NOTE: The document identifier and heading has been changed on this page to reflect that this is a performance specification. There are no other changes to this document. The document identifier on subsequent pages has not been changed, but will be changed the next time this document is revised.

INCH-POUND

MIL-PRF-83401F
9 October 1989
SUPERSEDING
MIL-R-83401E
9 March 1987

PERFORMANCE SPECIFICATION

RESISTOR NETWORKS, FIXED, FILM, AND CAPACITOR-RESISTOR NETWORKS, CERAMIC CAPACITOR AND FIXED FILM RESISTORS, GENERAL SPECIFICATION FOR

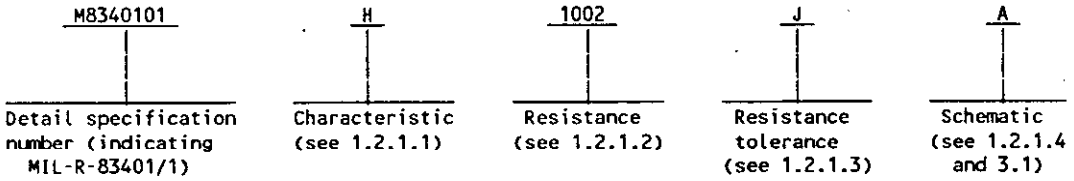
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for hermetically sealed (see 3.10) and nonhermetically sealed networks. These networks consist entirely of fixed, film resistors or, fixed film resistors and multilayer ceramic capacitors. They are primarily intended for use in electronic circuits.

1.2 Classification.

1.2.1 Military part number. Networks specified herein (see 3.1) shall be identified by a military part number which shall consist of the basic number of the detail specification and a coded number. Each detail specification covers a different network style. The number shall be coded to provide information concerning the network characteristic, resistance value, resistance tolerance, and schematic. The military part number shall be in the following form with a coded number derived as indicated:



1.2.1.1 Characteristic. The characteristic is identified by the single letter C, H, K, M, R, V, or Y in accordance with table I.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Electronics Supply Center, ATTN: DESC-ELDM, 1507 Wilmington Pike, Dayton, OH 45444-5765, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

TABLE I. Characteristics.

Test or condition		Symbol							Units
		Y 1/	C 1/	V 2/	H 2/	K 2/	M 2/	R 2/	
Resistance-temperature characteristic (see 3.13) Tracking to the reference element		±5 ±1 3/	±50 ±5 3/	±50 ±5 3/	±50 4/	±100 4/	±300 4/	±25 ±5 3/	PPM/°C
Maximum ambient temperature at rated wattage (see 3.5)		70	70	70	70	70	70	70	Degrees Celsius
Maximum ambient temperature at zero power derating (see figure 2)		125	125	125	125	125	125	125	
Thermal shock (see 3.7) and Power conditioning (see 3.8)	ΔR ΔRatio	±.02 ±.01	±0.25 ±.03	±0.25 ±.03	±0.5 4/	±0.7 4/	±0.7 4/	±.08 ±.04	Maximum percent change in resistance (0.01 ohm additional allowed for measurement error) and, when applicable, maximum percent change in resistance ratio
Low temperature operation (see 3.14)	ΔR ΔRatio	±.02 ±.01	±.10 ±.02	±.10 ±.02	±0.1 4/	±0.25 4/	±0.5 4/	±.03 ±.02	
Short-time overload (see 3.15)	ΔR ΔRatio	±.02 ±.01	±.10 ±.02	±.10 ±.02	±0.1 4/	±0.25 4/	±0.5 4/	±.03 ±.02	
Terminal strength (see 3.16)	ΔR ΔRatio	±.01 ±.01	±.10 ±.03	±.10 ±.03	±0.25 4/	±0.25 4/	±0.25 4/	±.03 ±.02	
Resistance to soldering heat (see 3.19)	ΔR ΔRatio	±.01 ±.01	±.10 ±.02	±.10 ±.02	±0.1 4/	±0.25 4/	±0.25 4/	±.05 ±.02	
Moisture resistance (see 3.20)	ΔR ΔRatio	±.02 ±.01	±.20 ±.02	±.20 ±.02	±0.4 4/	±0.5 4/	±0.5 4/	±.05 ±.02	
Shock (specified pulse) (see 3.21)	ΔR ΔRatio	±.02 ±.02	±.25 ±.03	±.25 ±.03	±0.25 4/	±0.25 4/	±0.25 4/	±.03 ±.02	

See footnotes at end of table.

TABLE I. Characteristics - Continued.

Test or condition		Symbol							Units
		Y 1/	C 1/	V 2/	H 2/	K 2/	M 2/	R 2/	
Vibration, high frequency (see 3.22)	ΔR ΔRatio	±.02 ±.02	±.25 ±.03	±.25 ±0.3	±0.25 4/	±0.25 4/	±0.25 4/	±.03 ±.02	Maximum percent change in resistance (0.01 ohm additional allowed for measurement error and, when applicable, maximum percent change in resistance ratio
Life (see 3.23)	ΔR ΔRatio	±.05 ±.025	±.10 ±.03	±.10 ±.03	±0.5 4/	±0.5 4/	±2.0 4/	±.1 ±.03	
25°C power rating (see 3.23.1)	ΔR ΔRatio	±.05 ±.025	±.10 ±.03	±.10 ±.03	±0.5 4/	±0.5 4/	±2.0 4/	±.1 ±.03	
High temperature exposure (see 3.24)	ΔR ΔRatio	±.02 ±.01	±.10 ±.03	±.10 ±.03	±0.2 4/	±0.5 4/	±1.0 4/	±.05 ±.02	
Low temperature storage (see 3.25)	ΔR ΔRatio	±.01 ±.01	±0.10 ±0.02	±0.10 ±0.02	±0.1 4/	±0.25 4/	±0.5 4/	±.03 ±.02	
Insulation resistance (see 3.18)		10,000	10,000	10,000	10,000	10,000	10,000	10,000	Megohms
Resistance tolerance and, when applicable, resistance ratio accuracy (see table V)	3/	.005(V) .01(T) .05(A) .1(B) .5(D) 1.0(F)	0.1(B) 0.5(D) 1.0(F)	0.1(B) 0.5(D) 1.0(F)	0.1(B) 0.5(D) 1.0(F)	0.5(D) 1.0(F) 2.0(G) 5.0(J)	1.0(F) 2.0(G) 5.0(J)	.05(A) .1(B) .5(D)	percent

1/ Hermetically sealed resistor network shall conform to the requirement specified in 3.10. These units may be furnished to meet characteristics H, K, M, and V requirements.
2/ Nonhermetically sealed resistor networks are those not meeting the requirement of 3.10. Characteristics H, K, M, R, or V shall not be furnished against C requirements.
3/ See 3.9.3.
4/ Not applicable.

1.2.1.2 Resistance.

1.2.1.2.1 Four digit resistance designation (all resistor values equal). The four digit resistance designation is applicable to all resistance tolerances. The nominal resistance is identified by four digits; the first three digits represent significant figures and the last digit specifies the number of zeros to follow. When the value of resistance is less than 100 ohms, or when fractional values of an ohm are required, the letter "R" shall be substituted for one of the significant digits to represent the decimal point. When the letter "R" is used, succeeding digits of the group represent significant figures. The resistance value designations are shown in table II. Standard values for every decade shall follow the sequence demonstrated for "10 to 100" decade in table IV. Resistance values not listed in table IV for the appropriate resistance tolerance shall be considered as not conforming to the specification. The resistance values for tolerances V, T, A and B may be any value within the limits specified in 3.1, but it is preferred that values be chosen from the "B" and "D" columns of table IV.

Although resistance tolerances "G" and "J" normally require less than three significant figures to adequately describe the true resistance value, for the purpose of this specification, the nominal value shall be three significant figures followed by the fourth digit to signify the number of zeros to follow.

1.2.1.2.2 Three digit resistance designation (all resistor values equal) (inactive for new design). The three digit resistance designation is applicable to tolerances G (±2.0 percent) and J (±5.0 percent). The nominal resistance expressed in ohms is identified by three digits; the first two digits represent significant figures and the last digit specifies the number of zeros to follow. When the value of resistance is less than 10 ohms, or when fractional values of an ohm are required, the letter "R" shall be substituted for one of the significant digits to represent the decimal point. When the letter "R" is used, succeeding digits of the group represent significant figures. The resistance-value designations are shown in table III. The standard values for every decade shall follow the sequence demonstrated for the "10 to 100" decade in table IV. The three digit resistance designation is for Army and Air Force use only.

TABLE II. Designation of resistance values for resistance tolerances of 0.10, 0.50, 1.0, 2.0, and 5.0 percent.

Designation	Resistance ohms
1R00 to 9R88 inclusive	1.00 to 9.88 inclusive
10R0 to 98R8 inclusive	10.0 to 98.8 inclusive
1000 to 9880 inclusive	100 to 988 inclusive
1001 to 9881 inclusive	1,000 to 9,880 inclusive
1002 to 9882 inclusive	10,000 to 98,800 inclusive
1003 to 9883 inclusive	100,000 to 988,000 inclusive
1004 to 9884 inclusive	1,000,000 to 9,880,000 inclusive

1.2.1.2.3 Resistance designation for network schematics H, J, N, and X. For network schematics H, J, N, and X, the four digit resistance designation becomes a code indicator with the first digit being an "A" and the following three digits a code number indicating a resistance combination described in the applicable detail specification.

TABLE III. Designation of resistance values for resistance tolerances of 2.0 and 5.0 percent. 1/ 2/

Designation	Resistance ohms
5R1 to 9R1 inclusive	5.1 to 9.1 inclusive
100 to 910 inclusive	10 to 91.0 inclusive
101 to 911 inclusive	100 to 910 inclusive
102 to 912 inclusive	1,000 to 9,100 inclusive
103 to 913 inclusive	10,000 to 91,000 inclusive
104 to 914 inclusive	100,000 to 910,000 inclusive

1/ Three digit resistance designation is inactive for new design.
2/ Three digit resistance designation is for Army and Air Force use only.

