24	89FB	3030	0*	330	open	12 Note 2

Resistance values are held to within ±1% unless otherwise indicated.

* Resistance values are 0.03 ohms.

NOTES:

1. Obtained when used in Bulge Equalizer in A2 Video Amplifier equipment.
2. Obtained when used in Slope Equalizer in A2 Video Amplifier equipment.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 4
CONSTRUCTION PER FIGURE B

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 3	4 - 6	3 - 4	1 - 6	A.
1	89FH	6.33	6.33	1902.0	1902.0	1
2	89FJ	12.77	12.77	960.0	960.0	2
3	89FK	26.22	26.22	486.0	486.0	4
4	89FL	49.25	49.25	287.7	287.7	7
5	89FM	78.20	78.20	211.7	211.7	10

* Obtained when used in 110 ohm balanced circuit in A2 Video Amplifier equipment.

Resistance values are held to eithin ±0.3%.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 5
CONSTRUCTION PER FIGURE B

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 4 - 5	3 - 5	TOLERANCE %	ATTENUATION DB
20	89FN	75	1000	Note 1	Note 2

NOTES:
1. Tolerance between terminals 4 - 5 is 1% and tolerance between terminals 3 - 5 is 1.5%.
2. This resistor is used in the A2 Video System for testing and is not used in transmission.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 6
CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 4 - 6	MAXIMUM TOLERANCE OHMS	ATTENUATION DB
35	89DL**	0	0.008	zero
36	89DT**	0	0.008	zero
37	89EK**	0	0.008	zero
38	89FC**	0	0.008	zero

**Contains no resistor units.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 7
CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 3	4 - 6	MAXIMUM TOLERANCE OHMS	ATTENUATION DB
1	89FG*	0	0	0.008	zero

* Contains no resistor units.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 8
CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 2	3 - 4	5 - 6	MAXIMUM TOLERANCE OHMS	ATTENUATION DB**
10	89A*	0	0	Infinite	0.008	zero

* Contains no resistor units.

** Obtained only when associated with other resistors in miscellaneous pads and equalizers, in 600 ohm circuits.

RESISTORS CONNECTED TO TERMINAL PINS
PER FIGURE 9
CONSTRUCTION PER FIGURE A

Line No.	CODE NO.	NOMINAL RESISTANCE BETWEEN TERMINALS OHMS 1 - 2	3 - 4	5 - 6	MAXIMUM TOLERANCE OHMS	ATTENUATION DB**
20	89B*	Infinite	Infinite	0	0.008	Infinite

* Contains no resistor units

** Obtained only when associated with other resistors in miscellaneous pads and equalizers, in 600 ohm circuits.

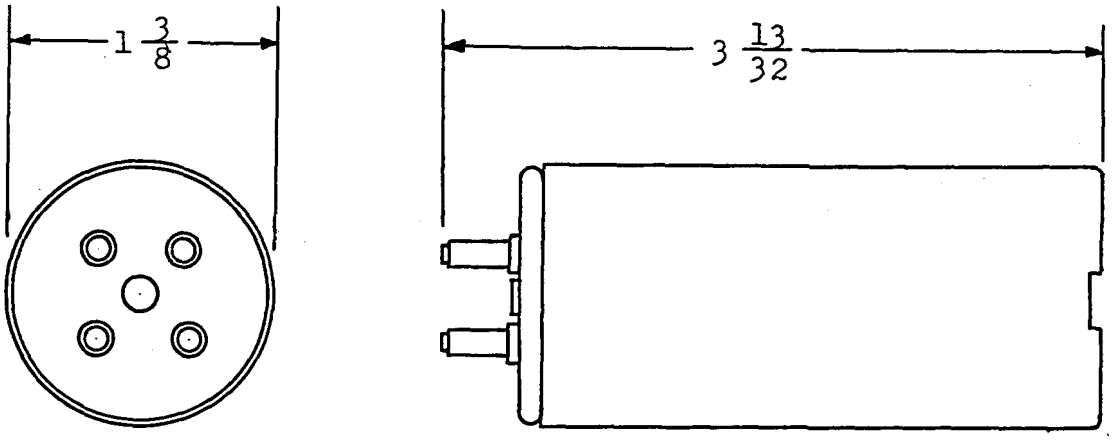
DESCRIPTION

98-type resistors are form wound with copper-nickel resistance wire, such as Advance, having a temperature coefficient of resistance of maximum ±50 PPM/°C. They are assembled in a phenolic case mounted on an electron tube type base having four terminal pins. The resistors are connected in circuit by inserting them in bayonet type electron tube sockets such as the No. 100R Socket.