TABLE IV. Standard resistance values for the 10 to 100 decade for .005, .01, .05, 0.1, 0.5, 1.0, 2.0, and 5.0 percent resistance tolerances. 1/

Resistance tolerances								
B (0.1) D (0.5)	F (1.0)	G (2.0) J (5.0)	B (0.1) D (0.5)	F (1.0)	G (2.0) J (5.0)	B (0.1) D (0.5)	F (1.0)	G (2.0) J (5.0)
10.00	10.00	10.00	22.90	---	---	49.30	---	---
10.10	---	---	23.20	23.20	---	49.90	49.90	---
10.20	10.20	---	23.40	---	---	50.50	---	---
10.40	---	---	23.70	23.70	---	---	---	51.00
10.50	10.50	---	24.00	---	24.00	51.10	51.10	---
10.60	---	---	24.30	24.30	---	51.70	---	---
10.70	10.70	---	24.60	---	---	52.30	52.30	---
10.90	---	---	24.90	24.90	---	53.00	---	---
11.00	11.00	11.00	25.20	---	---	53.60	53.60	---
11.10	---	---	25.50	25.50	---	54.20	---	---
11.30	11.30	---	25.80	---	---	54.90	54.90	---
11.40	---	---	26.10	26.10	---	55.60	---	---
11.50	11.50	---	26.40	---	---	---	---	56.00
11.70	---	---	26.70	26.70	---	56.20	56.20	---
11.80	11.80	---	---	---	27.00	56.90	---	---
12.00	---	12.00	27.10	---	---	57.60	57.60	---
12.10	12.10	---	27.40	27.40	---	58.30	---	---
12.30	---	---	27.70	---	---	59.00	59.00	---
12.40	12.40	---	28.00	28.00	---	59.70	---	---
12.60	---	---	28.40	---	---	60.40	60.40	---
12.70	12.70	---	28.70	28.70	---	61.20	---	---
12.90	---	---	29.10	---	---	61.90	61.90	---
13.00	13.00	13.00	29.40	29.40	---	---	---	62.00
13.20	---	---	29.80	---	---	62.60	---	---
13.30	13.30	---	---	---	30.00	63.40	63.40	---
13.50	---	---	30.10	30.10	---	64.20	---	---
13.70	13.70	---	30.50	---	---	64.90	64.90	---
13.80	---	---	30.90	30.90	---	65.70	---	---
14.00	14.00	---	31.20	---	---	66.50	66.50	---
14.20	---	---	31.60	31.60	---	67.30	---	---
14.30	14.30	---	32.00	---	---	---	---	68.00
14.50	---	---	32.40	32.40	---	68.10	68.10	---
14.70	14.70	---	32.80	---	---	69.00	---	---

See footnote at end of table.

TABLE IV. Standard resistance values for the 10 to 100 decade for .005, .01, .05, 0.1, 0.5, 1.0, 2.0, and 5.0 percent resistance tolerances - Continued. 1/

Resistance tolerances								
B (0.1) D (0.5)	F (1.0)	G (2.0) J (5.0)	B (0.1) D (0.5)	F (1.0)	G (2.0) J (5.0)	B (0.1) D (0.5)	F (1.0)	G (2.0) J (5.0)
14.90	---	---	---	---	33.00	69.80	69.80	---
15.00	15.00	15.00	33.20	33.20	---	70.60	---	---
15.20	---	---	33.60	---	---	71.50	71.50	---
15.40	15.40	---	34.00	34.00	---	72.30	---	---
15.60	---	---	34.40	---	---	73.20	73.20	---
15.80	15.80	---	34.80	34.80	---	74.10	---	---
16.00	---	16.00	35.20	---	---	75.00	75.00	75.00
16.20	16.20	---	35.70	35.70	---	75.90	---	---
16.40	---	---	---	---	36.00	76.80	76.80	---
16.50	16.50	---	36.10	---	---	77.70	---	---
16.70	---	---	36.50	36.50	---	78.70	78.70	---
16.90	16.90	---	37.00	---	---	79.60	---	---
17.20	---	---	37.40	37.40	---	80.60	80.60	---
17.40	17.40	---	37.90	---	---	81.60	---	---
17.60	---	---	38.30	38.30	---	---	---	82.00
17.80	17.80	---	38.80	---	---	82.50	82.50	---
18.00	---	18.00	---	---	39.00	83.50	---	---
18.20	18.20	---	39.20	39.20	---	84.50	84.50	---
18.40	---	---	39.70	---	---	85.60	---	---
18.70	18.70	---	40.20	40.20	---	86.60	86.60	---
18.90	---	---	40.70	---	---	87.60	---	---
19.10	19.10	---	41.20	41.20	---	88.70	88.70	---
19.30	---	---	41.70	---	---	89.80	---	---
19.60	19.60	---	42.20	42.20	---	90.90	90.90	---
19.80	---	---	42.70	---	---	---	---	91.00
20.00	20.00	20.00	---	---	43.00	92.00	---	---
20.30	---	---	43.20	43.20	---	93.10	93.10	---
20.50	20.50	---	43.70	---	---	94.20	---	---
20.80	---	---	44.20	44.20	---	95.30	95.30	---
21.00	21.00	---	44.80	---	---	96.50	---	---
21.30	---	---	45.30	45.30	---	97.60	97.60	---
21.50	21.50	---	45.90	---	---	98.80	---	---
21.80	---	---	46.40	46.40	---	---	---	---
---	---	22.00	47.00	---	47.00	---	---	---
22.10	22.10	---	47.50	47.50	---	---	---	---
22.30	---	---	48.10	---	---	---	---	---
22.60	22.60	---	48.70	48.70	---	---	---	---

1/ Resistance values not listed in table IV for the appropriate resistance tolerance shall be considered as not conforming to the specification. The resistance values for tolerances V, T, A, and B may be any value within the limits specified in 3.1, but it is preferred that values be chosen from the "B" and "D" column of table IV.

1.2.1.3 Resistance and ratio tolerance. The resistance and ratio tolerance is identified by a single letter in accordance with table V.

TABLE V. Resistance and ratio tolerance.

Symbol	Resistance tolerance percent	Ratio tolerance percent	Applicable characteristic
V	0.005	0.005	Y
T	0.01	0.01	Y
A	0.05	0.05	R, Y
B	0.10	0.10	C, V, R, Y
D	0.50	0.50	C, V, R, Y
F	1.0		
G	2.0		
J	5.0		
X 1/			

1/ The X tolerance shall be as specified in the detail specification.

1.2.1.4 Schematic. The network schematic shall be identified by a single letter in accordance with figure 1, and as specified (see 3.1). Dotted lines in the schematics refer to configurations that might have additional resistors.

1.2.1.5 Schematic "X". Additional special schematics may be identified as "X" schematics and described fully in the detail specification. See figure 1 for schematic "X" method of presentation.

1.2.2 Style. The style is identified by the two-letter symbol "RZ" followed by a three-digit number (see 3.1). The letters identify fixed resistor networks and the three digits represent envelope size and configuration.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

QQ-S-571 - Solder, Tin Alloy Tin Lead Alloy and Lead Alloy.

MILITARY

MIL-R-39032 - Resistors, Packaging of.

(See supplement 1 for list of associated detail specifications.)

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-810 - Environmental Test Methods.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.
MIL-STD-45662 - Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Detail specifications. The individual part requirements shall be as specified herein and in accordance with the applicable detail specifications. In the event of any conflict between requirements of this specification and the detail specifications, the latter shall govern (see 6.2).

3.2 Qualification. Networks furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3).

3.3 Material. The material shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the networks to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.4 Design and construction. Networks shall be of the design, construction, and physical dimensions specified (see 3.1). Each network shall consist of film type resistance elements with terminations or, film type resistance elements, and ceramic capacitor with terminations (see 3.1).

3.4.1 Enclosure. Networks shall be encapsulated sufficiently to withstand the environmental tests specified. There shall be no voids which expose the internal circuitry.

3.4.2 Termination leads. Terminal leads shall be free of foreign material and solderable as specified. Leads shall be judged to be free of foreign material if the visual criteria are met.

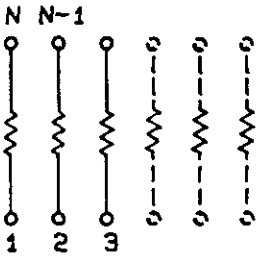
3.4.3 Internal visual inspection (applicable to characteristics C and V). Networks meeting the requirements of characterisitics C and V shall be subjected to a precap visual inspection that shall require as a minimum, the following inspections:

a. Inspection of internal connections.

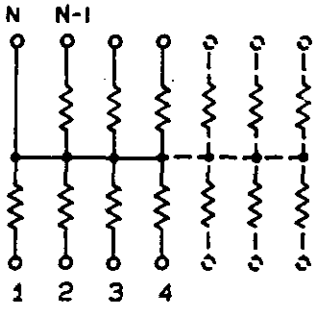
b. Inspection of metallization.

c. Inspection of die mounting.

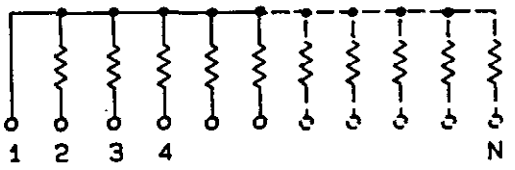
d. Inspection for foreign or extraneous material.



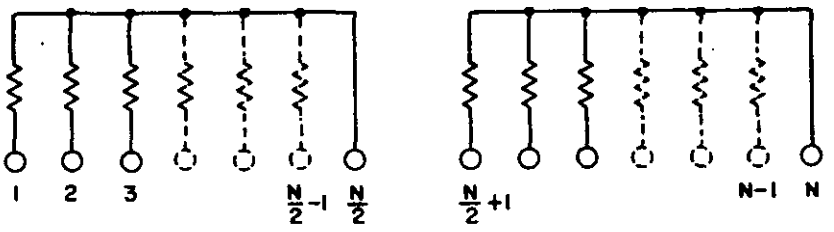
SCHEMATIC "A"



SCHEMATIC "B"

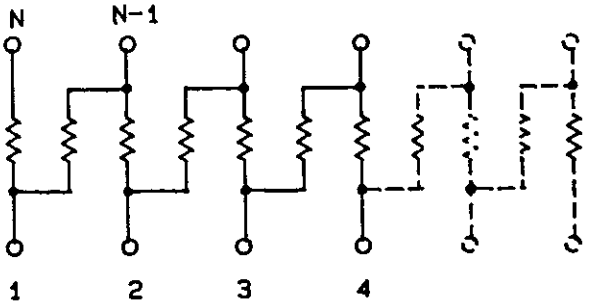


SCHEMATIC "C"

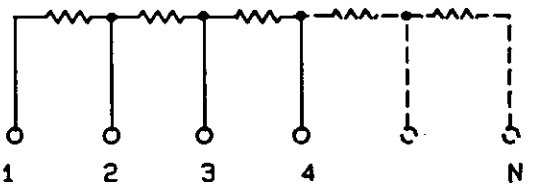


SCHEMATIC "D"

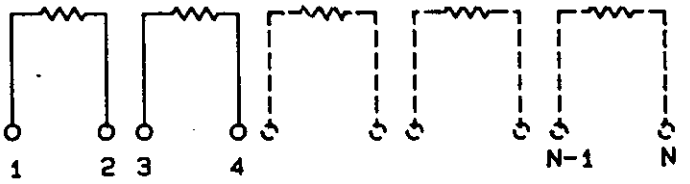
FIGURE 1. Schematics.



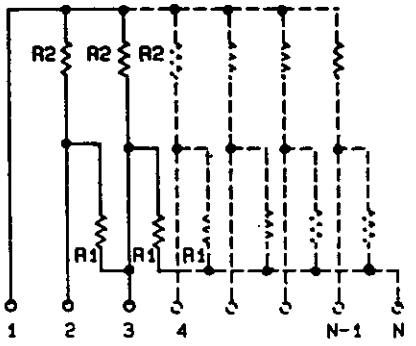
SCHEMATIC "E"



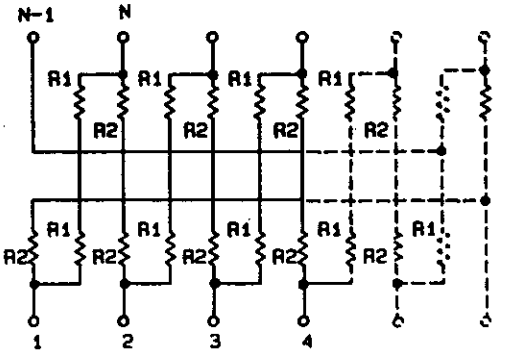
SCHEMATIC "F"



SCHEMATIC "G"

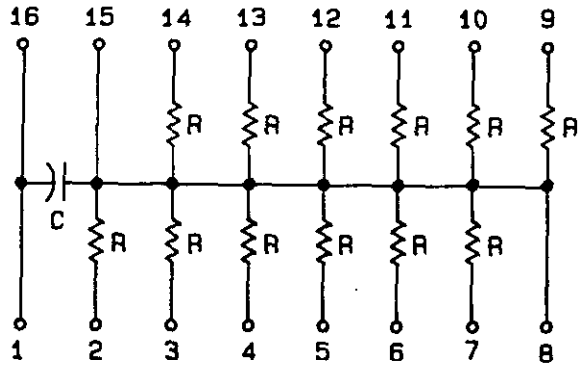


SCHEMATIC "H"

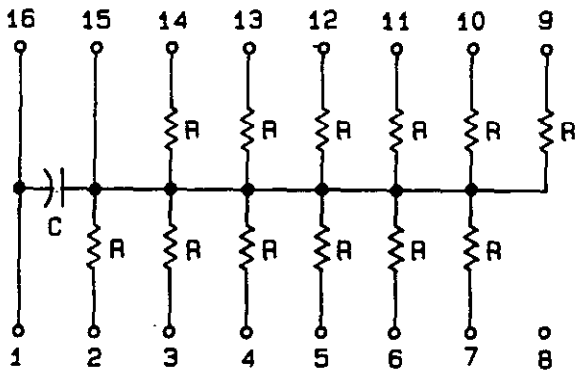


SCHEMATIC "J"

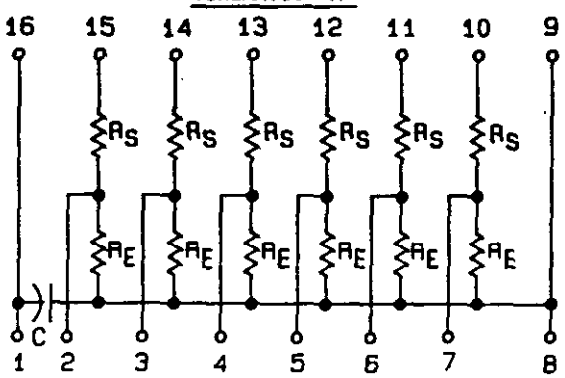
FIGURE 1. Schematics - Continued.



SCHEMATIC "K"



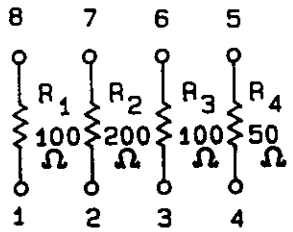
SCHEMATIC "M"



SCHEMATIC "N"

FIGURE 1. Schematics - Continued.

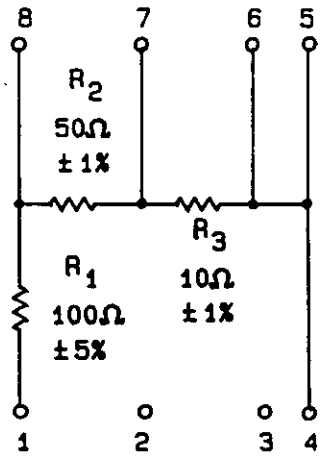
Resistor	Value	Tol	Char
R_1	100Ω	±1%	K
R_2	200Ω	±1%	K
R_3	100Ω	±5%	H
R_4	50Ω	±5%	H



SCHEMATIC "X"

(Resistance code A001)

Resistor	Value	Tol	Char
R_1	100Ω	±5%	K
R_2	50Ω	±1%	H
R_3	10Ω	±1%	H



SCHEMATIC "X"

(Resistance code A002)

FIGURE 1. Schematics - Continued.

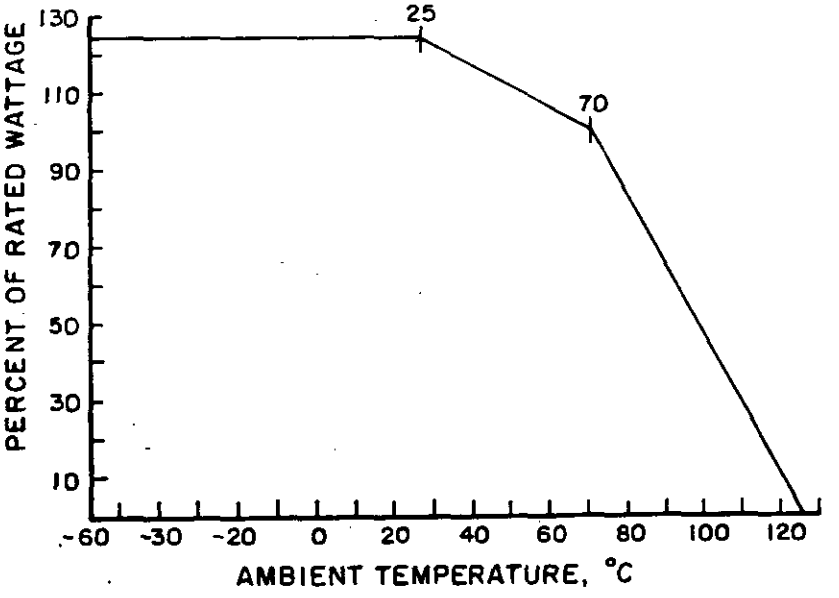
3.4.4 Metallization resistance. The resistance of the metallization of the longest path in the network shall not exceed the limits in table VI.

TABLE VI. Metallization resistance.

Nominal element resistance value (ohms) R	Maximum metallization resistance (ohms) R
R ≤ 1,000	1
1,000 < R < 10,000	5
R ≥ 10,000	10

3.4.5 Soldering. If soldering is used for internal connections, it shall be made with solder in accordance with QQ-S-571, having a liquid point not less than +280°C.

3.5 Power rating. The networks and individual resistors shall have a power rating based on continuous full-load operation at an ambient temperature of 70°C. For temperatures other than 70°C, the power rating shall be in accordance with figure 2.



NOTE: This curve indicates the percentage of nominal wattage to be applied at temperatures other than 70°C. However, at no time shall the applied voltage exceed the maximum for each style (see 3.1).

FIGURE 2. Power rating curve.

3.6 Voltage rating. Each resistor element shall have a rated dc continuous working voltage or an approximate sine-wave root-mean-square (rms) continuous working voltage corresponding to the wattage (power) rating, as determined from the following formula:

$$E = \sqrt{PR}$$

E = Continuous rated dc or rms working voltage in volts.
P = Rated wattage in watts.
R = Nominal resistance in ohms.

In no case shall the rated voltage be greater than the applicable maximum voltage (see 3.1).

3.7 Thermal shock. When networks are tested as specified in 4.6.3, there shall be no evidence of mechanical damage. For the combined thermal shock and power conditioning test (see 3.8) of qualification inspection group IV, and group C inspection, the networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.25 percent, +0.01 ohm. ΔRatio shall not exceed ±.03 percent.
Characteristic H:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristics K and M:	ΔR shall not exceed ±0.7 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.08 percent, +0.01 ohm. ΔRatio shall not exceed ±.04 percent.
Characteristic Y:	ΔR shall not exceed ±.02 percent, +0.01 ohm. ΔRatio shall not exceed ±.01 percent.

For the thermal shock test of qualification inspection group IV, and group C inspection, networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.15 percent, +0.01 ohm. ΔRatio shall not exceed ±.03 percent.
Characteristic H:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristics K and M:	ΔR shall not exceed ±0.50 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.05 percent, +0.01 ohm. ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm. ΔRatio shall not exceed ±.01 percent.

3.8 Power conditioning. When networks are tested as specified in 4.6.4, there shall be no mechanical damage. For the combined power conditioning and thermal shock test (see 3.7), networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.25 percent, +0.01 ohm. ΔRatio shall not exceed ±.03 percent.
Characteristic H:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristics K and M:	ΔR shall not exceed ±0.7 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.08 percent, +0.01 ohm. ΔRatio shall not exceed ±.04 percent.
Characteristic Y:	ΔR shall not exceed ±.02 percent, +0.01 ohm. ΔRatio shall not exceed ±.01 percent.