The resistors are used in toll systems. They are used in place of electron tubes while adjusting filament circuits which are connected to voltage regulated filament batteries.

The windings are connected to the two filament terminals of the base. There are no connections to the grid and plate terminals.

The power rating of the 98-type resistor is 7.0 watts.



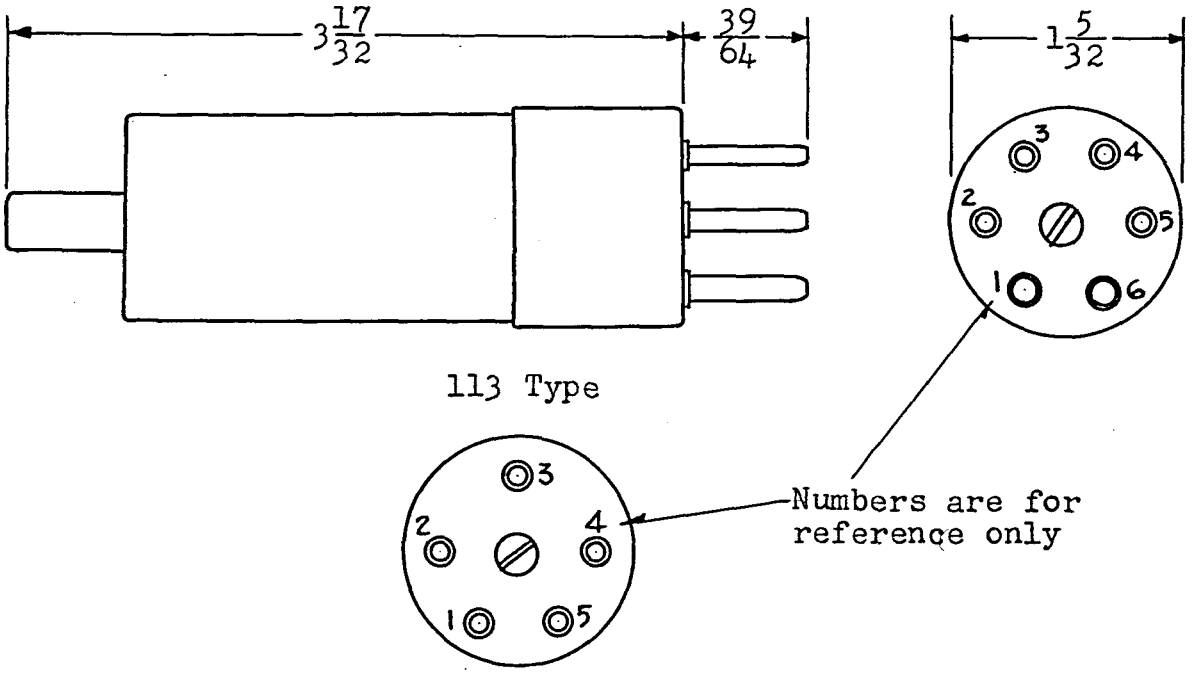
Line No.	CODE NO.	RESISTANCE OHMS	TOLERANCE %	SUBSTITUTES FOR ELECTRON TUBE
1	98A	4.5	1	101 & 104 (1 amp)
2	98B	8.5	1	101F, 101J, 102L
3	98C	4.0	1	102F
4	98D	2.1	5	102 (1 amp)
5	98F	16.9	0.5	101L

DESCRIPTION

The 113- and 114-type resistors consist of 84-type vitreous enameled resistors enclosed in phenolic cases assembled on electron tube type bases. The 113A resistor base has 6 terminal pins and the resistor is connected in circuit by inserting it in a No. 144B electron tube socket. The 114A and 114B resistor bases have 5 terminal pins and the resistors are connected in circuit by inserting them in No. 141A electron tube sockets.

The resistors are used in J and K Carrier Telephone Systems to adjust heater currents to proper values. For this purpose, the 113A, 114A, and 114B resistors are used as substitutes for the 310A, 311A, and 338A electron tubes, respectively.

The resistor units of the 113A, 114A, and 114B are the 84D, E, and F resistors, respectively. These resistor units are wound with copper-nickel resistance wire, such as Advance, having a maximum temperature coefficient of resistance of ±50 PPM/°C.