3.9 DC resistance.

3.9.1 Individual resistance. When networks are tested as specified in 4.6.5, the dc resistance shall be within the specified tolerance of the nominal resistance (see 1.2.1.3) and shall be stable within the specified tolerance during the measurement.

3.9.2 Resistance between isolated pins. The resistance between any two isolated resistors tested as specified in 4.6.5 shall be not less than 5 megohms. This shall only be measured during the resistance test on group I of qualification and group A inspection.

3.9.3 Resistance ratio accuracy (applicable to characteristics C, R, V, and Y). When networks are tested as specified in 4.6.5, the resistance ratio accuracy shall meet the requirements of table VII.

TABLE VII. Resistance ratio accuracy.

Characteristic	Resistance tolerance	Resistance ratio accuracy (percent)
Y	V T	.005 .01
R Y	A	.05
C R V Y	B	0.1
C R V Y	D	0.1
C R V Y	F	0.5

3.10 Hermetic seal (applicable to characteristics C and Y). For the purpose of this specification, a hermetically sealed network is one which shall be capable of passing the seal test specified in 4.6.21 or of meeting a leak rate requirement of not more than 5.0×10^{-7} cubic centimeters per second. Materials used for this enclosure shall be ceramic, metal, glass, or combinations thereof.

3.10.1 Nonhermetic seal (applicable to characteristics H, K, M, R, and V). For the purposes of this specification, a nonhermetically sealed network is one not conforming in full to the requirements of 3.10. A qualified network which meets all requirements of 3.10 may be furnished to meet these characteristics; however, the network must continue to meet all the requirements of the C characteristic. Characteristics H, K, M, R, V, and Y networks shall not be furnished against C and Y requirements.

3.11 Solderability. When networks are tested as specified in 4.6.6, they shall meet the criteria for wire lead evaluation in the test standard.

3.12 Resistance to solvents. When networks are tested as specified in 4.6.7, there shall be no evidence of mechanical damage and the marking shall remain legible.

3.13 Resistance-temperature characteristic. When networks are tested as specified in 4.6.8, the resistance-temperature characteristic, at each of the temperatures specified in table VIII referred to room ambient temperature, shall not exceed the following requirements:

Characteristics C and V:	±50 PPM with tracking of each element to the reference element of ±5 PPM.
Characteristic H:	±50 PPM.
Characteristic K:	±100 PPM.
Characteristic M:	±300 PPM.
Characteristic R:	±25 PPM with tracking of each element to the reference element of ±5 PPM.
Characteristic Y:	±5 PPM with tracking of each element to the reference element of ±1 PPM.

TABLE VIII. Resistance-temperature characteristic.

Sequence	Temperature	
	Qualification inspection	Group B acceptance inspection
	°C	°C
1	Room temperature 1/	Room temperature 1/
2	-15 ±3	-55 ±3
3	-55 ±3	Room temperature 1/
4	Room temperature 1/	+125 ±3
5	+65 ±3	---
6	+125 ±3	---

1/ This temperature shall be considered the reference temperature for each of the succeeding temperatures.

3.14 Low temperature operation. When networks are tested as specified in 4.6.9, there shall be no evidence of mechanical damage and shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.10 percent, +0.01 ohm. ΔRatio shall not exceed ±.03 percent.
Characteristic H:	ΔR shall not exceed ±0.10 percent, +0.01 ohm.
Characteristic K:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic M:	ΔR shall not exceed ±0.50 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±0.03 percent, +0.01 ohm. ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm. ΔRatio shall not exceed ±.01 percent.

3.15 Short-time overload. When networks are tested as specified in 4.6.10, there shall be no evidence of arcing, burning, or charring. The networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic H:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
Characteristic K:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic M:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.03 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

3.16 Terminal strength. When networks are tested as specified in 4.6.11, there shall be no evidence of breaking or loosening of terminals from the network form, or chipping of coating. The networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.10 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.03 percent.
Characteristics M, K, and H:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.03 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

3.17 Dielectric withstanding voltage. When networks are tested as specified in 4.6.12, there shall be no mechanical damage, arcing, or breakdown. The leakage current shall not exceed 1 milliampere (mA).

3.18 Insulation resistance. When networks are tested as specified in 4.6.13, the insulation resistance shall not be less than 10,000 megohms.

3.19 Resistance to soldering heat. When networks are tested as specified in 4.6.14, there shall be no external evidence of mechanical damage nor internal evidence of solder reflow or heat damage. The networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic H:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
Characteristics K and M:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.05 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

3.20 Moisture resistance. When networks are tested as specified in 4.6.15, there shall be no evidence of mechanical damage. The networks shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.2 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic H:	ΔR shall not exceed ±0.4 percent, +0.01 ohm.
Characteristics K and M:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.05 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

Additionally, the dielectric withstanding voltage shall be as specified in 3.17 and the insulation resistance shall be 100 megohms minimum.

3.21 Shock (specified pulse). When networks are tested as specified in 4.6.16, there shall be no evidence of mechanical damage and they shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.03 percent.
Characteristics H, K, and M:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.03 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

3.22 Vibration, high frequency. When networks are tested as specified in 4.6.17, there shall be no mechanical damage and they shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.03 percent.
Characteristics H, K, and M:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±.03 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

3.23 Life. When networks are tested as specified in 4.6.18, there shall be no evidence of mechanical damage and they shall meet the following requirements:

Characteristics C, V, and R:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.03 percent.
Characteristics H and K:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristic M:	ΔR shall not exceed ±2.0 percent, +0.01 ohm.
Characteristic Y:	ΔR shall not exceed ±0.05 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.025 percent.

3.23.1 25°C power rating (see 3.1 and 6.5). For qualification testing only, networks shall be subjected to the specified voltage and shall dissipate the assigned 25°C wattage rating for a 1000-hour duration. The networks shall meet the following requirements:

Characteristics C, V, and R:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.03 percent.
Characteristics H and K:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristic M:	ΔR shall not exceed ±2.0 percent, +0.01 ohm.
Characteristic Y:	ΔR shall not exceed ±0.05 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.025 percent.

3.24 High temperature exposure. When networks are tested as specified in 4.6.19, there shall be no evidence of mechanical damage and they shall meet the following requirements:

Characteristics C and V:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.03 percent.
Characteristic H:	ΔR shall not exceed ±0.2 percent, +0.01 ohm.
Characteristic K:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristic M:	ΔR shall not exceed ±1.0 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±0.05 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.02 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.

3.25 Low temperature storage. When networks are tested as specified in 4.6.20, there shall be no evidence of mechanical damage and they shall meet the following requirements:

Characteristics C and Y:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic H:	ΔR shall not exceed ±0.1 percent, +0.01 ohm.
Characteristic K:	ΔR shall not exceed ±0.25 percent, +0.01 ohm.
Characteristic M:	ΔR shall not exceed ±0.5 percent, +0.01 ohm.
Characteristic R:	ΔR shall not exceed ±0.03 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.02 percent.
Characteristic Y:	ΔR shall not exceed ±.01 percent, +0.01 ohm.
	ΔRatio shall not exceed ±.01 percent.

3.26 Fungus. All external materials shall be nonnutrient to fungus growth or shall be suitably treated to retard fungus growth. The manufacturer shall verify by certification that all external materials are fungus resistant or shall test the resistors as specified in 4.6.22. There shall be no evidence of fungus growth on the external surfaces.

3.27 Marking. Each network shall be marked in accordance with method I of MIL-STD-1285 and as indicated below:

a. Complete military part number.

b. Manufacturer's Commercial and Government Entity (CAGE) code.

c. Resistance value and resistance tolerance (manufacturer's option).

d. Manufacturing date code.

e. Manufacturer's lot code (manufacturer's option).

f. Pin identifier.

3.27.1 Resistance temperature characteristic and resistance tolerance substitution. Networks qualified to lower resistance temperature characteristics or lower tolerance levels, or both, with acquiring agency approval, are substitutable for networks marked to higher resistance temperature characteristics or higher tolerance levels and shall not be remarked unless specified in the contract or purchase order (see 6.2) (see tables IX and X).

TABLE IX. Substitution of temperature characteristics.

Characteristic	Characteristic substitution
H	H, K, M
K	K, M
M	M

TABLE X. Resistance tolerance substitution.

Resistance tolerance	Resistance tolerance substitution
B	B, D, F, G, J
D	D, F, G, J
F	F, G, J
G	G, J
J	J

3.28 Workmanship. Networks shall be processed in such a manner as to be uniform in quality and shall meet the requirements of 3.3 to 3.4.5 inclusive, and be free from other defects that will affect life, serviceability, or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.4).

b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions and precautions.

4.3.1 Conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.3.2 Precautions. Adequate precautions shall be taken during inspection to prevent condensation of moisture on networks, except during moisture-resistance test.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample. The number of sample units comprising a sample of networks to be submitted for qualification inspection shall be as specified in appendix A of this specification. The sample shall be taken at random from a production run and shall be produced with equipment and procedures normally used in production. The sample units shall have been subjected to and passed the requirements of group A inspection (see 4.5.1.2). Qualification shall not be granted if group A inspection requirements are not met. Each network style shall be qualified separately (see 3.1).

4.4.2 Inspection routine. Sample units shall be subjected to the qualification inspection specified in table XI in the order shown. All sample units shall be subjected to the inspection of groups I and Ia, except for the sample units required for groups II and VIII. All sample units shall be divided as specified in table XI for groups II through VIII inclusive, and subjected to the inspection for their particular group. For purposes of verifying the 25°C power rating (see 3.1 and 6.5) a separate sample of 30 units shall be subjected to group I, group Ia, and group VIa of table XI. This test is an initial qualification requirement only. Sample sizes and extent of qualification for characteristics shall be specified in appendix A of this specification.

4.4.3 Failures. Failures in excess of those allowed in table XI shall be cause for refusal to grant qualification.

4.4.4 Retention of qualification. To retain qualification, the contractor shall forward a report at 6-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B), indicating as a minimum, the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.

b. A summary of the results of tests performed for periodic inspection (group C), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 6-month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the Qualified Products List.

Failure to submit the report within 30 days after the end of each 6-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements and the reason for no production.

TABLE XI. Qualification inspection.

Inspection	Number of sample units	Requirement paragraph	Method paragraph	Number of failures allowed 1/
Group I 2/ 3/				
Thermal shock	All sample units 4/	3.7	4.6.3	5/
Power conditioning		3.8	4.6.4	
DC resistance		3.9	4.6.5	
Hermetic seal (when applicable)		3.10	4.6.21	
Group Ia 3/ 6/				
Visual and mechanical inspection		3.1,3.3,3.4, 3.27,3.28	4.6.2	0
Group II 7/				
Solderability	12 4/	3.11	4.6.6	1
Resistance to solvents		3.12	4.6.7	
Group III				
Resistance-temperature characteristics	20 10 high or 10 critical 8/ 30 10 low	3.13	4.6.8	1 9/
Low temperature operation		3.14	4.6.9	
Short-time overload		3.15	4.6.10	
Terminal strength		3.16	4.6.11	
Hermetic seal (when applicable)		3.10	4.6.21	
Group IV				
Thermal shock	20 10 high or 10 critical 8/ 30 10 low	3.7	4.6.3	1 9/
Dielectric withstanding voltage		3.17	4.6.12	
Insulation resistance		3.18	4.6.13	
Resistance to soldering heat 10/		3.19	4.6.14	
Moisture resistance		3.20	4.6.15	
Hermetic seal (when applicable)		3.10	4.6.21	
Group V				
Shock (specified pulse)	20 10 high or 10 critical 8/ 30 10 low	3.21	4.6.16	1 9/
Vibration, high frequency		3.22	4.6.17	
Hermetic seal (when applicable)		3.10	4.6.21	

See footnotes at end of table.

TABLE XI. Qualification inspection - Continued.

Inspection	Number of sample units	Requirement paragraph	Method para-graph	Number of failures allowed 1/
Group VI				
Life	20 10 high or 10 critical 8/ 30 10 low	3.23	4.6.18	0 9/
Group VIa				
25°C power rating	20 10 high or 10 critical 8/ 30 10 low	3.23.1	4.6.18	1 9/
Group VII				
High temperature exposure	20 10 high or 10 critical 8/ 30 10 low	3.24	4.6.19	1 9/
Low temperature storage		3.25	4.6.20	
Group VIII 4/ 11/				
Fungus	10	3.26	4.6.22	0

1/ Failure of a single network in one or more tests of a group shall be charged as a single defective.

2/ Tests need not be performed if group A inspection has been performed on the qualification samples.

3/ Nondestructive tests.

4/ Sample units for groups II and VIII are not required to be subjected to group I.

5/ Networks shall meet all requirements of group I before subjecting to groups III through VII.

6/ Marking shall be considered defective if the marking is illegible or incorrect.

7/ Tests may be performed on electrical rejects.

8/ When no critical value is specified, only the highest and lowest resistance values shall be tested (20 samples, total).

9/ Number of defective packages allowed per resistance value tested (e.g., low, critical, and high resistance).

10/ The internal visual examination shall be performed after the final inspection of group IV.

11/ The fungus requirement is either by certification or performance.

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspections.

4.5.1.1 Inspection lot. An inspection lot shall consist of all the networks of similar styles with the same protection enclosure or coating design configuration and height dimensions manufactured or presented for shipping against this document during a period of not more than a month. Resistors of various resistance values and tolerances may be combined to form a lot provided they are all made with the same enclosure material on the same production line using the same methods and processes. Characteristics may be sampled as provided in the qualification coverage table XX of appendix A to cover other characteristics as long as the materials and processes are the same.

4.5.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table XII, and shall be made on the same set of sample units, in the order shown.

TABLE XII. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of samples
Subgroup 1			
Thermal shock	3.7	4.6.3	100-percent
Power conditioning	3.8	4.6.4	inspection
DC resistance 1/	3.9	4.6.5	
Hermetic seal (when applicable)	3.10	4.6.21	
Subgroup 2			
Visual examination	3.1,3.4,3.26, 3.27,3.28	4.6.2	13

1/ Networks shall meet the specified initial resistance tolerance. The resistance measurement made upon completion of the power conditioning test may be used if a measurement has been made which can, without conversion, be directly related to nominal resistance value and tolerance.

4.5.1.2.1 Sampling plan. Subgroup 1 tests shall be performed on 100 percent of the product supplied under this specification. Networks that are out of resistance tolerance, or which experience a change in resistance greater than that permitted for the tests of this subgroup shall be removed from the lot. Lots having more than 10 percent total rejects, due to exceeding the specified resistance change limit shall not be furnished on contracts. Major and minor defects shall be as specified in table XIII.

TABLE XIII. Classification of defects.

Construction	Requirement	Classification
Body	Cracks or holes which could cause probable failure.	Major
Leads	Leads broken, crushed or nicked which would cause probable failure in use.	Major
	Crushed or nicked at ends which would not cause failure in use.	Minor
	Lead spacing incorrect dimensions.	Major
Marking	Incorrect, illegible marking.	Major

4.5.1.2.1.1 Manufacturer's production inspection. If the manufacturer performs tests similar to those specified in subgroup 1 of table XII as the final step of his production process, group A, subgroup 1 inspection may be waived and the data resulting from the manufacturer's production tests may be used instead. Authority to waive the subgroup 1 inspection shall be granted by the qualifying activity only. The following criteria must be complied with:

a. Tests conducted by the manufacturer during production shall be clearly identical to or more stringent than those specified for subgroup 1. Test conditions shall be equal to or more stringent than those specified for subgroup 1 tests.

b. Manufacturer subjects 100 percent of the product supplied under this specification to his production tests.

c. The parameters measured and the failure criteria shall be the same or more stringent than those specified herein.

d. The lot rejection criteria are the same or more stringent than those specified herein.

e. The manufacturer shall make available all information concerning the test procedures and instrumentation used in his production tests. The manufacturer shall also make available to the Government all records of all detail test data resulting from production tests.

f. Once approved the manufacturer shall not change the test procedures or criteria without prior notification to and concurrence from the qualifying activity.

4.5.1.2.1.2 Rejected lots (subgroup 2). Rejected inspection lots may be resubmitted for Government acceptance only if the manufacturer performs 100-percent inspection on networks of the lot for those characteristics which were defective and resulted in rejection of the lot, removes all defective units and resubmits the lot for quality conformance inspection. Resubmitted lots shall be kept separate from new lots, and shall be clearly identified as resubmitted lots.

4.5.1.3 Group B inspection. Group B inspection shall consist of the tests specified in table XIV, in the order shown. They shall be performed on sample units that have been subjected to and have passed group A inspection. As an option, subgroup 2 tests may be performed on electrical rejects or empty body networks. The empty body networks must be processed through all the standard manufacturing and test flow cycles, oven bakes, and temperature cycles of qualified networks to assure that the network leads and printed surfaces are in the usual condition prior to test.

TABLE XIV. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph	Sample size	Number of failures allowed
Subgroup 1				
Resistance temperature characteristic	3.13	4.6.8	13	0
Dielectric withstanding voltage	3.17	4.6.12		
Insulation resistance	3.18	4.6.13		
Short-time overload	3.15	4.6.10		
Subgroup 2 1/				
Solderability	3.11	4.6.6	6	0
Resistance to solvents	3.12	4.6.7	8	

1/ Tests may be performed on electrical rejects.

4.5.1.3.1 Subgroup 1. A sample of 13 parts shall be randomly selected, if one or more defects are found, the lot shall be rescreened and defects removed. A new sample of 13 parts shall then randomly be selected, if one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.1.3.2 Subgroup 2. A sample of 14 parts shall be randomly selected, 8 samples to the resistance to solvents test and 6 samples to the solderability test. If one or more defects are found, the lot shall be rescreened and defects removed. A new sample of 14 parts shall then randomly be selected, if one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.1.3.3 Disposition of sample units. Sample units which have passed all the group B, subgroup 1 inspections may be delivered on the contract provided they are within resistance tolerance and meet requirements for visual and mechanical inspection.

4.5.2 Periodic inspection. Periodic inspection shall consist of group C inspection. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.2.1.5), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

4.5.2.1 Group C inspection. Group C inspection shall consist of the tests specified in table XV, in the order shown. They shall be performed on sample units selected from lots that have passed groups A and B inspections. Networks of similar styles and method of enclosure may be grouped together. Group C samples shall be representative of production.

TABLE XV. Group C inspection.

Inspection	Number of sample units to be inspected	Requirement paragraph	Test method paragraph	Number of failures allowed
Monthly				
Low temperature operation	10	3.14	4.6.9	1
Short-time overload		3.15	4.6.10	
Terminal strength		3.16	4.6.11	
Hermetic seal (when applicable)		3.10	4.6.21	
Quarterly				
Subgroup 1				
Thermal shock	10	3.7	4.6.3	1
Dielectric withstanding voltage		3.17	4.6.12	
Insulation resistance		3.18	4.6.13	
Resistance to soldering heat 1/		3.19	4.6.14	
Moisture resistance		3.20	4.6.15	
Hermetic seal (when applicable)		3.10	4.6.21	
Subgroup 2				
Life	10	3.23	4.6.18	0
Semiannually				
Subgroup 1				
Shock (specified pulse)	10	3.21	4.6.16	1
Vibration, high frequency		3.22	4.6.17	
Subgroup 2				
High temperature exposure	10	3.24	4.6.19	
Low temperature storage		3.25	4.6.20	

1/ The internal inspection shall be performed after the final inspection of the subgroup.

4.5.2.1.1 Monthly. Ten sample units of any resistance value between the critical and low values shall be inspected every month. If none of these values are produced during the month, networks of the lowest resistance value produced shall be inspected, with one defective unit allowed.

4.5.2.1.2 Quarterly. Twenty sample units from the highest resistance decade shall be inspected quarterly. Ten sample units from the resistance decade produced shall be subjected to the tests of subgroup 1, and 10 sample units of the value produced closest to the critical value shall be subjected to the test of subgroup 2. One defective unit shall be allowed.

4.5.2.1.3 Semiannually. Ten sample units from the highest resistance decade produced shall be subjected to the tests of subgroup 1. Ten sample units of any resistance value shall be subjected to the tests of subgroup 2. One defective unit shall be allowed.

4.5.2.1.4 Disposition of samples. Sample units which have been subjected to group C inspection shall not be delivered on the contract.

4.5.2.1.5 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.3 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-R-39032.

4.6 Methods of inspection.

4.6.1 Network handling procedures. When specified herein, the networks shall be tested mounted on a test board as described in 4.6.1.1. For those test procedures where mounting requirements are unspecified, the networks may be tested unmounted using pressure type contacts.