114 Type (Otherwise same as 113 Type)

CODE NO.	TERMINALS*	RESISTANCE-OHMS	TOLERANCE %
113A	1 - 6	31.2	1
114A	1 - 5	15.6	1
114B	1 - 5	20.0	1

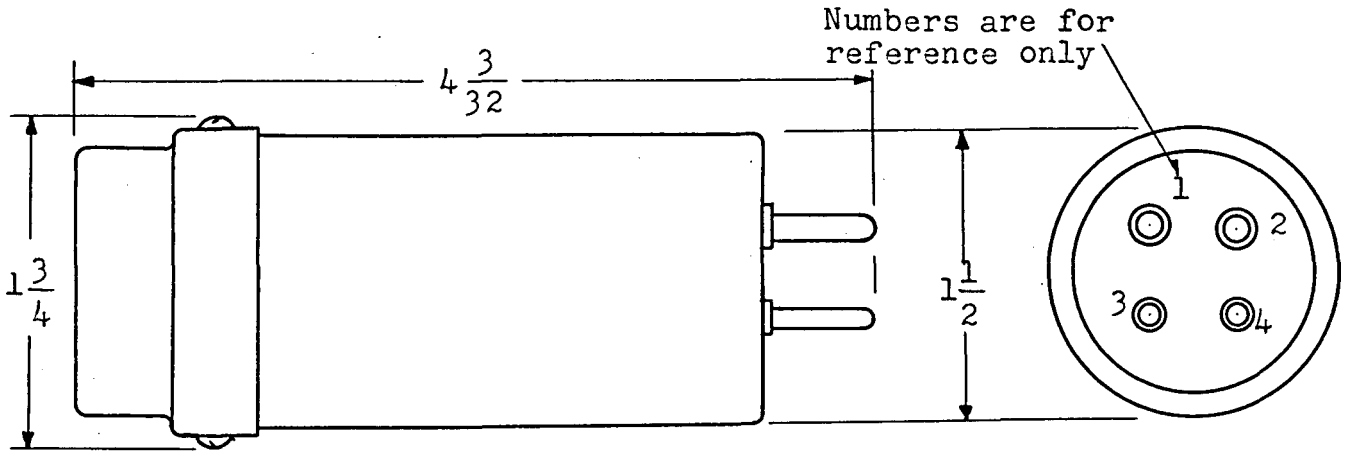
* There are no connections to the other terminals of the base.

DESCRIPTION

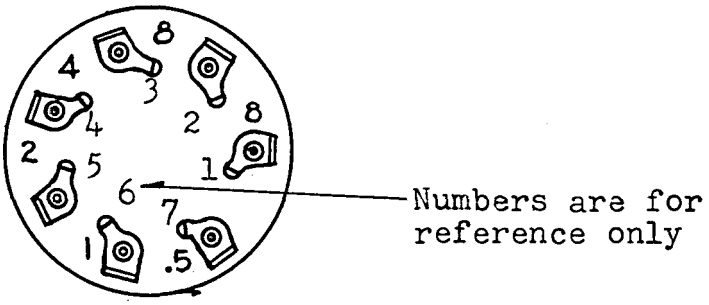
The 116A resistor is a tapped resistor enclosed in a ceramic shell provided with a removable metal cover. It is arranged to mount in a No. 143B electron tube socket, or similar type, with resistance across the filament contacts and has no connection to plate and grid contacts.

The total resistance is 23.5 ohms and by strapping the terminals, resistance may be varied in 0.5 ohms steps from 0 to 23.5 ohms. Resistance values are held within limits of ±5%. It is capable of dissipating 4.2 watts continuously.

The 116A resistor is intended for use in the Type "J" Carrier Telephone System in heater circuits.