4.6.1.1 Specified mounting. When specified in the test procedure, the networks shall be mounted on a suitable test board of glass base nominally .0625 inch thick. The test board shall be such that it shall not be the cause of, nor contribute to any failure of network in any of the tests for which it may be used. Networks must be spaced at least 0.5 inch from each other.

4.6.2 Visual and mechanical inspection. Networks shall be inspected to verify that the materials, design, construction, physical dimensions, and workmanship are in accordance with the acceptable requirements (see 3.1, 3.3, 3.4, 3.27, and 3.28).

4.6.3 Thermal shock (see 3.7). Networks shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting: The method used to transport and hold the networks shall ensure circulation of the ambient air to each network.

b. Measurement before cycling: DC resistance shall be measured as specified in 4.6.5.

c. Test condition: For qualification group I and group A inspection, test condition B. For qualification group IV and group C inspection, test condition B-1.

d. Measurement after cycling: Within three hours after stabilization at room temperature, dc resistance shall be measured as specified in 4.6.5. For qualification inspection group I, and group A inspection, dc resistance shall be measured following the test of 4.6.4.

Following the test, the networks shall be inspected for evidence of mechanical damage.

4.6.4 Power conditioning (see 3.8). Networks shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

a. Test temperature and tolerance: 25°C +20°C, -5°C.

b. Initial measurements: Measurements may be made inside or outside the chamber.

(1) Inside chamber: When measurements are to be made inside the chamber, the initial dc resistance shall be measured, at the applicable test temperature, after temperature stabilization, and within 8 hours of exposure of the networks to the test temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.

(2) Outside chamber: When measurements are to be made outside the chamber, the initial dc resistance shall be measured at the room temperature. This intial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.

c. Operating conditions: Rated dc continuous working voltage, filtered or nonfiltered full-wave rectified ac voltage shall be simultaneously applied to each resistor in the network intermittently, 1.5 hours on and 0.5 hour off, for 100 ±4 hours and at the test temperature. During the "on" cycle, the voltage shall be regulated and controlled to maintain ±5 percent of the rated continuous working voltage. Unless otherwise specified (see 3.1), power applied shall be 1.5 times rated power.

d. Measurements after test: Following a minimum 0.5 hour stabilization period, dc resistance shall be measured as specified in 4.6.5.

e. Inspection after test: Networks shall be inspected for evidence of mechanical damage.

4.6.5 DC resistance (see 3.9). The dc resistance shall be measured in accordance with method 303 of MIL-STD-202. The following details and exceptions shall apply:

a. Measuring apparatus: The same measuring instrument shall be used for any one test, but not necessarily for all tests.

b. Test voltage: Measurements of resistance shall be made using the test voltages specified in table XVI. The test voltage chosen, whether it be the maximum or a lower voltage which would still provide the sensitivity required, shall be applied across the terminals of the resistor. This same voltage shall be used whenever a subsequent resistance measurement is made.

TABLE XVI. Standard dc resistance test voltages.

Nominal resistance	Maximum test voltage		
	10 Milliwatts	25 to 99 Milliwatts	100 to 225 Milliwatts
Ohms	Volts	Volts	Volts
10 to 98.8	.3	.5	1.0
100 to 988	1.0	1.0	1.0
1,000 to 9,880	3.0	3.0	3.0
10,000 to 98,800	10.0	10.0	10.0
100,000 or higher	30.0	30.0	30.0

c. Temperature: The dc resistance test specified in group I of table XI shall be performed at 25°C ±5°C. For all other tests, unless otherwise specified herein, the temperature at which subsequent and final resistance measurements are made in each test shall be within ±2°C of the temperature at which the initial resistance measurement was made.

d. Procedure: Unless otherwise specified (see 3.1), all resistor elements which can be isolated in the network shall be individually measured. All resistor elements which cannot be isolated in the network shall be measured using a guarded resistance measuring technique as far as practicable (see 3.1). Interpin resistance shall be measured using the test instrument used for measuring the isolated resistors.

e. Resistance ratio accuracy (applicable to characteristics C, R, V, and Y): Ratio accuracy is defined as the percent difference between the nominal resistance ratio and the ratio determined from the actual resistance measurement using the specified reference resistor from the applicable schematic (see 3.1). The ratio accuracy required shall be as specified. The change in ratio for any test is defined as the percent change in the actual ratio determined from resistance measurements before and after the test referred to the actual ratio before the test. The resistance ratio is defined as follows:

$$\frac{R_r}{R_{REF}}$$

R_{REF} - Resistance of the reference element.

R_r - Resistance of the element being measured.

4.6.6 Solderability (see 3.11). Networks shall be tested in accordance with method 208 of MIL-STD-202. The following details and exceptions shall apply:

a. All terminals of each network shall be tested.

b. Application of standard solderable wire is not required.

c. Leads shall be solderable .010 inch (0.25 mm) above seating plane.

d. For flat packs, the seating plane will be defined as 0.060 from component body, excluding any epoxy meniscus.

4.6.7 Resistance to solvents (see 3.12). Networks shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply:

a. The marked portion of the network body shall be brushed.

b. The number of sample units shall be as specified in tables XI and XIV as applicable.

c. Networks shall be inspected for mechanical damage and legibility of markings.

4.6.8 Resistance-temperature characteristic (see 3.13). Networks shall be tested in accordance with method 304 of MIL-STD-202. The following details and exceptions shall apply:

a. Reference temperature: Room ambient temperature.

b. Test temperature: In accordance with table XVII.

TABLE XVII. Resistance-temperature characteristic.

Sequence	Temperature	
	Qualification inspection	*Group B acceptance* inspection
	°C	°C
1	Room temperature 1/	Room temperature 1/
2	-15 ±3	-55 ±3
3	-55 ±3	Room temperature 1/
4	Room temperature 1/	+125 ±3
5	+65 ±3	---
6	+125 ±3	---

1/ This temperature shall be considered the reference temperature for each of the succeeding temperatures.

4.6.9 Low temperature operation (see 3.14). Following a dc resistance measurement as specified in 4.6.5, the networks shall be placed in a cold chamber at -65°C +0°C, -5°C. After 1 hour of stabilization at this temperature, full rated continuous working voltage as specified in 3.6 shall be applied for 45 minutes. The networks may be loaded individually or in parallel. Fifteen +5, -0 minutes after the removal of the voltage, the temperature in the chamber shall be gradually increased to room temperature within a period of not more than 8 hours. The networks shall be removed from the chamber and maintained at a temperature of 25°C ±5°C for a period of approximately 24 hours; the dc resistance shall then be measured as specified in 4.6.5. Networks shall then be inspected for evidence of mechanical damage.

4.6.10 Short-time overload (see 3.15). The dc resistance shall be measured as specified in 4.6.5. A dc test potential, 2.5 times the rated continuous working voltage but not exceeding twice the maximum voltage (see 3.1), shall be applied for 5 ±1 seconds to each resistor in the network, one at a time. If single resistors cannot be isolated, the voltage applied at the two terminals shall be $2.5\sqrt{PR}$, where R is the actual resistance measured at the two terminals and P is the combined power rating of the elements contributing to the measured resistance. The following conditions shall be maintained:

a. Networks are to be mounted horizontally in still air with no circulation other than that created by the heat of the network being operated.

b. Ambient temperature during test shall be 25°C ±5°C.

c. Thirty +15, -0 minutes after removal of the test potential, the resistance shall be measured as specified in 4.6.5. Networks shall be inspected for evidence of arcing, burning, and charring.

d. For referee purposes, a 10-second waiting period between voltage pulses shall be used.

4.6.11 Terminal strength (see 3.16).

4.6.11.1 Pull test. Networks shall be tested as follows:

a. Test weight:

(1) 24 ounces for flat packs.

(2) 4.5 pounds for other body styles.

b. Test time: 30 seconds.

c. Number of terminals to be tested: 5 randomly selected terminals.

d. Procedure: The specified weight shall be applied, without shock, to each lead or terminal to be tested in a direction parallel to the axis of the lead (or terminal) and maintained for the specified test time. The tension shall be applied as close to the end of the lead (or terminal) as practicable.

e. Measurement after test: Networks shall be inspected for evidence of mechanical damage, and resistance shall be measured as specified in 4.6.5.

4.6.11.2 Bend test.

4.6.11.2.1 Bend test for configurations other than flat packs. Networks in dual-in-line and single-in-line packages shall be tested as follows:

a. Number of terminals to be tested: 5 randomly selected terminals.

b. Procedure: Each lead, selected to be tested, of the network shall be bent through an angle sufficient to cause the lead to retain a permanent bend (i.e., after stress removal) of at least 15 degrees measured at the lead extremities about the first bend. At the completion of the initial bend, the leads shall be returned to their approximate original position. This procedure shall be performed three times.

c. Measurement after test: Networks shall be inspected for evidence of mechanical damage, and resistance shall be measured as specified in 4.6.5.

4.6.11.2.2 Bend test for flat packs. Networks in flat pack shall be tested as follows:

a. Number of terminals to be tested: 5 randomly selected terminals.

b. Procedure: Unless otherwise specified (see 3.1) a force of 8 ±0.5 ounces shall be applied to each lead to be tested for three 90 ±5 degree arcs of the case. For leads with a section modulus equal to or less than that of a lead with a cross-section of 0.006 by 0.020 inch, the force shall be 3 ±0.3 ounces. An arc is defined as the movement of the case, without torsion, to a position perpendicular to the pull axis and return to normal. All arcs on a single lead shall be made in the same direction and in the same plane without lead restriction. A bending cycle shall be completed in from 2 to 5 seconds. For networks with rectangular or ribbon leads the plane of the arcs shall be perpendicular to the flat plane of the lead. The test shall not be applied to end leads of packages where its application will apply primarily torsion forces at the lead seal.

c. Measurement after test: Networks shall be inspected for evidence of mechanical damage and resistance shall be measured as specified in 4.6.5.

4.6.12 Dielectric withstanding voltage (see 3.17).

4.6.12.1 Atmospheric pressure. Networks shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

a. Mounting:

(1) Dual-in-line (DIP) packages: The network shall be clamped by mounting with its top on a metal plate of sufficient size to extend beyond the network extremities. An additional metal plate shall be mounted against the bottom of the network, avoiding contact with the terminals. The terminals of the network shall be connected together.