116A Resistor

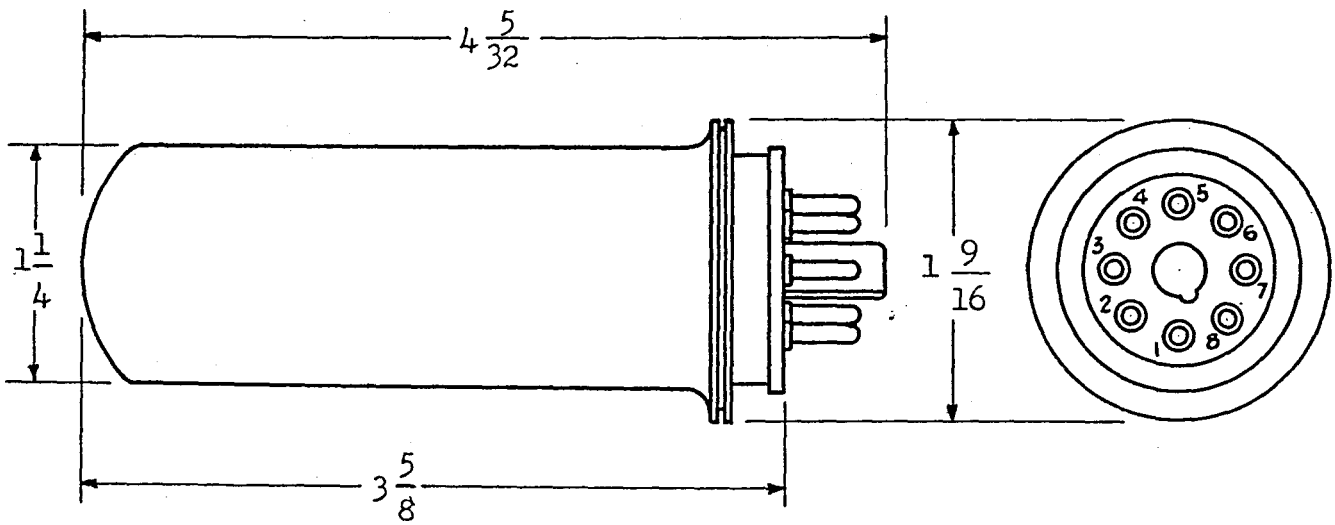


116A Resistor with Cover removed

CODE NO.	NOMINAL RESISTANCE OHMS	BETWEEN TOP TERMINALS
116A	8	1 - 2
	8	2 - 3
	4	3 - 4
	2	4 - 5
	1	5 - 6
	0.5	6 - 7

DESCRIPTION

The 125A resistor consists of three vitreous enameled type resistors enclosed in a metal shell and mounted on an octal electron tube base. It is put into circuit by mounting in a KS-13364, L2 or similar type electron tube socket. The three resistors R1, R2, and R3 are connected to the terminals in the tube base as shown in the table. They are KS-8512, L3A type resistors with notched terminals. R2 and R3 are wound with copper-nickel wire, such as Advance or equivalent, and R1 is wound with iron free nickel-chromium wire, such as Nichrome V or equivalent.