(2) Single-in-line (SIP) and flat packages: The network shall be clamped by mounting with its sides on metal plates of sufficient size to extend beyond the network extremities and the terminals shall be connected together.

b. Magnitude of test voltage: 200 volts rms for DIPs and SIPs, and 100 volts for flat packs.

c. Nature of potential: An ac supply at commercial-line frequency (not more than 100 hertz (Hz)) and waveform.

d. Duration of application of test voltage: One minute.

e. Points of application of test voltage: Between the terminals connected together and metal-mounting plate.

f. Inspections and measurements: During the tests, the leakage current shall be monitored and the networks inspected for evidence of arcing and breakdown. At the conclusion of the test, networks shall be inspected for evidence of damage.

4.6.13 Insulation resistance (see 3.18). Networks shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply:

a. Test condition A.

b. Special preparation: As specified in 4.6.12.1a.

c. Points of measurement: As specified in 4.6.12.1e.

4.6.14 Resistance to soldering heat (see 3.19). Networks shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

a. Measurement before test: DC resistance shall be measured as specified in 4.6.5.

b. Special preparation of specimen: Sample units shall not have been soldered during any of the previous tests.

c. Test condition C (solder 260°C, immersion 10 seconds).

d. Depth of immersion: Depth of immersion shall be .0625 from seating plane.

e. Measurement after test: After completion of terminal immersion and following a minimum 3-hour cooling period, dc resistance shall be measured as specified in 4.6.5.

f. Inspection after test: Networks shall be inspected for evidence of mechanical damage.

g. Internal inspection: Upon completion of the final inspection of group IV in qualification inspection and quarterly, subgroup 1 of group C inspection, the networks shall be de-capped and inspected for evidence of solder reflow and heat damage.

4.6.15 Moisture resistance (see 3.20). Networks shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

a. Initial measurement: Immediately following the initial conditioning period, dc resistance of resistors in the network shall be measured as specified in 4.6.5.

b. Loading voltage: A dc voltage equivalent to .010 of rated wattage shall be applied to all resistor elements during the first 2 hours of steps 1 and 4.

c. Subcycle: Step 7b shall not be applicable. Step 7a shall be performed during any five of the first eight cycles only.

d. Measurements at high humidity: None.

e. Final measurements: Upon completion of step 6 of the final cycle the resistor networks shall be removed from the chamber and within 24 hours, without any additional handling, the dc resistance, dielectric withstanding voltage, and insulation resistance shall be measured in accordance with 4.6.5, 4.6.12, and 4.6.13. When the networks are tested as specified, the change in resistance between initial and final measurements shall not exceed the value specified in 3.20.

f. Inspection after test: Networks shall be inspected for evidence of mechanical damage.

4.6.16 Shock (specified pulse) (see 3.21). Networks shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply:

a. Special mounting means: Networks shall be mounted in accordance with 4.6.1.1 on an appropriate mounting fixture. The mounting fixture shall be constructed in such a manner as to insure that the mounting supports remain in a static condition with reference to the shock-test table. Networks shall be mounted in relation to the test equipment in such a manner that the stress applied is in the direction which would be considered most detrimental. Single-in-line networks with a height profile in excess of .200 inch (5.08 mm) (styles RZ040, RZ050, and RZ060), shall be mounted as specified. However, the body of the network shall be cemented to the printed circuit board. The cement material shall not extend up the body more than 50 percent in the vertical plane or beyond the resistor body ends in the horizontal plane. In no case shall the resistor body be completely encapsulated (see figure 3).

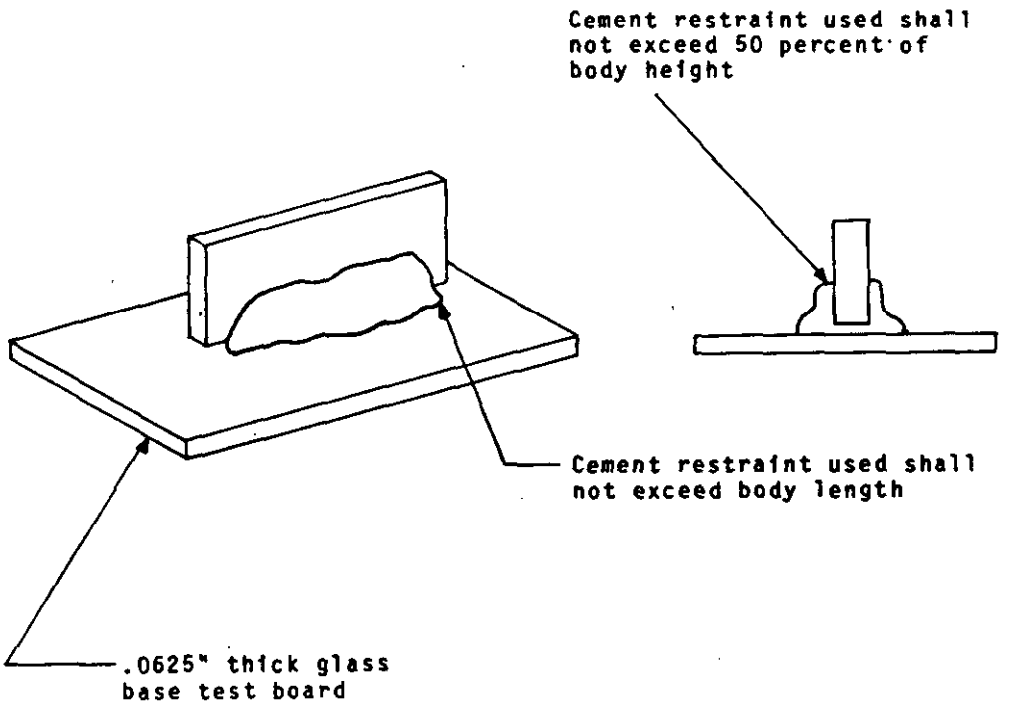


FIGURE 3. Special mounting for high profile SIPs.

b. Test leads: Test leads used during this test shall be no larger than AWG size 22 stranded wire, so that the influence of the test lead on the resistor shall be held to a minimum. The test-lead length shall be no longer than necessary.

c. Measurements before shock: Resistance shall be measured as specified in 4.6.5.

d. Test condition I.

e. Measurements after shock: Resistance shall be measured as specified in 4.6.5.

f. Inspection after shock: Networks shall be inspected for evidence of mechanical damage.

4.6.17 Vibration, high frequency (see 3.22). Networks shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting: As specified in 4.6.16a.

b. Test leads: As specified in 4.6.16b.

c. Measurements before vibration: As specified in 4.6.16c.

d. Test condition D.

e. Measurements after vibration: As specified in 4.6.16e.

f. Inspection after vibration: Networks shall be inspected for evidence of mechanical damage.

4.6.18 Life (see 3.23). Networks shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting: As specified in 4.6.1.1, with wiring to be connected to landing pads on the top and bottom of the circuit board. If forced air circulation is employed, the air velocity shall not exceed 500 feet per minute and there shall be no direct impingement of the forced-air supply upon the networks.

b. Test temperature and tolerance: 70°C ±5°C.
25°C power rating: 25°C ±5°C (qualification inspection).

c. Initial measurements: Measurements may be made inside or outside the chamber.

(1) Inside chamber: When measurements are to be made inside the chamber, the initial dc resistance shall be measured at the applicable test temperature, after temperature stabilization, and within 8 hours of exposure of the resistor networks to the test temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.

(2) Outside chamber: When measurements are to be made outside the chamber, the initial dc resistance shall be measured at the room temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.

d. Operating conditions: Rated dc continuous working voltage, filtered or nonfiltered full-wave rectified ac voltage shall be simultaneously applied to each resistor in the network intermittently, 1.5 hours on and 0.5 hour off, for the specified number of hours and at the test temperature. During the "on" cycle, the voltage shall be regulated and controlled to maintain the rated continuous working voltage ±5 percent. In no case shall the network power rating be exceeded.

e. Test condition: 1,000 hours total test time.

f. Measurements during test:

(1) DC resistance shall be measured at the end of the 0.5 hour off periods after 250 +48, -0; 500 +48, -0; and 1,000 +48, -0 hours. Measurements shall be made as near as possible to the specified time but may be adjusted (within specified tolerances) so that measurements need be made only during the normal workday.

(2) Measurements outside of chamber: When measurements are made outside the chamber, networks shall be outside of the chamber for a minimum of 45 minutes and stabilized before measurement.

g. Inspection after test: Networks shall be inspected for evidence of mechanical damage.

4.6.19 High temperature exposure (see 3.24).

a. Mounting: Not required.

b. Initial measurements: DC resistance shall be measured as specified in 4.6.5 at 25°C ±2°C.

c. Procedure: Following initial resistance measurements, networks shall be placed in a chamber with forced air circulation maintained at 125°C ±5°C for a period of 100 ±4 hours with no load applied.

d. Final measurements: After removal from the test chamber, networks shall be permitted to stabilize at an ambient temperature of 25°C ±5°C for 4 hours. Resistance measurements shall be made as specified in 4.6.5. Networks shall be inspected for evidence of mechanical damage.

4.6.20 Low temperature storage (see 3.25).

a. Mounting: Not required.

b. Procedure: DC resistance shall be measured as specified in 4.6.5. Within 1 hour after this measurement, the networks shall be placed in a cold chamber at -65°C +0°C, -3°C. Twenty-four hours after the networks have reached this temperature, the temperature of the chamber shall be gradually increased to room temperature within a period of not more than 8 hours. The networks shall be removed from the chamber and maintained at a temperature of 25°C ±5°C for a period of approximately 24 hours; the dc resistance shall then again be measured as specified in 4.6.5. Networks shall then be inspected for evidence of mechanical damage.

4.6.21 Hermetic seal (applicable to characteristics C and Y) (see 3.10). Networks shall be tested in accordance with method 112 of MIL-STD-202. The following details shall apply:

a. Test condition C, procedure 111a or 111b of method 112, MIL-STD-202 shall be used.

b. Gross leak test: Test condition D.

4.6.22 Fungus (see 3.26). Networks shall be tested in accordance with method 508 of MIL-STD-810. Networks shall be inspected for evidence of fungus.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-R-39032.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Networks described herein are intended to be used in electronic circuits where miniaturization is required.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Title, number and date of the applicable detail specification, and the complete military part number (see 3.1 and 1.2.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Electronic Support Division AFLC, 2750 AWB/ES, Gentile AF Station, Dayton, OH 45444-4500; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), 1507 Wilmington Pike, Dayton, Ohio 45444-5000.

6.4 Application notes.

6.4.1 Stacking of networks. Stacking is generally not recommended, but if required, care should be taken to compensate for the lower heat dissipation capabilities by derating the wattage rating.

6.4.2 Close-tolerance networks. Close-tolerance networks (i.e., ±0.1 percent and tighter) should be mounted by a method which produces the least heating effect over a short time to avoid permanent change in resistance.

6.4.3 Caution note. When the printed wiring assembly utilizes components made of brittle materials (glass or ceramic), such components should be protected, prior to coating, against breakage by the conformal coating type covering the component with transparent, clean, thin, pliant buffer material securely fitted, such as with heat shrinkable sleeving, polyethylene terephthalate covered by MIL-I-23053/7. The buffer material should cover the entire component and should not extend over the component by more than 0.062 inch and should be compatible with the conformal coating material. Buffer material may not be needed when types SR and XY per MIL-I-46058 are used.

6.5 Power ratings at 25°C. Power ratings for networks under this specification have been established by a 1,000-hour life test and ΔR = ±0.50 percent for characteristics H and K, and ΔR = ±2.0 percent for characteristic M. ΔR = ±0.10 percent and ΔRatio = ±0.03 percent for characteristics C, R, and V. For characteristic Y, ΔR = ±0.05 percent and ΔRatio = ±0.025 percent. The power ratings established should be in accordance with figure 2.

6.6 Supersession data.

6.6.1 Resistance designations. Prior to MIL-R-83401B, dated 1 March 1976, a three-digit resistance designation was used for resistance tolerances of ±2 percent and ±5 percent. Networks specified with a ±2 percent or ±5 percent resistance tolerance using the four-digit resistance designation required by this specification supersede and are interchangeable with the ±2 percent and ±5 percent resistors using the three-digit resistance designation provided the resistors have the same resistance value, tolerance, style, and performance characteristic. The supersession of the three-digit resistance designation by the four-digit resistance designation shall be as indicated in table XVIII.

TABLE XVIII. Resistance designations for ±2 percent and ±5 percent networks.

Resistance designations		Resistance			
Four digits	Three digits 1/	Megohms			
10R0 to 91R0 inclusive	100 to 910 inclusive	10.0	to	91.0	inclusive
1000 to 9100 inclusive	101 to 911 inclusive	100	to	910	inclusive
1001 to 9101 inclusive	102 to 912 inclusive	1,000	to	9,100	inclusive
1002 to 9102 inclusive	103 to 913 inclusive	10,000	to	91,000	inclusive
1003 to 9103 inclusive	104 to 914 inclusive	0.1	to	.91	inclusive
1004 to 9104 inclusive	105 to 915 inclusive	1.0	to	9.1	inclusive

1/ Three-digit resistance designations used prior to MIL-R-83401B, dated 1 March 1976.

6.7 Subject term (key word) listing.

DIP
Flat pack
Network
Resistor
SIP

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

APPENDIX A

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 Scope. This appendix details the procedure for submission of samples, with related data, for qualification inspection of networks covered by this specification. The procedure for extending qualification of the required sample to other networks covered by this specification is also outlined herein. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. SUBMISSION

30.1 Sample. A sample consisting of 60 sample units of each resistance value (lowest, highest, and critical or nearest to critical value (see table XIX)) and in each style, characteristic, resistance tolerance, and schematic for which qualification is sought, shall be submitted and subjected to the inspection of table XI. Twelve sample units of any value shall be submitted and subjected to the tests of group II of table XI. In addition, 10 sample units of any characteristic or resistance value shall be submitted and subjected to the test of group VIII of table XI. The range extension at higher or lower values will be qualified by supplemental testing of the new highest or lowest value in accordance with the following: Submit 60 additional samples of the new resistance value to be qualified to groups I and Ia of table XI; of this group, 10 samples shall be subjected to group III, 10 samples to group IV, 10 samples to group V, 10 samples to group VI and 10 samples to group VII. An additional sample submission is required under the following conditions:

a. Qualification to a closer tolerance than submitted above is desired:

Submit

30 additional samples of the closer tolerance to be qualified to group I of table XI.	10 high value 10 critical value 10 low value

b. Qualification to H or J schematics by schematics A, B, C, or G submission is desired:

Submit

40 additional samples of schematic H or J. All to group I, and 10 each to groups III, IV, VI, and VII.	40 highest value

30.2 Test data. When inspections and tests are to be performed at a Government laboratory, prior to submission, all sample units shall be subjected to all of the tests indicated as nondestructive in table XI. Each submission shall be accompanied by the test data obtained from these tests. The performance of the destructive inspections and tests by the manufacturer on a duplicate set of sample units is encouraged, although not required. All test data shall be submitted in duplicate.

APPENDIX A

30.3 Description of items. The manufacturer shall submit a detailed description of the network being submitted for inspection, including materials used for the resistance element and the protective enclosure or coating. For characteristics C and V, the manufacturer shall submit a description of the precap visual examination used for inspection of (1) internal connections, (2) metallization, (3) die mounting, and (4) inspection for foreign or extraneous material. After qualification has been granted, no changes shall be made in materials, design, or construction without proper notification to the qualifying activity.

TABLE XIX. Critical resistance value for qualification inspection. 1/

Style	Critical resistance value 2/											
	Schematic A		Schematic B		Schematic C		Schematic G		Schematic H		Schematic J	
	Characteristics											
	C,R,V,Y	H,K,M	C,R,V,Y	H,K,M	C,R,V,Y	H,K,M	C,R,V,Y	H,K,M	C,R,V,Y	H,K,M	C,R,V,Y	H,K,M
	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ	MΩ
RZ010	0.1	0.047	0.2	0.1							.390	.200
RZ020	0.1	0.047	0.2	0.1							.390	.200
RZ030	0.047	0.047	0.1	0.1							.160	.160
RZ040					.024	.012	.024	.012	.039	.020		
RZ050					.024	.012	.024	.012	.039	.020		
RZ060					.024	.012	.024	.012	.039	.020		
RZ070					.039	.020	.039	.020	.062	.033		
RZ080					.039	.020	.039	.020	.062	.033		
RZ090					.039	.020	.039	.020	.062	.033		
RZ100	0.047	0.047	0.1	0.1							.160	.160

1/ Maximum continuous working voltage shall be applied (see 3.1).
2/ The critical resistance value is the maximum standard resistance value which will dissipate full wattage when the maximum continuous working voltage is applied.

40. EXTENT OF QUALIFICATION

40.1 Extension of qualification. The resistance range included in the qualification of any one network style will be between the lowest and highest resistance values which pass the qualification inspection (see 3.1). Qualification of one characteristic is basis for qualification of another characteristic, as indicated in table XX. Qualification of the lower resistance tolerances will qualify for the higher resistance tolerances in accordance with table XXI. Extent of qualification by style shall be in accordance with table XXII. Extent of qualification by schematic shall be in accordance with table XXIII. As a requisite for extension of qualification as described herein between characteristics, tolerances, schematics, and resistance values, the product involved must be manufactured using the same facilities, processes, and materials as the product originally submitted for qualification.

TABLE XX. Extent of qualification of characteristics.

Characteristic submitted	Characteristic(s) qualified
C	C,V
H	H,K,M
K	K,M
M	M
R	R,V
V	V
Y	C,R,V,Y

TABLE XXI. Extent of qualification of resistance tolerance.

Resistance tolerance submitted	Resistance tolerance(s) qualified
A	A, B, D, F
B	B, D, F, G, J
D	D, F, G, J
F	F, G, J
G	G, J
J	J
T	T, A, B, D, F
V	V, T, A, B, D, F

TABLE XXII. Extent of qualification by style.

Style	Will qualify style(s)
RZ010	RZ010
RZ020	RZ010, RZ020, RZ110 1/
RZ030	RZ030, RZ120 1/
RZ040	RZ040
RZ050	RZ040, RZ050
RZ060	RZ040, RZ050, RZ060
RZ070	RZ070
RZ080	RZ070, RZ080
RZ090	RZ070, RZ080, RZ090
RZ100	RZ030, RZ100, RZ120 1/

1/ When styles RZ110 and RZ120 are included, additional test samples must be tested as specified in MIL-R-83401/11 and MIL-R-83401/12.

TABLE XXIII. Extent of qualification by schematic.

Schematic	Will qualify schematic(s) 1/ 2/
A	A, J
B	B, A, J, K, M, N
C	C, G, H
G	G, H

1/ When H or J schematics are included, additional test samples must be tested as specified in 30.1b.

2/ When K, M, and N schematics are included, additional test samples must be tested as specified in MIL-R-83401/11 and MIL-R-83401/12.

APPENDIX B

PROCEDURE SPECIFYING ADDITIONAL SCHEMATICS
(SCHEMATIC X)

10. SCOPE

10.1 Scope. This appendix details the procedure to be followed to include additional schematics to this specification. These new schematics will be incorporated in the applicable detail specification as a "schematic X". This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Standard. The following standard forms a part of this appendix to the extent specified herein.

STANDARD

MILITARY

MIL-STD-965 - Parts Control Program.

30. REQUIREMENTS

30.1 Procedure for submission of schematics. Resistor networks with schematics other than those currently listed in the current specification should be submitted as a non-standard part request in accordance with MIL-STD-965. The usage record of the particular schematic will be researched, and if the schematic has been used previously on any military equipment, the schematic will be included in the applicable existing detail specification or a new detail specification. If no previous use of the schematic is found, then the information will be included in the usage record.

30.2 Extension of qualification for schematics. Qualification will be extended to the new schematics based on qualification of:

a. Schematic B for resistor networks in DIP packages and flat packs and,

b. Schematic C for SIP packages.

CONCLUDING MATERIAL

Custodians:
Army - ER
Navy - EC
Air Force - 85
NASA - NA

Review activities:
Army - AR, MI
Navy - AS, OS
Air Force - 17
DLA - ES

User activities:
Army - AT, AV, ME
Navy - CG, MC
Air Force - 19

Preparing activity:
Air Force - 85

Agent:
DLA - ES

(Project 59GP-0072)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-R-83401F	Resistor Networks, Fixed, Film, and Capacitor-Resistor Networks, Ceramic Capacitor and Fixed Film Resistors, General Specification for

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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