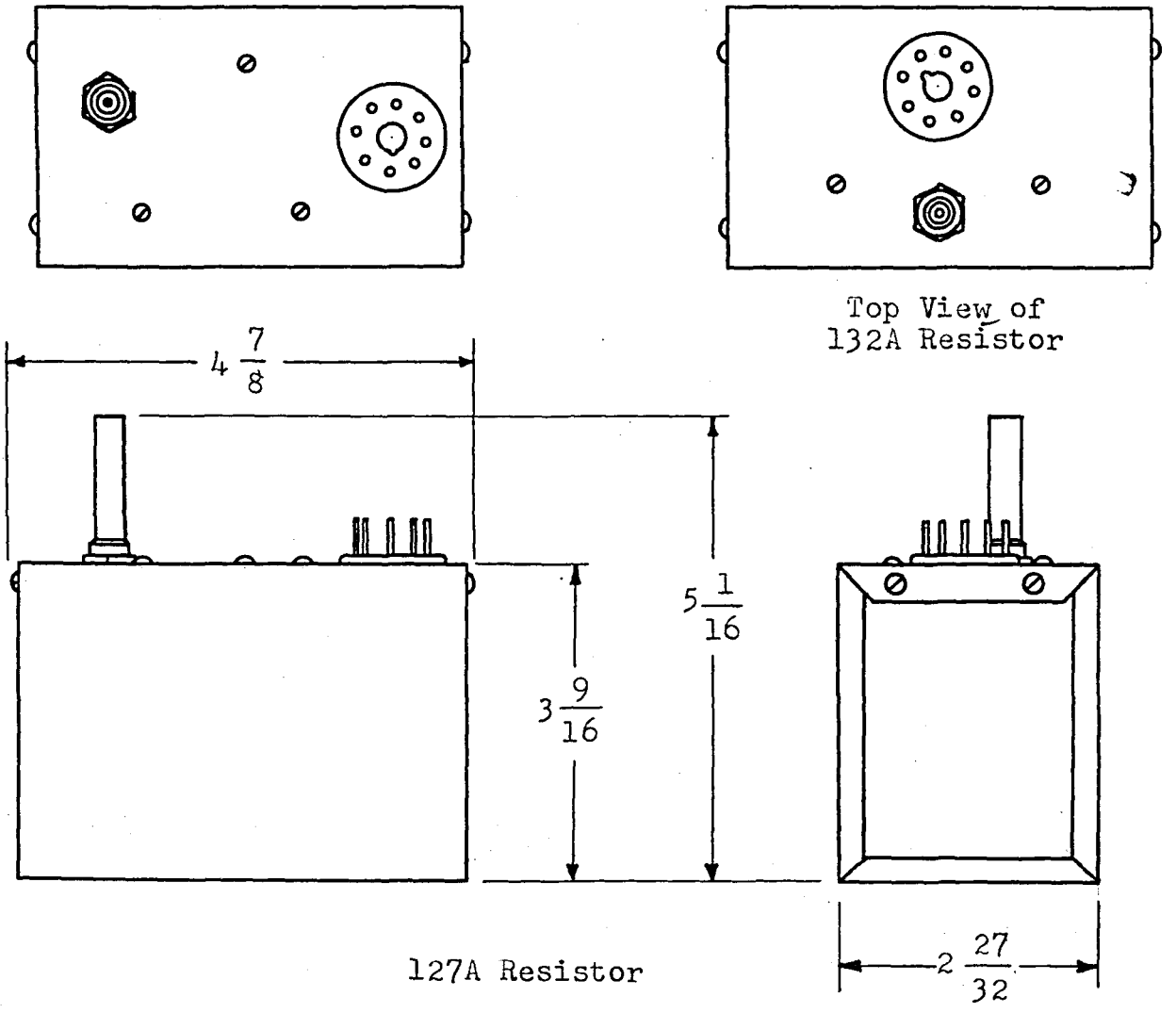
125A Resistor

CODE NO.	TERMINALS	R NUMBER	RESISTANCE OHMS	TOLERANCE %
125A	1 - 5	R1	4000	±5
	2 - 3	R2	15	±5
	7 - 8	R3	15	±5

DESCRIPTION

The 127A and 132A resistors consist of several D167000-type wire wound resistors having ceramic cores and black enamel moisture-resistant finish. The 127A resistor also uses a KS-13490 L2 fixed composition resistor. They are assembled in a rectangular metal can provided with an 8 pin electron tube base designated KS-13871 plug and a 343B coaxial plug. While the 127A and 132A resistors use the same size can and have the same plugs on the same side of the can, the relative positions of the two plugs differ.

The 127A resistor is a dummy amplifier load and the 132A resistor is a dummy regulator load, and consume the same power as an amplifier and a regulator, respectively. When the circuit of an amplifier and regulator are not being used for transmission, the dummy loads are used in place of the amplifier and regulator to conserve the latter units while maintaining the proper voltages and currents on the other amplifier and regulator on the repeater panel.



127A and 132A RESISTORS - ELECTRON TUBE BASE

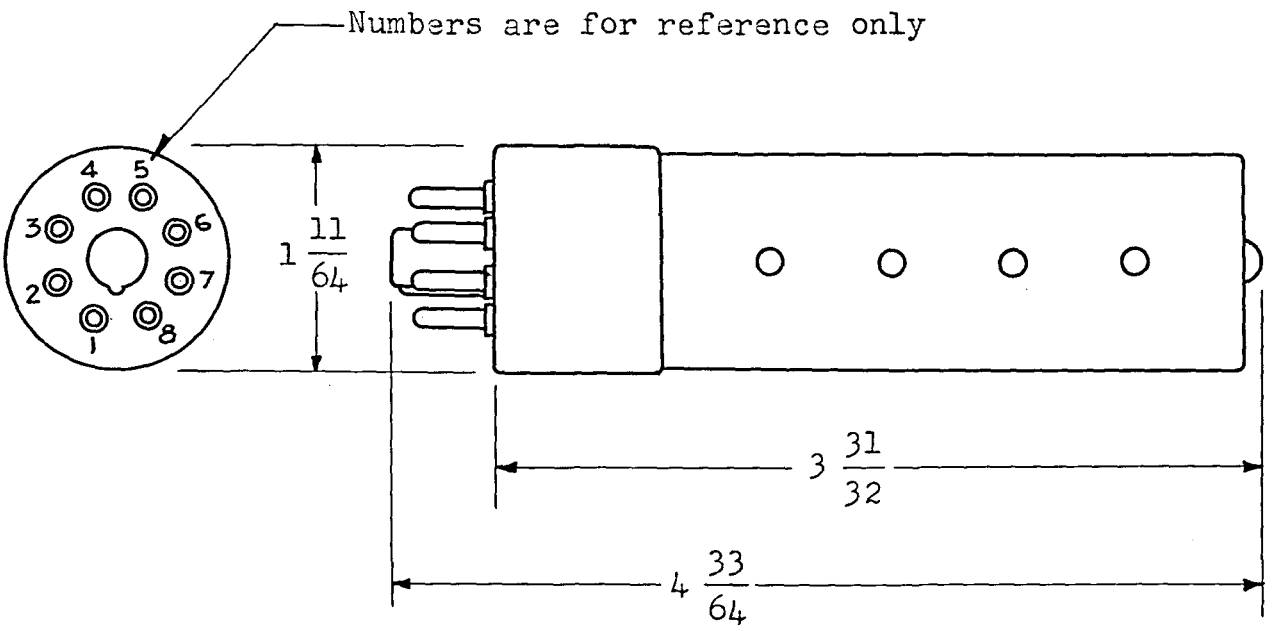
		D167000 TYPE						KS-13490	
		R1		R2		R3		R4	
CODE NO.	FIG NO.	OHMS	TOL %	OHMS	TOL %	OHMS	TOL %	OHMS	TOL %
127A	1	15	1	4800	2	15	1	100	10
132A	2	15	1	18000	2				

DESCRIPTION

The 135A resistor consists of a vitreous enameled type resistor enclosed in a phenol fiber shell assembled on an electron tube octal base. The resistor is connected to terminal pins 2 and 7. There are no connections to the six other pins.

The power rating is 7.5 watts at 104° F ambient temperature.

The 135A resistor is used to substitute for the No. 375A electron tube while adjusting heater currents to their proper values in the toll systems telephone repeater program transmission voice amplifier circuit.

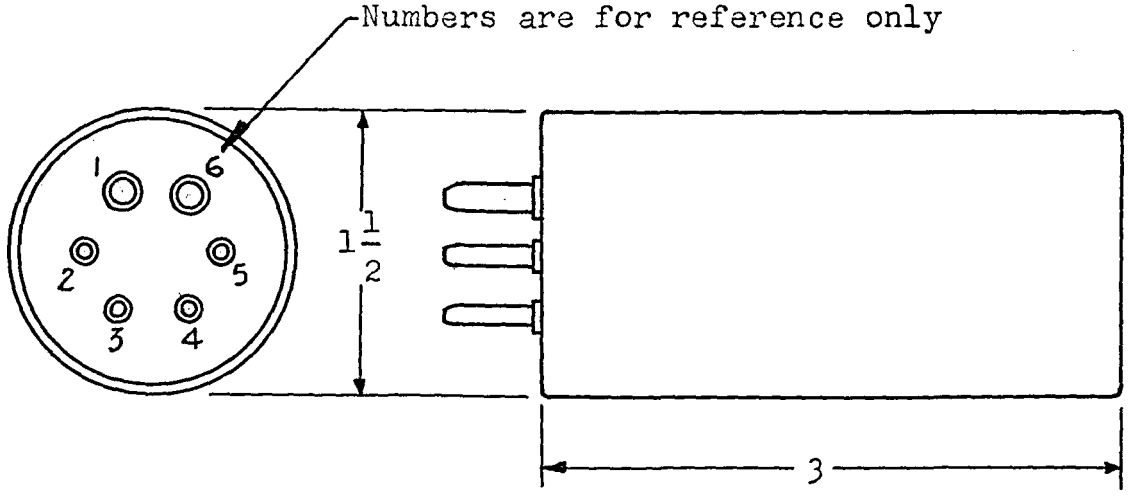


CODE NO.	RESISTANCE VALUE OHMS	TOLERANCE %
135A	62.4	±1

DESCRIPTION

The 148A and B resistors each consist of three resistors enclosed in a housing of insulating material, mounted on an electron tube type base equipped with 6 terminal pins. They are connected in circuit by inserting in a six terminal electron tube socket such as the No. 144B electron tube socket. They are used as 75 ohm unbalanced resistance pads in A2 Video Amplifier equipment.

The component resistors are vitreous enameled resistors manufactured in accordance with specification KS-13657 and have notched terminals. They have essentially non-inductive windings of the Ayrton Perry type and are wound with essentially iron free nickel-chromium resistance wire such as Nichrome V.



CODE NO.	DB VALUE	RESISTANCE BETWEEN TERMINALS OHMS 1 - 3	1 - 6	3 - 4	TOLERANCE %
148A	10	107	144	144	1.5
148B	20	371	92	92	1.5